Benefits of an abscission agent for mechanically harvested citrus

By Fritz Roka and Jackie Burns

Mechanical harvesting systems harvested more than 30,000 acres of Florida processing oranges during the 2005-06 season. Although this is less than 5 percent of the total acreage, current thinking is that use of a selective abscission agent with mechanical harvesters has the potential to markedly reduce harvesting costs and increase on-tree returns for growers.

A selective abscission agent can boost the operational efficiency of a citrus mechanical harvesting system in three ways.

First, and most important, an abscission agent will extend the window for use of mechanical harvesting systems. Second, an abscission agent will allow a mechanical system to operate faster within a grove, thereby allowing more boxes per hour for harvesting. Third, an abscission agent may improve overall recovery percentages – that is, the amount of fruit that is moved from the grove to the processing plant.

Presently, mechanical systems cannot harvest Valencias beyond mid-May. In normal growing years around mid-May, immature green fruit reach quarter-sized (2-3 cm) diameters and aggressive shaking of the trees by either trunk or canopy shakers will remove a substantial number of young fruitlets. Previous IFAS research has shown yield reductions of between 25 percent and 50 percent if mechanical systems harvest fruit into late May and June.

An abscission agent that selectively loosens only the current year's mature fruit would result in less aggressive shaking to remove mature fruit, thus minimizing removal of the immature fruit. Consequently, a mechanical harvesting system could have an additional four to six weeks of operation during the harvest season, thus increasing efficiency.

With trees and groves that have been skirted and pruned, continuous canopy shakers without abscission agents can travel between three-quarter and 1 1/4 miles per hour down a row and remove up to 95 percent of the mature crop. Trunk shakers require between 5 and 10 seconds per tree to achieve a 95 percent removal rate.

An abscission agent loosens fruit by reducing the fruit's "pull-force," thereby allowing mature fruit to come off the tree easier and quicker. This means that canopy and trunk shakers can move faster and spend less time harvesting trees that have been treated or sprayed with the abscission agent. Initial field trials with the abscission agents in Southwest Flor-ida have shown that canopy shakers can increase harvest speeds and trunk shakers can reduce shake durations and still achieve 95 percent fruit removal.

MORE TRAILERS NEEDED

The economic value of moving faster through the trees, however, is contingent upon a sufficient increase in the number of daily trailers allocated to the harvest site. If faster harvest speeds increase acreage harvested by 33 percent, then the number of trailers allocated by a processing plant to the harvest site has to increase by a third as well. Simply filling the same number of trailers in half the time will not change the cost structure of a harvesting system.

In theory, the use of abscission agents may enhance recovery percentages of current trunk and canopy shakers. Recovery percentage represents the percentage of fruit hanging on the tree that is harvested and delivered to the bulk trailer through the mechanical system. Working in "prepared" groves (i.e., trees that are skirted and lower scaffold limbs pruned), trunk and canopy shakers with catch frames recover between 88 percent and 92 percent of the available crop. Between 3 percent and 6 percent of the fruit that is removed misses the catch frame. Current research is testing whether reducing the aggressiveness of the machine will allow the removed fruit to drop straight down to a catch frame, enhancing overall fruit recovery.

Increasing fruit recovery percentage is an important goal, either through the use of an abscission agent or improvements in machine design. If recovery percentages from mechanical harvesters can be increased above 95 percent, the expensive cost of hand gleaning could be eliminated.

CMNP

Among the number of possible abscission agents, CMNP has emerged as the best candidate to be registered for use in citrus mechanical harvesting. The compound is highly selective, and when used at recommended rates, does not defoliate the tree nor affect next year's crop. While CMNP may cosmetically scar the bottom peel, the internal juice qualities of fruit are unaffected. Registration of CMNP is progressing through EPA testing protocols and special use permits may be available by 2009.

In the meantime, University of Florida-IFAS is conducting research on up to 10 acres per year (acreage limit by law) to develop successful harvesting strategies for CMNP application, grove management and machine operation. The results of these field trials should allow harvesters to effectively apply CMNP and exploit the benefits from this abscission agent by 1) extending the mechanical harvesting window, 2) increasing harvest speeds, and 3) enhancing fruit recovery.

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