

Mechanical Harvesting and Tree Health¹

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What are the long-term effects of tree shakers on yield?

Studies with well managed healthy trees that were mechanically harvested annually with trunk shakers for 6 consecutive years in the 1970s and 1980s, as well as studies during 5 years in the late 1990s, did not show any reduction in fruit yield. When mechanically harvested trees were compared to hand harvested trees, there has been no evidence of tree mortality or yield reductions.

What about leaf loss?

Mechanical harvesting, whether performed by trunk shakers or canopy shakers, can remove some leaves from the tree. Leaf loss of 10 to 20% is not unusual. Experiments that removed up to 50% of 'Hamlin' and 'Valencia' leaves two years in a row resulted in no reductions in yield after two years. Data from these defoliation studies indicated that remaining leaves can compensate for leaf loss, allowing the tree to maintain normal growth and yield.

What about roots?

A small number of surface roots may become exposed during trunk shaking, especially during longer duration shake times. Such root exposure has not been observed with canopy shakers. Root pruning studies that removed up to 50% of the total root mass of healthy well-watered trees, have shown that remaining roots can rapidly compensate for any root loss. A well-watered root system rapidly regrows to establish an appropriate balance between roots and shoots. There have been no measurable drought stress effects from mechanical harvesting compared to hand harvested trees. Again, where mechanical harvesting has been performed annually, yield has not been affected.

What about bark injury on the trunk?

Early models of multidirectional trunk shakers, that were improperly padded or run by less-experienced operators, did remove sections of bark on the trunk. Nonetheless, there is no evidence of increased tree mortality from mechanically harvested trees than from hand-harvested trees. This 'barking' has been minimized by using

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linear-direction trunk shakers with proper clamp pads and experienced operators. Trunk girdling experiments, where rings of bark were removed from around the entire trunk and allowed to heal, actually increased yield with no apparent long-term tree injury. Today, trunk shakers are seldom used to commercially harvest citrus fruit in Florida.

What about bark injury on branches from canopy shakers?

Branch injury from canopy shakers can occur especially the first time trees are mechanically harvested. Many times, such injury is no worse than branch injury from ladders in hand-harvested trees. Partially broken branches will experience increased drought stress but this does not usually affect overall tree health. The future use of fruit abscission agents is expected to loosen mature fruit allowing less intense mechanical harvesting and thus, less branch loss and branch scuffing. There is even some evidence that opening up canopies with the loss of old and non-productive branches can be good for trees and result in increases in subsequent yields.

What are the factors that affect branch loss?

Trees that are mechanically harvested for the first time lose more branches, but this does not appear to have significant consequence in well-managed groves. Larger scaffold limbs located on the bottom 3 feet (1 meter) of the tree should be removed to allow placement and travel of fruit catch frames. Removal of these 'skirt' branches is strongly encouraged to prevent trunk splitting damage due to travel of the catch frame down the row.

If I see bark injury, what should I do?

In healthy citrus trees, there have been no reports of negative effects of barking on tree health. Any bark wounds should be allowed to dry out and heal naturally. Remedial "pruning scar seal" treatments should be avoided since they can trap pathogens under the seal over the wound. Avoid soil contamination of wounds. Recommended practices should be followed to decontaminate all grove equipment with quaternary ammonium to prevent the spread of canker.

What about loss of flowers and young pea-sized fruit in mechanically harvested 'Valencia'?

At peak bloom, mechanical harvesting removes about the same number of flowers and young fruit as hand harvesting. This loss averaged about 12% but there was no measurable effect of this loss on subsequent fruit set, as citrus trees can compensate by increasing the percentage of fruit set from the remaining flowers.

What about removal of green fruit in late season 'Valencia' mechanical harvesting?

After young green fruit reach about 1 inch or greater in diameter, excessive removal of green fruit by mechanical harvesting can reduce yield the following year. This does not always happen, however, even in very late season mechanical harvesting because the tree can compensate for the lost young green fruit by retaining more fruit until harvest. Studies have revealed that the future use of fruit abscission agents will loosen mature fruit allowing less forceful mechanical harvesting and thus, avoid yield reductions of late-season harvested 'Valencia'. Winter-time drought stress has been shown to effectively delay flowering and fruit set. Research that artificially imposed month-long winter drought stress slowed growth of young fruit, making them less susceptible to loss during late season mechanical harvesting. If trees were then well watered from the spring on, fruit growth caught up with previously well-watered trees so and there was no effect on subsequent yield or fruit quality.

The bottom line – research studies and commercial experience has shown that with healthy well managed trees, mechanically harvesting trees does not reduce yield or tree health.

Drs. Jim Syvertsen and Jackie Burns, UF/IFAS, CREC, contributed to information in this fact sheet. (Last update, 18 Aug 09).

References

Whitney, J. D., D. B. Churchill, and S. L. Hedden. 1986. A five-year study of orange removal with trunk shakers. Proc. Fla. State Hort. Soc. 99:40-44.

Hedden, S. L. and G. E. Coppock. 1968. Effects of the tree shaker harvest system on subsequent citrus yields. Proc. Fla. State Hort. Soc. 81:48-52.