To glean or not to glean?

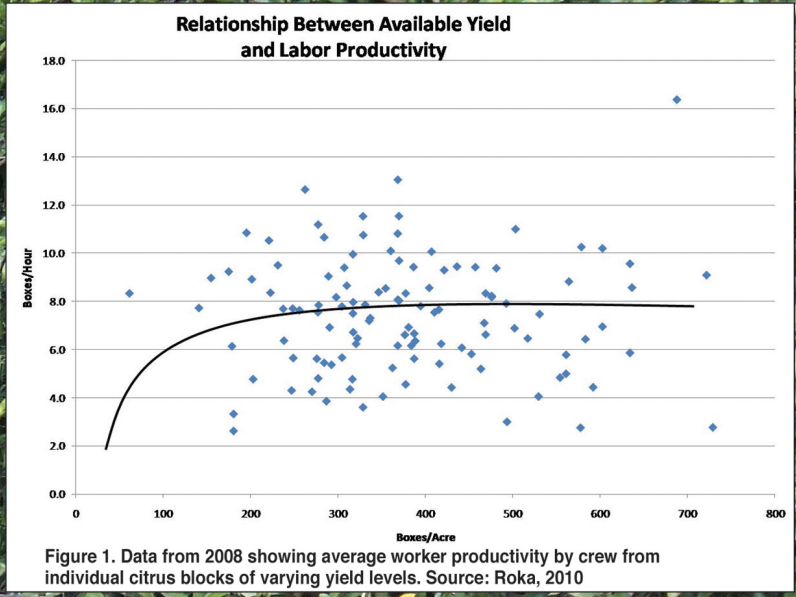

Figure 1. Data from 2008 showing average worker productivity by crew from individual citrus blocks of varying yield levels. Source: Roka, 2010

By Fritz Roka

To glean or not to glean is one of the questions facing growers who adopt mechanical harvesting. Gleaning is the hand-harvest of wholesome fruit that is not collected by a mechanical system.

To be clear, in this article, we refer to gleaning as a decision made in conjunction with a mechanical system that shakes and catches fruit in the same operation. For mechanical equipment that only shakes fruit to the ground, a hand crew is a necessary part of that system and those workers would not be considered "gleaners."

Some growers insist on gleaning fruit simply because they want the aesthetic appearance of a "clean" harvested grove. From an economic perspective, however, a grower should glean fruit only when the cost to harvest and haul gleaned fruit is less than the delivered-in price of fruit. For instance, if the fruit price is $1.50/p.s., hauling costs are 75 cents per box, and the grower is harvesting 6.25 p.s. per box, the grower would be willing to pay up to $8.62 per box to pick and roadside gleaned fruit (Calculation: $1.50/p.s. x 6.25 p.s./box – 75 cents/box). Clearly an $8.62 cost threshold exceeds any current hand-harvesting cost. Thus, only in very unusual situations would a grower not insist on gleaning.

On the other hand, if fruit prices were 60 cents/p.s. and the block was yielding 5.9 p.s. per box, a 75-cent hauling charge would leave the grower with only $2.79 to pick and roadside a box of gleaned fruit. Under these circumstances, if a harvesting company was to charge $2.80 or more per box to pick and roadside, the grower should not glean unless he or she is willing to accept the economic loss.

The cost of gleaning will vary directly with the recovery percentage of the mechanical harvesting system. That is, the more effective the harvesting machine (i.e. higher fruit recovery percentage), the higher the cost to glean the remaining fruit. To understand this cost relationship, one must realize two things. First, a worker's productivity will decline as the total volume of available fruit declines. Second, the piece rate to glean fruit will be adjusted to the hourly earnings expectation of a typical worker.

In blocks of oranges that yield between 400 and 500 boxes, labor productivity of hand-harvesters averages between eight and 10 boxes per hour. If a mechanical harvesting system recovers 90 percent of the crop, only 40 to 50 boxes per acre are available for gleaning. Figure 1 (inset, top photo) illustrates the relationship between the productivity of hand-harvesters (vertical axis) and the number of boxes available to be harvested (horizontal axis). These data were collected during the 2008 harvest season and combine blocks that were completely hand-picked with those blocks that were gleaned after mechanical harvesting occurred. What is interesting to note is that worker productivity remains fairly high even as available yield declines to less than 200 boxes per acre. As available yield falls below 200 boxes per acre, worker productivity drops off dramatically. Analysis of these data indicate that average productivity falls to five boxes per hour as total available fruit declines to less than 50 boxes per acre.

Experienced citrus harvesters know their individual productivity. Thus, when presented with a piece rate, they can quickly calculate their hourly or daily earnings. Typically these workers start the day with specific income expectations in mind. If harvesting conditions prevent them from performing at their usual productivity levels, they will argue for an increase in the per box piece rate in order to meet their income targets. At the very least, workers have to be paid the federal minimum wage, which currently

Table 1. Comparison of harvesting costs as mechanical harvesting recovery percentage increases from 85% to 95%

Recovery % of mechanical system	Block Yield: 500 boxes/acre	Costs	
85%	Mechanical cost:	85% @ $1.20/box	$510/acre
	Gleaning cost:	15% @ $3.00/box	$225/acre
	Total cost:		$735/acre
	Unit cost:		$1.47/box
95%	Mechanical cost:	95% @ $1.20/box	$570/acre
	Gleaning cost:	5% @ $4.00/box	$100/acre
	Total cost:		$670/acre
	Unit cost:		$1.34/box

is $7.25 per hour. (Note: Employers have to abide by the higher of federal and state minimum wage levels. Currently, the Florida state minimum wage is slightly less than the federal rate.) If average productivity to glean fruit is five boxes per hour, the gleaning piece rate has to at least be $1.45 per box just to cover the minimum wage threshold. Rates for roadsiding gleaned fruit would be adjusted upward as well.

Improving fruit recovery of mechanical harvesting systems is an important goal toward achieving lower harvesting costs. Table 1 provides an example with current representative cost numbers to illustrate how unit harvesting costs can be reduced when the machine recovery percentage improves from 85 percent to 95 percent. The cost of harvesting is the weighted average of both machine and gleaning costs. Even though gleaning costs increase from $3 to $4 per box as the recovery percentage increases, overall unit harvest cost decreases by 13 cents per box.

It would be unrealistic to expect mechanical harvesting to ever approach the nearly 100 percent fruit recovery achievable by a hand-harvesting crew. What is important, however, is that mechanical harvesting systems achieve a lower unit cost of harvesting. Improving a machine's recovery would certainly move the mechanical harvesting program in that direction. Whether mechanical harvesting could ever completely eliminate gleaning depends on the delivered-in price of fruit. If fruit prices remain high, it is likely that gleaning will, and should, occur.

When making a decision to glean or not to glean, a grower needs to be aware of the dynamic relationship between the piece rate for hand-harvesting and the available fruit to be gleaned, as well as the cost ceiling above which it would not be in a grower's economic interests to glean.

For questions or comments about citrus mechanical harvesting, please visit the UF/IFAS citrus mechanical harvesting Web site at http://citrusMH.ifas.ufl.edu. On the Web site you will find the entire IFAS faculty actively engaged in the mechanical harvesting program. Feel free to contact anyone.

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