FE751

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A Decision-Aid Tool to Compare Costs of Mechanical Harvesting Systems[1]

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Introduction

Trunk and canopy shakers harvested more than 35,000 acres during the 2006–07 season, nearly 7% of the processed orange acreage. Grower interest in machine harvesting is likely to increase over the next five years as mechanical systems improve their operations and incorporate new technology, including an abscission agent (CMNP) that should allow late-season harvesting of Valencia oranges.

A grower's decision when considering a mechanical harvesting system should be based on "net" harvest costs and whether net costs from mechanical systems are less than hand harvesting. It is important to understand that "net" cost means more than a contractor's quoted price to pick and roadside fruit. Determination of the net cost of a harvest system includes pre-harvest grove preparation, post-harvest grove repairs, and the value of any non-harvested fruit. If gleaning (hand harvesting) occurs behind a mechanical system, net harvest costs must be weighted by the percentage of fruit harvested at a higher gleaning rate. Many growers are concerned about whether mechanical harvesters diminish next year's crop or adversely affect long-term tree productivity. Even though mechanical systems appear to be harsher on trees than hand crews, data from UF/IFAS research and grower experience have *not* documented any yield decline or shortened tree life from mechanical harvesting. Inexperienced equipment operators, however, can uproot trees or inflict significant tree damage. If a grower has a choice of more than one mechanical harvesting system, then net harvest costs must be determined for each system, as well as a hand harvest option.

The Citrus Harvesting Decision Tool (Decision Tool) was developed to help growers and harvesting contractors organize the relevant harvest cost information and then calculate and compare net harvest costs among all available harvesting options. The Decision Tool can be accessed online at http://www.citrustool.ifas.ufl.edu or through the mechanical harvesting website at http://citrusMH.ifas.ufl.edu/index.asp. A user ID and password can be created instantly. By logging in with a user ID and password, information entered during one session can be stored and reused at a later date.

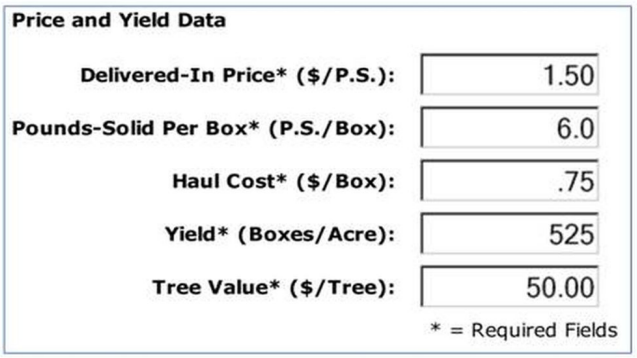
1. This is EDIS document FE751, a publication of the Food and Resource Economics Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL. Published September 2008. Please visit the EDIS website at http://edis.ifas.ufl.edu.

2. Fritz Roka, associate professor, Food and Resource Economics Department, Southwest Florida Research and Education Center, Immokalee, Florida, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL. Published September 2008. Please visit the EDIS website at http://edis.ifas.ufl.edu.

The web-based program is comprised of three pages, with additional pages to provide numerical details on specific harvesting options. The remainder of this paper is devoted to explain what information must be entered and to describe the results that the Decision Tool provides. For illustrative purposes, a numerical example is created. While these values may be close to actual situations, they should NOT be interpreted as typical costs or benefits of any harvesting system. Each harvest situation is unique and requires individual analysis based on the relevant data.

Entering Basic Information

After "logging in," a user of the Decision Tool proceeds to the first page, where there are three data entry boxes. Box 1 asks for market and grove information—yield, delivered-in price, hauling costs from the grove to the processing plant, and an estimated tree value. "Delivered-in price" is the value of fruit as stated in a typical fruit contract. A delivered-in price, reported as dollars per pound-solids, includes harvesting and hauling costs. "Hauling" is the per-box cost to transport fruit by bulk trailer from a grove to a processing plant. Hauling costs are independent of harvest method. Production is separated into overall yield (boxes per acre) and pound-solids per box. This information allows a grower to evaluate expected harvest costs by individual block and for specific market conditions. The "**?**" icon to the right of each entry provides further explanation about the values to be inputted.



