

# Rural Migration News

## Blog 186

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### Labor in Fruit and Vegetable Agriculture

U.S. households, what the government calls consumer units, spent an average \$615 a year or \$12 a week on fresh fruits and vegetables in 2019. Fresh fruits and vegetables are

considered labor intensive because the wages and benefits of the hired farm workers who plant, tend, and harvest them average at least a third of the farm price.

What would happen if fewer farm workers were available and farm labor costs rose?

#### 1997 Census Data

A study of hand labor in U.S. fruits and vegetables based on the 1997 Census of Agriculture estimated the number of hand workers required for major fruits and vegetables. For example, 50 hours were required to harvest each of the 454,000 acres of apples, and 60 hours to harvest each of the 668,000 acres of processing oranges. The apple harvest was much shorter, so that 57,000 apple pickers were required over 10 weeks, versus 39,000 orange pickers to harvest oranges over 26 weeks.

#### U.S. Fruits in 1997 Required an Estimated 280,000 Harvest Workers

Table 1. Hand-Harvested U.S. Fruit Crops, 1997

Crop <sup>1</sup>	Acres (1,000)	Farms	Leading States (Most to Least)	Production (Millions of lbs.)	Farm Gate Value <sup>4</sup>	Value Rank	Lh/ac	Harv. Weeks	Harv. Wrkers. <sup>3</sup> (1,000s)	Proc. Pct.	Mech Proc?	Harv. Fresh?	Labor Aid?
Apple	454.2	28,100	WA, NY, MI, CA, PA	10,226.6	1,575.4	16	50	10	57	40	N	N	N
Apricot	21.9	3,063	CA, WA	276.0	42.6	86	70	6	13	79	N	N	N
Avocado	66.00	6,069	CA, FL	356.6	277.8	50	25	30	1	1	N	N	N
Cherries, Sweet, Fresh	27.4	8,423	OR, WA, MI, CA, UT	230.9	84.7	47	160	6	18	0	n/a	N	N
Grapes, Fresh	107.4	19,961	CA, AZ, NY, GA, PA	1,874.2	588.5	11	50	16	8	0	n/a	N	N
Kiwifruit	6.6	589	CA	78.0	16.5	107	175	4	7	2	N	N	N
Nectarine	37.1	2,488	CA, WA, PA, SC, NJ	528.0	98.9	75	65	12	5	2	N	N	N
Olive	33.7	1,363	CA	208.0	66.8	79	85	8	9	100	N	n/a	N
Peach, Fresh	75.4	14,459	CA, SC, AL, TX, IL	1,126.8	274.5	34	65	12	10	0	n/a	N	N
Peach, Proc.	31.6	*	CA, SC	1,381.6	169.7	*	65	8	19	100	N <sup>2</sup>	n/a	N
Pear, Fresh	38.5	8,062	WA, CA, OR, NY, MI	1,144.6	188.0	43	55	8	7	0	n/a	N	N
Pear, Proc.	31.6	*	CA, WA, OR, NY, MI	939.2	99.8	*	55	8	5	100	N	n/a	N
Plum	46.7	6,585	CA, OR, MI	539.4	83.3	74	45	12	4	5	Y	N	N
Grapefruit, Fresh	90.0	4,445	FL, TX, CA	2,742.0	233.8	48	70	26	6	0	n/a	N	N
Grapefruit, Proc.	82.4	*	FL, TX, CA	2,510.0	*	*	60	26	5	100	N	n/a	N
Lemon	60.4	2,108	CA, AZ	1,718.0	294.1	44	185	26	11	52	N	N	N
Lime	2.1	861	FL	28.0	4.4	122	75	26	< 1	26	N	N	N
Orange, Fresh	173.5	13,468	CA, FL, AZ, TX	5,712.0	1,936.4	14	65	26	11	0	n/a	N	N
Orange, Proc.	668.3	*	FL, CA, TX, AZ	22,002.0	*	*	60	26	39	100	N <sup>2</sup>	n/a	N
Tangelo	13.3	1,001	FL	354.0	19.1	101	55	16	1	68	N	N	N
Tangerine	42.5	1,855	FL, CA, AZ	836.0	118.5	71	55	26	2	33	N	N	N
Cult. Blueberry, Fresh	22.8	5,159	NJ, MI, NC OR, GA	69.3	76.2	66	530	12	25	0	n/a	N <sup>2</sup>	N
Strawberry, Fresh	33.0	7,141	CA, FL, OR, NY, NC	1,201.8	788.0	24	200	16	10	0	n/a	N	Y
Strawberry, Proc	11.7	*	CA, OR, WA, MI	426.0	115.4	*	200	16	4	100	N	n/a	Y

