

Dollar\$ and ¢ents of Mechanical Harvesting

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Thanks in large part to financial investments by the Florida Dept. of Citrus, pioneering growers, entrepreneurial harvesting contractors, and the leadership of Dr. Galen Brown, citrus mechanical harvesting systems are no longer solely concept ideas of agricultural engineers. Mechanical citrus harvesting is occurring on commercial Florida groves. During the 2002-03 season, three mechanical systems (trunk-shake-catch, continuous-canopy-shake-catch, and tractor-drawn-canopy-shake) harvested approximately 17,000 acres of processed oranges. During the 2003-04 season, twenty-seven machine sets are being operated among eight separate harvesting companies. While most of the current harvesting is occurring in southwest Florida, more and more growers across the citrus region are being provided with the very real opportunity to mechanically harvest their fruit.

Some growers using mechanical harvesting enjoy real savings and increased on-tree returns within the first season of use. For other growers, two or three years were required to adapt their grove situations to mechanical harvesting. Is mechanical harvesting the right choice for every grower and on every block today? No. But every grower should start considering the possibilities of mechanical harvesting and begin making the necessary adjustments to their groves so that in the near future, they will be in a position to reap a real and significant harvest cost reduction from mechanical systems.

Growers should consider converting to *mechanical harvesting* for the sole reason of *reducing NET harvest costs*. In most cases, a grower will incur expenses to prepare trees for mechanical systems (see article by Dr. Robert Rouse in the March 2004 issue of Citrus Industry). Further, a mechanical harvesting system will not likely recover 100% of the available crop. The value of the non-harvested fruit is a cost a grower has to consider. However, when a mechanical harvesting is viable, the per box savings from a mechanical system versus a hand crew, will more than offset the costs of preparation and lost fruit.

Every grove situation is different. Therefore, before a grower can make a reasoned decision about a particular mechanical harvesting system, four questions must be answered.

What is the per-box cost difference between a hand crew and a mechanical system?

The price quoted by an operator of a mechanical system needs to be compared against the “pick” and “roadside” costs associated with a hand crew. It is important to realize that it is *not* the absolute value of machine or hand harvest costs, but the *difference* between them. For example, a hardship block may cost you \$2/box to hand pick and roadside. If a mechanical system offered to harvest the same block for \$1.75/box, then the \$0.25 /box cost difference could be viewed as the “revenue” associated with the mechanical harvesting system.

What is the fruit recovery percentage guaranteed by the mechanical system? The operator of a mechanical system has to guarantee the percentage of the crop to be

harvested. If a harvester quotes a price of \$1.30 per box and guarantees 97% fruit recovery, the harvester is implying that the price includes a gleaning crew. Harvesting systems that shake and catch fruit usually recover 90% of the available crop. If the grower is willing to leave 10 to 15 percent of the crop behind, or chooses to employ his/her own gleaning crew, a reduction in the price of mechanical harvesting should be expected. Using a spreadsheet, it is possible to determine the “break-even” price of harvesting associated with a lower fruit recovery percentage.

What is the productivity (yield) of the block I want mechanically picked? The *magnitude* of gains (or losses) from mechanical harvesting is directly related to the block’s productivity. If market conditions are such that mechanical harvesting increases per box returns, then the value of mechanical harvesting increases in more productive trees.

What is the delivered-in price of my fruit? The higher the price, the more costly it becomes for a mechanical system not to recover fruit. Conversely, the monetary gain from mechanical harvesting increases as grower prices fall.

Whether a mechanical harvesting system lowers harvesting costs and increases on-tree returns depends on a grower’s specific set of circumstances. Answers to the above questions can be inputted into a spreadsheet located at the following website address: <http://www.imok.ufl.edu/economics>. This spreadsheet should help a grower organize the necessary information to evaluate the economic possibilities of a particular mechanical harvesting system.

Figure 1 illustrates the use of the spreadsheet for a generic mechanical harvesting system. The bars represent the gain per acre in grower returns from using mechanical harvesting rather than a hand crew. Starting with the left-hand bar, an initial situation describes a 25-cent/box difference in cost between hand and mechanical harvesting, 98 percent fruit recovery, a 400-box/acre yield, and a delivered-in price of \$5/box. Grower returns would increase by \$62 per acre from using mechanical harvesting rather than a hand crew. If fruit recovery drops to 90 percent (i.e. no gleaning by the mechanical harvesting contractor), the cost difference between hand and mechanical systems must increase to at least 51 cents for the grower to make the same return from mechanical harvesting. The third bar indicates how per acre returns increase with higher crop yields. The fourth bar illustrates how the value of non-recovered fruit crops with lower fruit prices, and thereby increases the monetary gain from mechanical harvesting

Mechanically harvesting Florida citrus crop will be an evolutionary process. For its ultimate success, all segments of the industry will have to reap positive economic benefits. On-tree returns to growers have to increase, harvesting contractors have to earn an adequate profit from the investment in the harvesting equipment, and processors returns will have to be enhanced either by more timely fruit deliveries, less trailer debris, and/or higher quality of delivered fruit.

Figure 1: Net grower gains per acre from mechanical harvesting.
 Amount of gain corresponds to conditions listed in the table below.

	1 initial	2 lower recovery	3 higher yield	4 lower market price
Harvesting cost:				
Hand – Mechanical price	\$.25	\$.51^{1/}	\$.51	\$.51
Fruit Recovery %	98%	90%	90%	90%
Yield	400 bx/ac	400 bx/ac	500 bx/ac	500 bx/ac
Delivered-in price	\$5/bx	\$5/bx	\$5/bx	\$4/bx
Gain per acre	\$62	\$64	\$104	\$154

^{1/} For a grower to maintain a \$60+/ac gain from mechanical harvesting with only a 90% fruit recovery, the cost differential between hand and mechanical system must increase from 25-cents to 51-cents per box.