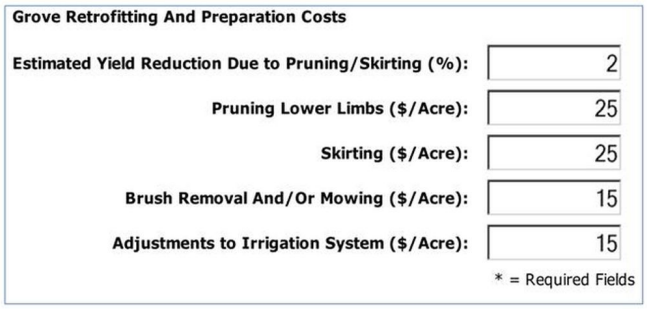
Box 1. Yield and price data for block to be harvested.

In Box 2 the relevant cost information for hand harvesting is entered. Cost to hand harvest is the reference point against which all other harvesting options are compared. "Pick and roadside" costs include both the per-box cost to remove fruit from the tree (pick) and the cost to transport fruit from in-field collection tubs to a bulk trailer parked at the edge of a grove (roadside). A grower should know, either from general knowledge or from a harvesting contractor, the "pick and roadside" charges to harvest a particular block. Pick and roadside rates generally vary inversely with production (i.e., the lower the yield, the higher the pick and roadside rate). Harvest rates also vary with the time of year. Harvesting rates for Valencia oranges during the latter part of May, June, and July typically run higher to compensate workers for the unfavorable weather conditions of higher heat and humidity. For the most part, hand pickers clean the tree of all fruit, so that the "minimum recovery percentage" for hand harvesting is either close to or at 100%. If a grower anticipates some post-harvest repairs, such as irrigation line repairs, then a dollar-per-acre estimate can be entered.

Box 2. Cost data to hand harvest.

Box 3 requires a user to input costs associated with preparing trees for mechanical harvesting. It is strongly recommended that trees be skirted and pruned of any low-hanging limbs prior to mechanical harvesting. If trees are not skirted and pruned, catch frame equipment cannot perform effectively. Furthermore, equipment will break off lower limbs and risk extensive damage to the lower trunk area. Tree preparation includes skirting, pruning, brush removal, adjustments (repositioning) of irrigation sprinklers, and accounting for any lost fruit as a result of skirting and pruning. Lost fruit may or may not be a factor. Some growers commission a hand crew to harvest low-hanging fruit prior to tree skirting and pruning. The value of this fruit may more than offset the added cost of the additional labor to harvest the fruit. In either case, yield losses from tree preparation should occur only during the first year. In subsequent

years, yields should return to normal expectations. Tree preparation costs are one-time expenses and could be viewed as an investment into a mechanical harvesting program. The Decision Tool will calculate a "pay-back" period, which equals the tree preparation costs divided by the estimated annual cost savings from a mechanical harvesting system. With basic production and cost information inputted, the user continues on to page 2 of the Decision Tool.

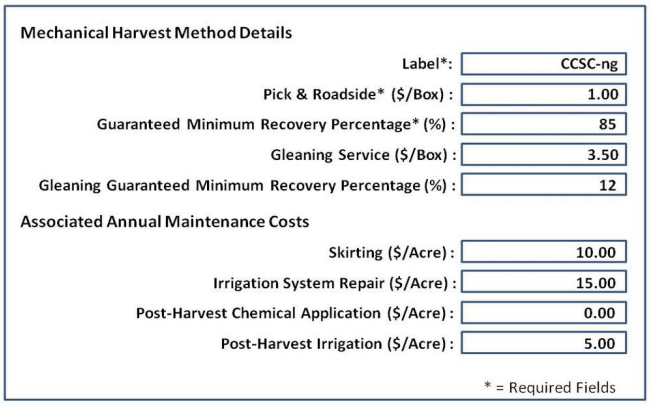


Box 3. Cost data to retrofit existing block for mechanical harvesting, tree and grove preparation.

Selecting Mechanical Harvesting Options

On the second page of the Decision Tool, a user selects one or more mechanical harvesting options. Most, if not all, of this information is available from a mechanical harvesting contractor. The contractor needs to provide answers to three questions concerning (1) the contract price ($/box) to harvest and deliver fruit to the bulk trailer, (2) recovery percentage (i.e., the percent of fruit on the tree that the mechanical system delivers to the trailer), and (3) whether gleaning is included in the contract price.

