Mechanical Harvesting Always Advancing

The origins of citrus mechanical harvesting in Florida date back to the mid-1950s when the Florida Department of Citrus, USDA, and the University of Florida collectively initiated a mechanical harvesting program. The primary objective of this program was to improve labor productivity, thereby reducing the required number of harvest workers.

While some research was directed toward worker aids for fresh fruit harvesting, most was focused on mass harvesting of processed oranges. Early mass harvester designs included trunk, limb, and canopy shakers, as well as some innovative concepts that utilized air blasters and water cannons to remove fruit. Catch-frames and pickup machines collected the fruit and abscission chemicals, including CMNP (5-chloro-3-methyl-4-nitro-1H-pyrazole), were tested to loosen fruit. Early shake and catch systems increased labor productivity threefold. The original harvesting research program continued for nearly 30 years until devastating freezes in the 1980s significantly reduced citrus acreage and eased the pressure for harvest labor.

Renewed Interest

The mechanical harvesting program was revitalized in the 1990s by the Department of Citrus, and its program administrator, Dr. Galen Brown. Two shake and catch harvesting systems were brought into commercial use, the trunk shake and catch and the continuous canopy shake and catch. These systems work best in large uniform groves where trees are skirted and lower limbs pruned. Under prepared grove conditions, shake and catch systems increase labor productivity by tenfold, or 100 boxes per man hour. A third system, a tractor-drawn canopy shaker, works well with non-uniform unskirted trees. Fruit is shook to the ground and retrieved by a hand crew.

During the 1999–2000 season, 5,500 acres of round oranges were mechanically harvested primarily with trunk shakers. By the end of the 2006–2007 season, a total of 35,600 acres were mechanically harvested, predominately by canopy shakers.

With one important exception, research to date has not documented any adverse effects to crop yield or tree mortality from mechanical harvesting. The exception occurs when mechanical harvesting Valencias after the average fruitlet size of the emerging crop exceeds 1-inch diameter. At that point, trunk and canopy shaking removes sufficient fruitlets to reduce next year's yields by at least 25%.

Prepped To Shake Free

In the near term, research into abscission and registration of the CMNP abscission compound are the highest priorities within the University of Florida Citrus Mechanical Harvesting and Abscission Program. Incorporating an effective abscission compound into the harvesting program should allow mechanical harvesting to proceed throughout the Valencia season. Abscission may also allow equipment to operate faster through the grove and may increase fruit recovery percentages. Improving the performance efficiencies of mass harvesting systems should drive harvest costs to less than one dollar a box.

Another machine enhancement includes yield monitoring devices. While not directly influencing harvesting performance, yield monitors could provide growers with a valuable tool to better direct fertilizer and chemical inputs into fruit production.

Robo Picking

Looking into the future, the advantages of high-density groves and the need for automated fresh fruit harvesting increase the promise of robotics.

The trunk shake and catch (top) and the continuous canopy shake and catch harvesters were developed by the Florida Department of Citrus and brought into commercial use in the 1990s.

Significant advances along a broad range of technologies have improved computing speed, machine vision, manipulator, and "end-effector" technology, allowing robotic systems to find and harvest fruit. Harvesting robots of the future will likely be fully autonomous, operating independently of human operators. Robotic harvesting and automated vehicle guidance already are being tested in Florida groves.

As the Florida citrus industry strives to remain competitive within a global orange juice market, and at the same time, absorb the higher costs associated with canker and greening management, mechanical harvesting offers an opportunity to significantly reduce harvest costs. For mechanical harvesting to be successful, it will require a coordinated effort from all sectors of the industry — growers, harvesters, and processors. For more information on citrus mechanical harvesting, please visit our Web site at **www.citrusMH.ifas.ufl.edu.** FG

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