

New findings provide cost, benefit data for Florida citrus industry

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This is an example of the type of large debris that can occur when citrus is mechanically harvested. Credit: Photo courtesy of Timothy M. Spann

Harvesting is an expensive enterprise for Florida's important citrus industry. In fact, harvesting can account for as much as 50% of the production cost for citrus crops. To improve production and decrease costs associated with hand harvesting, Florida's researchers and citrus producers have been working for decades to develop cost-effective mechanical harvesting technologies.

In a new study in [HortScience](#), Timothy M. Spann and Michelle D. Danyluk from the University of Florida's Citrus Research and Education Center, designed experiments to determine the amount and types of debris in mechanically harvested loads of sweet oranges compared with hand-harvested controls. The research yielded data that will be valuable

for evaluating the costs and benefits of mechanical harvesting, and should assist agricultural engineers working to develop debris removal systems for mechanical harvesting machines.

Although mechanical harvesting is advantageous to many in the citrus industry, the technology is not without its drawbacks. [Orange juice](#) processors report that mechanical removal of leaves, twigs, and branches results in more debris being delivered to processing plants. "Any increase in debris entering the processing plant increases operational costs as a result of machine damage, labor to remove the debris, and disposal costs," explained Spann.

Spann and Danyluk collected debris samples from three different harvest systems: hand harvesting (control), continuous travel canopy shake and catch harvesting system, and tractor-powered continuous travel canopy shake harvester. Study results indicated that mechanical harvesting increased the amount of debris per load of fruit by as much as 250% compared with hand-harvested fruit. In addition, the amount of sand on the surface of mechanically harvested fruit that was picked up from the orchard floor was found to be up to 10 times greater compared with hand-harvested controls.

The researchers found that fruit harvested with the tractor-drawn 3210 system had the most debris of any harvest system. According to the researchers, this finding is counterintuitive. "Fruit harvested by this system are dropped to the ground and picked up by hand and, therefore, should be very clean," they explained. "However, hand labor crews are usually paid per box of fruit harvested, giving them an incentive to move quickly. Thus, many laborers working with the (3210) system will tend to sweep fruit from the orchard floor into their picking sacks rather than picking up individual pieces of fruit and in so doing collect large quantities of debris."

The outcomes of the research will be useful to engineers who work to design debris elimination systems for mechanical harvesting systems, and for economic analyses of the costs of mechanical harvesting. The team noted that tree management practices that may prevent debris from entering the harvesting stream should also be investigated.

More information: The complete study and abstract are available on the ASHS HortScience electronic journal web site:

hortsci.ashspublications.org/content/45/8/1297

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