

Labor Requirements and Costs for Harvesting Tomatoes

Zhengfei Guan,¹ Feng Wu, and Steven Sargent
University of Florida

Introduction

Florida accounted for 30% to 40% of all commercially produced fresh-market tomatoes in the United States. Before 2007, Florida ranked first in the production of fresh-market tomatoes. In recent years, its tomato acreage has been trending lower and it has fallen slightly behind California in tomato production. In 2015, Florida produced 950 million lbs of tomatoes on 35,000 acres (USDA, 2016). Florida produces field-grown tomatoes from October through June each year, with the greatest production in April and May and again in November to January. Almost every southern county in the state grows tomatoes.

The majority of fresh-market tomatoes in Florida are hand-harvested at the mature-green stage with specific criteria on size, color and defects. The harvest crew needs to be trained and supervised so that immature, over-mature, defective, and decayed tomatoes are left in the field (Sargent et al., 2005). Harvesting tomatoes is labor-intensive and costly. Tomatoes are usually harvested two or three times, and sometimes four times, over the season depending on weather, market, and labor availability. The Florida Tomato Committee estimated that about 33,000 workers are needed to hand pick 31,500 acres of fruit in 2013 (Florida tomato Growers Exchange, 2017). Due to escalating labor costs, harvesting costs are also increasing. In order to examine hand harvest efficiency and calculate the cost of harvesting tomatoes, we conducted a harvest timing study at the end of 2015. This article presents the timing study and the results.

Harvesting Operation

Tomato harvesting at a commercial farm is usually done by workers hired by the farm or through labor contractors. One harvest crew generally consists of 24 pickers and two dumpers. Each crew covers six rows on either side of the flatbed truck carrying full-size field bins on it. Each picker picks tomatoes on one side of the rows and places them into a plastic bucket which holds 30-35 lbs of tomatoes. After filling the bucket, pickers carry the filled bucket to the truck and pass it to the dumpers (Figure 1). Then the dumper empties the fruits into the bin and gives one plastic coin to pickers for counting. Pickers take the coin and return to the picking place in the row to continue harvesting. The time completing the picking cycle depends on the harvest speed, fruit density, and the distance of the row being picked to the truck. A flatbed truck can transport 22-24 filled bins and each bin holds about 1,000 lbs of fruit. To minimize the walking distance of

¹ Contact author: guanz@ufl.edu; 813-419-6590.

pickers, the truck is positioned in the field near the crew and moves along with it. Once the field trucks with the pallet bins have been filled, they are transported to the packinghouse.



Figure 1. Hand harvesting green tomatoes at a commercial farm

Harvest Timing Study

The timing study was performed for harvesting of the winter-season tomatoes in Southwest Florida. We studied the harvest of conventional round tomatoes at the same farm during December 4-23, 2015. The tomato varieties were FL91 and HM1823. Tomatoes are usually planted on different dates, so the first harvest occurred at different times. We were able to observe and record times from the first to the fourth harvests of specific fields during that time window. At each harvest, pickers were identified along with the row distance from the truck, and the time was recorded in filling the bucket, walking to the truck to have the bucket dumped, and returning to the picking place in the row. We timed 5-8 picking cycles for each randomly-chosen picker and calculated the average for each task of the picking cycle. Table 1 presents a summary of times completing each task for male and female pickers, and table 2 presents times for pickers by distance to the truck.

The results show that the time completing one picking cycle increases with the number of times the crop is picked. Pickers used 74, 84, 122, and 140 seconds to complete one picking cycle in the four harvests, respectively. There are usually many tomatoes for harvest in the first picking, and pickers spent only about 49 seconds to fill one bucket. Tomatoes in the second picking are less dense, and pickers took 58 seconds to fill the bucket. In the later two pickings, tomatoes are

usually smaller and fewer, and pickers need longer time to identify tomatoes meeting the harvest criteria. Therefore, the filling time substantially increased, to 97 and 112 seconds for these two harvests. The combined time of delivering tomatoes and returning to the picking place was relatively stable for the first three harvests, about 25 seconds. The time in the last harvest increased to 28 seconds. A possible reason is that pickers realize that time saved in walking does not make a big difference in the entire picking cycle and therefore slow down.

We observed that male pickers seemed to take less time than female pickers in the first harvest, and the difference narrows down in the later harvests. Male pickers took 73, 82, 119, and 139 seconds to complete one picking cycle in four harvests, while female pickers needed 78, 87, 133 and 142 seconds. However, given the smaller number of females in the sample, there are not enough observations to test for statistical difference after controlling for distances to the truck.