1 Information for the first seven columns is from various USDA-NASS summaries, see Ref. 20  
 2 Number of harvest workers = (acres x Lh/ac) + (harvest weeks x 40h/week). This is probably a low estimate.  
 3 Mechanical harvesting technology is beginning to be adopted, but use is less than 5 percent.  
 4 Millions  
 \* Only total data (fresh plus processed) found, see number above.  
 Source: <https://cis.org/Report/Alternatives-Immigrant-Labor>

The most labor-intensive fruit was fresh blueberries, which required 530 hours per acre, so that harvesting 23,000 acres over 12 weeks required 25,000 workers. By contrast, the 45,000 acres of strawberries required 200 harvest hours per acre over 16 weeks, and a total of 14,000 harvest workers.

The fruits in the 1997 table required a total of 280,000 harvest workers for periods that ranged from six weeks (sweet cherries) to 30 weeks (avocados). The three key variables affecting the required harvest workforce are acres of the commodity, harvest hours per acre, and the duration of the harvest. Fewer than 280,000 workers would be required because some workers could harvest several crops, such as cherry harvesters who also pick apples.

A similar review of farm labor in vegetables estimated that 31,000 workers were required to harvest 74,000 acres of asparagus, followed by 17,000 workers to harvest 285,000 acres of lettuce and 15,000 workers to harvest 236,000 acres of fresh sweet corn. The most labor-intensive vegetables were 15,000 acres of green onions, requiring 300 hours per acre, and 56,000 acres of bell peppers that required 200 harvest hours per acre. Fresh asparagus and cucumbers each required 150 hours per acre.

The vegetables listed in the table required a total of 145,000 harvest workers for periods that ranged from nine weeks for asparagus to 24 to 26 weeks for lettuce, beans, and melons. As with fruit sector workers, some vegetable workers could

harvest two crops, so that fewer than 145,000 may be needed.

The study concluded that the mechanization of hand tasks was the “only solution to significantly reduce production costs and maintain competitiveness.” It emphasized the technical challenges and economic hurdles to mechanization in “minor” fruit and vegetable commodities, and urged public-private partnerships to support the research needed to accelerate labor-saving mechanization.

## 2017 Census Data

There have been many changes in fruit and vegetable production between 1997 and 2017. The U.S. population rose by more than 50 million, from 273 million to 325 million. The per capita consumption of many

