Mechanical harvesting:

By Walt Kender

For more than three decades, Florida's citrus industry has been anticipating troubles with declining grower income, higher cost of harvest labor, and the signals of potential decreases in available harvest labor. Since 1995, the Florida Department of Citrus has addressed these issues by sponsoring a new research and development program to escape the ominous labor situation.

On the short-term, the focus has been on methods and equipment to improve harvesting efficiency using hand labor. Long-term goals are aimed at fruit removal and handling using primarily mechanized systems, including design of machinery, design of groves and abscission (fruit loosening) research. The ultimate goal is to reduce harvest costs in order to compete on a global basis.

Progress toward accomplishing these goals has been highly successful thanks in main part to the stellar efforts of the FDOC's Citrus Harvesting Research Advisory Council, consisting of 17 industry members presently headed by Chairman Joe Davis, Jr. of Wauchula and Vice Chairman, Paul Meador of Immokalee, and directed since its inception by Harvesting Program Administrator Galen Brown.

In 2001, the commercial use of mechanical citrus harvesting systems gained surprising momentum and has reached a critical transition from research and development to implementation, from theory to practice. It is estimated that approximately 10,000 acres of oranges destined for processing were harvested mechanically this year by 32 different harvesting machines.

I recently had the opportunity to informally discuss the present status and future potentials of citrus harvesting with Davis, Meador and Brown. It is clear that the factors impacting future development are complex and will require intense study as well as citrus industry experience.

MECHANICAL HARVESTING SYSTEMS

The machines presently being used for harvesting processing oranges fall into three general categories, namely 1) Non-catch harvest only, 2) mechanical pick-up, and 3) mechanical harvest and catch. Some of the most promising harvesters in these classes include:

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Non-catch (glean and roadside)
- Foliage Shaker (Mongoose)
- Monoboom Trunk Shaker (Stackhouse, Coe-Collier, FMC-Compton)
- Continuous Canopy Shaker (OXBO)

Mechanical pick-up (glean and roadside)
- Rake and pick-up (FDOC equipment)
- Direct pick-up (Stackhouse, OXBO)

Mechanical harvest (catch, glean, and roadside)
- Fruit pull and catch (Crunkelton)
- Trunk shake and catch (Coe-Collier, FMC-Compton)
- Continuous canopy shake and catch (OXBO, Korvan)

In general, canopy shakers and monoboom trunk shakers remove about 85-95 percent of the fruit from the trees.

COST COMPARISONS

Although the current mechanical harvesters are generally efficient, the cost to growers may vary according to the type of harvester used, grove conditions

and delivery allocations.

For example, the average estimated pick and roadside contract costs for a mechanically harvested field box of oranges range from $1.25 to $1.60. Savings of $0.10 to $0.20 are usually possible now, and will grow as adoption, experience and competition increase.

Depending on down time for machine repair, etc. compared to hand harvest, mechanical harvesters are stable, have high reliability and can operate in the rain or hot weather.

FACTORS AFFECTING HARVEST EFFICIENCY

The entire process of managing groves for mechanical harvesting requires a highly honed, coordinated operation - from preparing the grove to delivery of fruit to the processing plant. New strategies will be needed and management will become more critical. The downside will be higher initial investment costs to get your grove ready or to convert trees for optimal machine harvest.

PREPARING THE GROVE

Tree spacing

For trunk shakers, trees should be set no closer than 12 feet trunk to trunk in the row. Spacings of 10 feet in the row are acceptable for continuous canopy shakers. All harvest systems are compatible with flat unbedded groves. These groves are also best adapted to mechanical fruit pick-up machines. For bedded groves, two or more rows per bed are compatible if swales are relatively shallow (one-half to one-and-one-half feet deep). The row spacing should not exceed 25 feet, with a working alley of seven to eight feet.

Rootstock

Newly set trees should have 30-inch clear trunks. Citrus nurseries will need to accommodate growers planning to harvest their crops mechanically. Rootstocks that afford a more upright, rigid growth habit and are less susceptible to trunk damage are most desirable for machine harvest.

Skirting

In established groves, mechanical harvesting will require skirting the lower canopy 1) to have better access to trunks, 2) to make it easier to catch all the fruit, 3) to minimize damage to the trees and machine, and 4) to facilitate pick-up machines and gleaners. The height above the ground to the first branches along the dripline should be at least 36 inches.

Irrigation systems

The location and type of emitters will be an important management decision, especially for trunk shake and catch systems and pick-up machines. Sprinklers should be placed so as not to be disrupted by the harvesting equipment. Placement will not be a problem for continuous canopy harvesters.

Gleaning

Experience has shown that the gleaning process (fruit pick-up and follow-up hand harvesting after mechanical harvesting) will determine the cost savings to the grower. If the machines are less than 100 percent efficient, gleaning may be considered in order to recover all the fruit from the tree. Gleaning is improved by skirting the tree canopy and the use of abscission agents (if developed in the future).

Will gleaning result in cost savings? According to Paul Meador, depending on how effective the harvester (percent of fruit remaining on the tree after harvest), the economics of paying gleaners to clean up the grove is not clear cut.

Delivery scheduling to the processor

As mechanical harvesting becomes more common in the future, and the fruit removal process from a grove becomes more rapid, strategies may be needed to schedule truck deliveries to adjust to the capacity of the machines. For example, assuming that the processing plant operates at 100 percent efficiency in handling delivered fruit, harvesting cost will increase if machines are limited to part-time harvesting. Harvester capacity, is indeed, a key to the success of the harvesting systems.

Fruit condition

To the surprise of many growers and processors, oranges harvested mechanically are cleaner than hand picked fruit.

FUTURE OF MECHANICAL HARVESTING IN FLORIDA

The transition from hand harvest to mechanized harvest in Florida is expected to evolve rapidly over the next few years. Our experts predict a

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