A user opens a data input page by clicking on "add harvesting option." Box 4 describes a continuous canopy shake and catch system. Gleaning is charged as a separate activity. In this option, labeled "CCSC-ng," the mechanical harvesting contractor charges a price of $1 per box and guarantees that the CCSC equipment will harvest 85% of the fruit as described in Box 1. If a grower chooses, a gleaning crew will be hired to harvest an additional 12% of the block at a cost of $3.50 per box. The grower anticipates $30 per acre in post-harvest tree and grove repair costs.



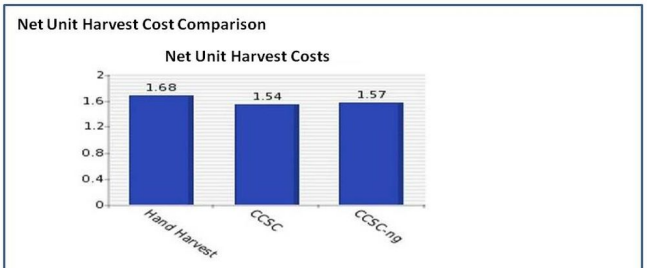
Box 4. Data entry for a mechanical harvest option, CCSC with separate gleaning charge.

A second harvest method, labeled "CCSC," evaluates with the same mechanical harvesting equipment. In this option, however, gleaning services are "bundled" together with the mechanical equipment. That is, for a price of $1.35 per box, 97% of the available fruit will be harvested and delivered to the bulk trailer.

Ranking Costs of Alternative Harvesting Systems

With all the relevant cost data of harvesting options inputted, a user proceeds to the third page, where the Decision Tool computes and summarizes "net" unit costs by harvest method. A user can readily rank harvest methods from least to most expensive. For those users who want to examine the detailed calculations, highlighting each harvest option in the summary table (Box 5) opens an additional page with the corresponding details. The Decision Tool also calculates the change in per-acre harvest costs as compared to the hand harvest standard. If a mechanical system generates a savings, then a "time to recoup retrofitting costs" is calculated.

Based on the information inputted for this example, the CCSC (continuous canopy shake and catch) mechanical system saves a grower at least $70 per acre annually over hand harvesting. Given the specific cost details used in this example, the contractor price, which includes gleaning, would reduce harvest costs by an additional $7 per acre, as compared to the option that separated gleaning from mechanical harvesting costs. The cost estimates for grove/tree preparation were computed to be nearly



Harvest Method Comparison

	Harvest Method		
	Hand Harvest	CCSC	CCSC-ng
Unit Harvest Cost ($/Box)	$1.68	$1.54	$1.57
Total Harvest Cost ($/Acre)	$871.51	$794.40	$801.49
Net Savings (Costs)	--	$77.11	$70.03
Total One-Time Retrofitting Costs	--	$149.83	$149.83
Time to Recoup Retrofitting Costs	--	2 Yrs. (23 Months)	2 Yrs. (26 Months)

Box 5. Summary of unit harvesting cost by harvest method.

$150 per acre. Thus, at least two years of mechanical harvesting is required before grove preparation costs have been recouped.

Conclusions

Citrus mechanical harvesting has the potential to significantly reduce harvest costs and increase on-tree revenue. Whether a specific mechanical harvest system accomplishes this economic goal depends on a number of site- and equipment-specific variables. The Citrus Harvesting Decision Tool allows a grower to enter information on as many different harvesting options as are available. Options could mean different equipment, same equipment but different contractors, and same equipment and same contractor with and without gleaning. By determining “net” unit costs of harvesting, a grower can make an informed decision about the financial viability of any specific harvest method. Growers and other users of the Citrus Harvesting Decision Tool are encouraged to contact Fritz Roka at the UF/IFAS Southwest Research and Education Center (239-658-3400) to ask questions and offer any comments on how the Decision Tool can be improved. For other questions about citrus mechanical harvesting, please visit the UF/IFAS website at http://citrusMH.ifas.ufl.edu/index.asp.