Table 1. Average Time of Completing Each Task for Male and Female Pickers (seconds)

		Observed Pickers	Fill Bucket	Walk to truck	Return to row	Total
1st Harvest	Male	12	46.4	12.5	13.9	72.8
	Female	3	58.3	9.8	10.2	78.3
	Average		49.1	11.9	13.0	74.0
2nd Harvest	Male	13	57.2	11.2	13.1	81.6
	Female	8	58.8	13.2	14.7	86.7
	Average		57.9	12.2	13.9	84.0
3rd Harvest	Male	10	94.4	11.5	13.3	119.2
	Female	3	104.0	13.3	15.6	132.9
	Average		96.6	11.9	13.8	122.4
4th Harvest	Male	14	111.5	12.3	15.0	138.7
	Female	6	111.6	14.2	16.1	141.9
	Average		111.5	12.9	15.3	139.7

Pickers closer to the truck spend less time in walking (Table 2). We divide the distance of pickers to the truck into three categories: Close, Middle and Far. The first and second rows beside the truck are defined as Close, the third and fourth rows are the Middle, while the fifth and sixth rows are defined as Far. Pickers at the far rows have to walk longer to carry tomatoes to the truck and thus spend more time. Non-filling times (the sum of walking to truck and returning to the row) in the first harvest were 20, 23, and 30 seconds for pickers at the close, middle, and far rows, respectively. In the subsequent harvests, the time ranges from 22-25, 25-31, 35-36 seconds for pickers at these three categories.

Table 2. Average Time (seconds) of Pickers at Different Distance from the Truck

	Distance	Fill Bucket	Non-filling			Total
			Walk to truck	Return to row	Sub-total	
1st Harvest	Close	56.3	11.3	8.5	19.8	76.2
	Middle	48.5	11.5	11.8	23.4	71.9
	Far	46.4	13.6	16.4	30.0	76.4
2nd Harvest	Close	55.2	10.4	12.1	22.5	77.7
	Middle	54.8	11.0	13.9	24.9	79.8
	Far	72.3	16.1	19.3	35.3	107.6
3rd Harvest	Close	96.1	9.7	11.8	21.5	117.6
	Middle	97.9	15.0	15.5	30.5	128.5
	Far	97.0	16.1	19.2	35.4	132.4
4th Harvest	Close	121.1	11.2	13.3	24.5	145.6
	Middle	105.8	13.1	16.1	29.2	135.0
	Far	103.3	16.6	18.2	34.8	138.1

Note that the total is the sum of time of filling bucket and non-filling activities.

Harvest Cost

Pickers are paid a piece rate for each bucket they deliver to the truck. In the first and second harvests, the piece rate pickers received was 60 cents per bucket. Our data suggest that pickers could pick 30-33 buckets per hour, meaning the average hourly earnings during active harvesting were about \$18-\$20 per hour. More skilled pickers could pick as many as 250-300 buckets in a typical 6-hour workday. In the later two harvests, the piece rate increased to 75 cents per bucket since the harvesting efficiency declines significantly due to the smaller number and size of tomatoes. Pickers harvested 17-20 buckets per hour. In addition, dumpers in the crew were paid at a daily rate of \$100, while truck drivers were paid at a rate of \$120 per day.

For a standard working group with 24 pickers, two dumpers and one driver, in a typical workday they could pick 4,752, 4,320, 2,880, and 2,448 buckets in four harvests and receive a collective total wage of \$3,071, \$2,812, \$2,380, and \$2,056, respectively, which are calculated with corresponding piece rates for each harvest. However, not all harvested tomatoes meet grading standards for shipment. In the packing house, cull tomatoes are removed. Assuming a 30% cull rate, to produce 1,500 boxes per acre (25 lbs per box) of marketable tomatoes with 700, 500, 200, and 100 boxes from four harvests, growers have to pay pickers a total of \$539, \$387, \$197 and \$100, respectively, based on corresponding piece rates. The total picking cost sums up to \$1,223 per acre. In fact, it costs employers more than this amount due to workers' waiting time counted as hours worked, which was not included in this study. In addition, the workers in this timing study were hired through labor contractors, which will receive an additional payment on top of the wages paid to workers.

References

Florida Tomato Growers Exchange, 2017. Tomato 101 Fact Sheet. Available at: <https://www.floridatomatoes.org/tomato-101/>.

Greenhouse, S. 2014. In Florida Tomato Fields, a Penny Buys Progress. New York Times, April 24, 2014. Available at: https://www.nytimes.com/2014/04/25/business/in-florida-tomato-fields-a-penny-buys-progress.html?_r=0.

Sargent ,S. A., J. K. Brecht, and T. Olczyk. 2005. Handling Florida Vegetables Series - Round and Roma Tomato Types. EDIS document SS-VEC-928. Horticultural Sciences Department, Florida Cooperative Extension Service, IFAS, University of Florida, Gainesville, FL. <http://edis.ifas.ufl.edu/SS-VEC-928>.

USDA, 2016. Quick Stats. United States Department of Agriculture, National Agricultural Statistics Service, Washington, D.C.