### U.S. Vegetables in 1997 Required an Estimated 145,000 Harvest Workers

Table 2. Hand-Harvested U.S. Vegetable Crops, 1997

Crop <sup>1</sup>	Acres (1,000)	Farms	Leading States (Most to Least)	Production (Millions of lbs.)	Farm Gate Value <sup>4</sup>	Value Rank	Lh/ac	Harv. Weeks	Harv. Wrkrs. <sup>2</sup> (1,000s)	Proc. Pct.	Mech. Proc? <sup>3</sup>	Harv. Fresh?	Labor Aid?
Artichoke	9.3	nd	CA	93.0	73.9	80	60	26	< 1	25	N	N	N
Asparagus	74.0	2,672.2	WA, CA, MI, NJ, IL	202.6	182.4	62	150	9	31	38	N	N	Y
Broccoli	130.8	2,413	CA, AZ, TX	1,688.0	481.5	32	80	22	12	7	N	N	Y
Cantaloupe	113.8	6,273	CA, AZ, TX, GA, IN	2,355.6	417.9	38	50	26	5	12	N	N	Y
Cauliflower	47.4	1,228	CA, AZ, NY, MI, TX	688.9	217.5	58	80	16	6	8	N	N	Y
Collards	16.7	358	GA, SC, NC, AL, TX	nd	nd	nd	40	26	< 1	15	Y	N	N
Cucumbers, Fresh	56.0	6,821	FL, GA, CA, MI, NC	1,095.7	185.2	60	150	16	13	0	n/a	N	N
Honeydew Melon	37.3	369	CA, AZ, TX	579.5	109.4	73	50	23	2	5	N	N	Y
Lettuce, Head	203.0	2,775	CA, AZ, CO, NM, NJ	7,509.4	1,324.1	20	50	24	11	nd	N	N	Y
Lettuce, Romain	34.3	*	CA, AZ, FL, OH	985.8	190.9	63	50	22	2	0	n/a	N	N
Lettuce, Leaf	48.6	*	CA, AZ, OH, FL	1,038.7	299.2	55	75	22	4	0	n/a	N	N
Mustard Greens	12.3	1,182	CA, GA, TX, SC, IL	nd	nd	nd	40	16	< 1	30	Y	N	N
Green Onion	14.6	1,356	CA, TX, GA, AZ, OR	nd	nd	nd	300	26	4	0	n/a	N	N
Okra	3.3	1,962	FL, TX, GA, AL, SC	nd	nd	nd	160	26	< 1	nd	N	N	N
Bell Pepper	56.2	6,271	CA, FL, NJ, TX, NC	1,495.9	479.5	31	200	26	11	35	N	N	Y
Snap Beans, Fresh	82.7	nd	FL, CA, GA, TN, NY	380.5	154.4	64	75	26	6	0	n/a	Y <sup>3</sup>	N
Spinach, Fresh	22.7	1,173	CA, NJ, TX, CO, MD	326.5	102.3	82	40	26	< 1	0	n/a	N	N
Sweet Corn, Fresh	236.4	22,805	FL, CA, GA, NY, OH	2,364.1	418.6	39	30	12	15	0	n/a	Y <sup>3</sup>	N
Tomato, Fresh	125.4	14,386	FL, CA, GA, VA, TN	1,246.8	3,780.9	18	50	16	9	0	n/a	N	Y
Turnip Greens	11.1	918	GA, TN, AR, SC, AL	nd	nd	nd	40	26	< 1	30	Y	N	N
Watermelon	184.6	8,623	CA, FL, GA, TX, AZ	4,073.4	309.2	41	25	16	7	2	N	N	Y

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3 Mechanical harvesting technology is beginning to be adopted, but use is less than 5 percent.

4 Millions

\* Only total data (fresh plus processed) found, see number above.

nd = No data found

Source: <https://cis.org/Report/Alternatives-Immigrant-Labor>

fresh fruits and vegetables rose: fresh strawberry consumption rose from four pounds per person in 1997 to seven pounds per person in 2018. However, the consumption of lettuce fell from 30 pounds per person to 25 pounds between 1997 and 2017.

The acreage of the most labor-intensive fruits rose over the past three decades. The acreage of cultivated blueberries rose from 23,000 to 113,000 between 1997 and 2017, and the acreage of strawberries rose from 45,000 to 60,000. The acreage of apples fell from 454,000 to 382,000 in 2017 and the acreage of all oranges from 842,000 to 603,000.

The acreage of lettuce rose from 286,000 to 343,000, but the acreage of asparagus fell from 74,000 in 1997 to 30,000 in 2017. The acreage of green onions fell from 15,000 to 6,800, and acreage of bell peppers fell from 56,000 to 49,000.

Employment in many fruits and vegetables rose over the past three decades due to rising yields. Take apples. Yields per acre rose with dwarf trees planted closer together, and labor intensity increased as high-value varieties such as Honeycrisp replaced red and golden delicious.

Estimating the number of hours and workers needed to produce and harvest commodities is difficult for several reasons. First, the most reliable data are for acres, but the acres of apples and oranges include different varieties with unique labor requirements. Oranges include those harvested to be processed into orange juice and do not have to be handled carefully and oranges harvested for the fresh market that require more care in picking and handling.

Second, commodities may be both hand picked and machine picked, as when the first harvest of blueberries is picked by hand and the second

### Strawberry harvesting requires the most labor per acre; apple harvesting requires the most workers

Fruits	Acreage (2017)	Harvest Hours/acre	Harvest Hours (mils)	Harvest hours/worker	Harvest workers
Apples	381,718	126	48	500	96,193
Blueberries, tame	113,199	160	18	500	36,224
Cherries, sweet	105,978	80	8	500	16,956
Grapes, table	83,000	149	12	500	24,734
Oranges	602,830	50	30	1250	24,113
Peaches	112,861	84	9	500	18,961
Strawberries	60,162	700	42	1250	33,691
<b>Fruit subtotal</b>	<b>1,459,748</b>		<b>151</b>		<b>236,404</b>
All noncitrus	2,160,940				
Citrus	824,983				
Berries	253,000				

Harvest hours per worker assumes 50 hour weeks for 10 weeks except oranges and strawberries, 25 weeks

