## Facilitating mechanical harvesting with the abscission agent CMNP

## By Bob Ebel

here is currently strong interest by many leaders of Florida's citrus industry to promote expansion of acres of juice oranges that are mechanically harvested. Even with the current economic downturn and the associated impact on the citrus industry, availability and cost of high quality labor is still a major concern.

Along with interest in mechanical harvesting has been the recognition that an abscission agent that stimulates the formation of the abscission layer of fruit

(i.e. loosen the fruit) to allow easier detachment from the trees by shakers is needed. CMNP has been studied as a citrus abscission agent since the early 1970s. Through concerted efforts by the Florida citrus industry, the Florida Department of Citrus (FDOC), the University of Florida Institute of Food and Agricultural Sciences (IFAS), and AgroSource Inc., we hope to finally have an Experimental Use Permit (EUP) for a CMNP-based product formulation in approximately two years.

In preparation for the EUP, IFAS has been studying how to best use CMNP to aid its transition into commercial harvesting. A series of trials have been conducted with variable rates of CMNP and mechanical harvester settings at different times of the growing season. In our experience, CMNP improves fruit removal at lower canopy shaker head speeds (Fig. 1).

One of the major concerns expressed by growers is the impact of mechanical harvesting on tree health. Over the past two years I have observed the health of trees in the southern flatwoods region and found that due to numerous factors — including hurricanes, drought stress during the



dry season, flooding stress during the rainy season, perhaps reduced fertilization due to rising fertilizer costs, and of course canker and greening — that many trees are in poor health (Fig. 2).

Figure 1 The

percent of Hamlin

fruit removed by a

shaker with head

pull-behind canopy

speeds of 180, 220

and 260 cycles per

minute (cpm) and

for trees sprayed

with CMNP at

0, 200 and 300

ppm at 300 gal/

acre. The trees

were sprayed and

harvested the first

percent of fruit were

cpm with 300 ppm,

which was nearly

ter than all CMNP

treatments at 200

cpm and 260 ppm.

as good or bet-

week of January.

More than 95

removed at 180

While healthy citrus trees are very forgiving of mechanical stress



**Figure 2** Aerial view of a typical Valencia grove in the flatwoods region. The areas with darker tree canopies indicate healthy trees compared to areas with lighter canopies. In viewing aerial photographs of different grove blocks in this region, there appears to be no relationship to soil type.

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**Figure 3** Can you select the trees that were harvested with a canopy shaker four days ago? The three trees with blue and orange flags were the only three mechanically harvested by a canopy shaker in this view down the row of an experimental block. Because this is a well-managed grove, the trees show very little impact by the harvester. These trees were harvested in late March in the middle of the dry season, and in a grove in the flatwoods region where drought stress is some of the most severe in Florida due to the shallow roots that are root pruned to about 18 inches below the soil line.

(Fig. 3) as has been shown in previous research, it is not hard to understand why grove managers are concerned about the additional stress of mechanical harvesters with so many trees stressed by other factors. Nevertheless, the industry clearly needs to be more aggressive in promoting tree health, even if growers are not mechanically harvesting their trees.

Another concern of mechanical harvesting expressed by representatives of processors has been the amount of debris in the trailers that cause problems with equipment at processing plants. Large branches are of particular concern since they cause the most shutdowns at processing facilities. Small sticks, leaves and sand from loads must be hauled to dump sites, and the quantity per day is a significant cost to processors. Through multiple studies, researcher Tim Spann has found that CMNP will provide an additional benefit to mechanically harvested fruit by reducing debris that will end up in trailers (Fig. 4).

Fruit loosening by CMNP is affected by a few factors besides application concentration. Thorough coverage of

Figure 4. The effects of CMNP on the amount of loose debris (not attached to fruit) and adhering debris (attached to fruit) in loads of mechanically harvested "Hamlin" oranges. Means with different letters within columns indicate significant differences.

3 / 2	loose debris				adhering debris				Estimated debris
CMNP	leaves	small stems	large stems	total	leaves	small stems	total	overall total	per harvested load of fruit (lbs Fresh Weight)
(ppm)		(gram dry weight of debris/kilogram of fruit							
0	0.21	0.10	0.03	0.34	0.75 a	0.66 a	1.41 a	1.74 a	84.25 a
200	0.22	0.11	0.07	0.40	0.21 b	0.20 b	0.41 b	0.80 b	24.46 b
300	0.11	0.05	0.0	0.16	0.09 b	0.08 b	0.17 c	0.33 c	10.00 c



Figure 5. We are developing a mathematical model to predict the rate of loosening, as measured by fruit detachment force (FDF) of Hamlin and Valencia after application of CMNP. It is our goal to have the model available by the time CMNP is commercially available. The model would be accessible by mechanical harvest companies via the Florida Agricultural Weather Network (FAWN) as an aid to accurately time sprays and harvests to optimize that balance between fruit removal and minimal tree impact. We are also studying the feasibility of developing a model to predict the rate of drop, a critical issue for self-propelled machines that catch fruit on decks and unload it directly into goats.

fruit is important and air temperature has a large impact on efficacy. We are in the process of developing a predictive tool that will aid timing of sprays and harvest to maximize fruit removal (Fig. 5). It is our goal to have a functional tool on FAWN by the time the EUP is granted. The number of hours after application will need to be carefully timed to maximize removal and minimize fruit drop, especially for self-propelled canopy shakers where harvesting before drop rises significantly is concerned. The application of CMNP will need to be closely coordinated between applicators and harvester operators to ensure proper timing of fruit harvest. These activities likely will be performed by the same commercial companies.

Research over the last few years

has produced valuable information for using CMNP as an aid to mechanical harvesting of sweet oranges in Florida. We are on track to provide the industry sound recommendations for its use when an EUP is granted. However, we fully anticipate a learning period as the wider industry starts to use it because of the relatively high degree of precision its use will require. Our goal is to work closely with the industry and AgroSource for a smooth transition to its adoption. We recognize the time, effort and funding that the industry and AgroSource have provided this effort, and we are committed to facilitating the next step in supporting adoption of CMNP by the industry and promoting the expansion of mechanical harvesting in commercial groves.

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