Apples harvest labor is for Gala in WA

Blueberries assume 8,000 pounds per acre and workers pick 50 pounds per hour

Cherries assume yields average 8,000 pounds per acre and workers pick 100 pounds an hour

There were 11 million acres of grapes, including 83,000 bearing acres of table grapes in 2019

Oranges assume 240 boxes per acre and workers pick 12 boxes an hour

Peaches are based on [https://coststudyfiles.ucdavis.edu/uploads/cs\\_public/65/6c/656ce5fa-f4f9-4e95-99fe-a01c1ea8a7a4/2017peachsvsjv-ecling-final\\_draft2.pdf](https://coststudyfiles.ucdavis.edu/uploads/cs_public/65/6c/656ce5fa-f4f9-4e95-99fe-a01c1ea8a7a4/2017peachsvsjv-ecling-final_draft2.pdf)

Strawberries assume 7,000 trays per acres and workers pick 10 pick trays per hour

Berries are blackberries, tame blueberries, raspberries, and strawberries

harvest is by machine. Even if commodities are entirely hand picked, the first harvest may be a careful pick, and the second harvest a strip pick of remaining fruits and vegetables.

Third, harvesting is not always the most labor-intensive part of production. For example, producing Gala apples is estimated to require over 200 hours an acre to prune trees, thin apples, and cover them with netting, and only 125 hours an acre to harvest.

With these caveats, the table shows that strawberries require the most labor per acre, four times more than the next most labor-intensive commodities, blueberries and table grapes. Apples require the most harvest workers because of their large

acreage, labor intensity, and relatively short harvest season. Oranges require fewer harvest workers because they require fewer hours per acre and are harvested over a longer season.

These data show that the major fresh fruits and vegetables could be harvested with about 400,000 hand workers if these workers were employed 50 hours a week during the harvest period. Most workers are not employed 50 hours a week for 10 or 25 weeks, which is why more workers are employed in these harvests than indicated in the table. Seasonality, mismatches between where workers live and where crops are grown, and declining migrancy are some of the factors that make it difficult to assemble harvest workforces efficiently.

## Broccoli and Lettuce Require the Most Harvesting Hours Per Acre

Vegetables	U.S. Acreage	Harvest Hours/acre	Harvest Hours (mils)	Harvest hours/worker	Harvest workers
Broccoli	135,185	210	28	1250	22,711
Lettuce	342,965	270	93	1250	74,080
Sweet Corn	496,096	23	11	500	22,820
Sweet Potatoes	172,983	50	9	500	17,298
Tomatoes	102,000	72	7	500	14,688
Watermelons	129,790	40	5	500	10,383
<b>All fresh vegetables</b>	<b>2,617,646</b>				
Potatoes, fresh	535,792				

Vegetables are harvested to be consumed fresh and to be processed by canning or freezing. Vegetables harvested for the fresh market require the most farm workers, and (iceberg) lettuce stands out as requiring a high number of hours per acre and having a large acreage. The other fresh vegetables with 100,000 or more harvested acres employ fewer than 25,000 workers if workers work 50-hour weeks during the major harvest period.

Harvest hours per worker assumes 50 hour weeks for 10 weeks except broccoli and lettuce, 25 weeks

Hours per acre data from <https://coststudies.ucdavis.edu/>

Broccoli and (iceberg) lettuce hours divide harvest cost per acre in 2017 by \$20 an hour

Sweet corn is based on a 2008-09 FL cost study of \$345 an acre to pick, pack, and haul at \$15 = 23 hours/acre

<https://fred.ifas.ufl.edu/pdf/iatpc/files/PalmBeachCorn09.pdf>

Sweet potatoes based on NC 2020 harvesting 500 bushels per acre at a cost of \$1.50 per bushel, and \$750 per acre at \$15 per hour

<https://cals.ncsu.edu/are-extension/news/new-2020-sweet-potato-enterprise-budget/>

Tomatoes excludes 233,000 acres of processing tomatoes

Watermelons based on \$600 per acre harvesting costs in 2012 at \$15 an hour

<http://pubs.cahnr.wsu.edu/publications/wp-content/uploads/sites/2/publications/FS150E.pdf>

## References

Sarig, Yoav, James Thompson, and Galen Brown. 2000. Alternatives to Immigrant Labor? CIS. <https://cis.org/Report/Alternatives-Immigrant-Labor>

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