

benefits, cover-alls, hard hats, meals, etc. supplied to these people. It was the first step in giving them dignity. Incidentally, it is very hard for people like ourselves to conceive that, at the level at which most of these laborers work, a "hard hat" is a symbol of an aristocrat amongst laborers. To be given hard hats to protect their heads against the sharp thorns of a lemon tree was immensely important. What has been the result of these measures?

1. They have vastly reduced the damage to the fruit, with consequent maintenance of keeping quality and market demand.

2. They have increased the weekly productivity per worker very substantially. This has been due, not so much to increasing the amount of lemons

picked per hour, but to increasing the number of hours the pickers work per week.

Many years ago, my boss, Dr. Herman Reitz, remarked that the problem was "How to motivate these people so they will be greedy, avaricious folk like ourselves, ready to work for 40 hours a week for monetary return." The Ventura County lemon growers look like being well on the road to doing that. It has been achieved first by a mental adjustment on the part of the employer enabling him to give a consequent new sense of dignity to the picker.

As I said when I started, I am no expert on labor relations, but I know that we need to have dignity on both sides of any successful negotiations.

HARVESTING LABOR IN FLORIDA HORTICULTURE WITH EMPHASIS ON THE CITRUS INDUSTRY

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Abstract. As the production of horticultural crops increases in Florida, the demand for harvesting labor also increases. The supply of harvesting labor is not expected to keep pace with this increasing demand. Problems associated with harvesting labor are expected to continue to plague Florida's horticultural industries in the near future. Technological innovations such as mechanical harvesting systems may significantly affect the demand for labor. Supply-demand relationships for labor as well as demographic and other types of information pertaining to the harvesting labor force are valuable inputs for the assessment of the effects of technological changes on the labor force.

The one problem presently shared by practically all horticultural industries in Florida is labor. The majority of vegetable, fruit, and ornamental crops produced in Florida tend to be labor-intensive in nature, particularly with respect to the harvesting operation.

Several factors contribute to the problems as-

sociated with harvesting labor. The seasonal nature of the demand for harvesting labor creates problems in labor recruitment. Since an adequate supply of labor is not always available in a particular area when needed, labor must be recruited, on both an intra-state and inter-state basis. The problems associated with recruitment programs have been increasing in recent years.

Although large amounts of relatively unskilled seasonal workers are needed, the supply of such labor to many horticultural industries in Florida has not been keeping pace with demand. One of the reasons may be the relatively low gross unemployment rate in Florida of 2.8 percent compared to the national average of approximately 5.0 percent. The insured unemployment rate in Florida is presently 1.4 percent (7).

These low levels of unemployment accentuate the competition for relatively unskilled labor in Florida. This competition for harvesting labor can be identified at three levels: (1) competition among firms within an agricultural industry; (2) competition among various agricultural industries; and (3) competition between agricultural and non-agricultural industries. As the demand for harvesting labor increases and/or the supply decreases, both intra-industry and inter-industry competition will increase. The demand for labor by non-agricultural industries has increased greatly

in recent years, particularly in the construction and services sectors. It is highly probable that this trend will continue.

Another possible factor affecting the availability of harvesting labor in recent years has been the increase in welfare and food stamp program benefits. These programs have provided some potential harvest workers with substantial income supplements which may have prevented their participation in the harvesting labor force.

Attempts by labor unions to organize farm workers in many parts of the country have proven to be a disruptive factor in several labor-intensive agricultural industries. The industries affected most have been those requiring large amounts of seasonal harvesting labor. Labor union activities have been associated with strikes, boycotts, and a decrease in managerial control over the hiring and supervision of workers. Florida horticulture is by no means exempt from such problems.

As a result of developing problems, primarily of supply and demand, associated with harvesting labor, Florida horticultural industries have witnessed increasing wage rates, expanding labor recruitment programs, and increasing interest in mechanical harvesting systems. However, harvesting labor problems still continue despite the fact that in July 1973 farm wage rates for all types of farm workers in Florida averaged \$2.25 per hour according to the Florida Crop and Livestock Reporting Service (4). This figure was considerably higher than other nearby states as well as the national average of \$1.91 per hour and was exceeded only by the California rate of \$2.44 per hour. For the same period, Florida farm workers paid on a piece-rate basis averaged \$3.34 per hour compared to \$2.95 per hour in California and the national average of \$2.36 per hour.

Labor recruitment programs have been expanding in recent years on both an intra-state and inter-state basis. Even in the presence of such programs, the supply of harvesting labor in many industries continues to be a critical factor.

The supply-demand relationships for harvesting labor and associated problems have caused several industries to focus attention on the development of mechanical harvesting systems. To date, mechanical harvesting on a commercial basis has been limited primarily to selected vegetable crops. The sugar cane, tomato, and citrus industries are examples of horticultural industries that are making progress in this area. The degree to which mechanical harvesting systems can be expected to ease harvesting labor problems varies considerably with

each industry. A large percentage of *several vegetable crops* (potatoes, corn, beans, celery, carrots, radishes, bush beans, and southern peas) are presently being harvested by mechanical methods (6). Many of these crops are produced for processing which permits more favorable application of mechanical harvesting techniques.

The number of mechanical harvesting machines in the sugar cane industry has been increasing in recent years. It is feasible that the entire sugar cane crop could be harvested by mechanical methods in the very near future. For the tomato industry, it has been estimated that the maximum probable level of mechanical harvesting adoption will be 10 percent over the next four to six years (13). The potential for the mechanical harvesting of Florida tomatoes for the fresh market is considerably different from the processed market situation in California.

A 1970 study by the University of Florida estimated that 10 percent of the Florida citrus industry would be mechanized by the 1977-78 season and that by the 1982-83 season the degree of harvesting mechanization would range from 20 to 30 percent of the grapefruit to 50 to 60 percent of the early and midseason oranges. However, due to the fact that technological advance and commercial adoption of mechanical harvesting equipment have not progressed as rapidly as anticipated in 1970, it is questionable whether the industry will mechanize at this rate.

Thus, mechanical harvesting does not appear to represent a simple solution to harvesting labor problems for Florida horticulture in the near future.

The remainder of this paper will focus on the harvesting labor situation and the need for mechanical harvesting systems in the Florida citrus industry.

The Florida Citrus Industry

Estimated Future Crop Sizes

Florida's total citrus production has increased steadily over the past two decades. Production of round oranges, Temples, and grapefruit reached 220 million boxes during the 1972-73 season. Average production estimates for the near future range from 206 million boxes in 1973-74 to 252 million boxes in 1979-80. The maximum potential production during this period could range from 264 to 340 million boxes between 1973-74 and 1979-80 (9). The average estimates and their associated

Table 1. Actual production of round oranges, Temples, and grapefruit from 1951-52 through 1972-73 with average estimates and potential ranges from 1973-74 through 1979-80.

| Season | Orange, Temple and grapefruit production (estimates) | Potential ranges | Other | Total all citrus |
|-----------------------------------|--|------------------|--------|------------------|
| - - - - - million boxes - - - - - | | | | |
| 1951-52 | 109.9 | | 6.0 | 116.0 |
| 1952-53 | 103.0 | | 6.9 | 109.9 |
| 1953-54 | 129.8 | | 7.1 | 136.9 |
| 1954-55 | 120.7 | | 8.0 | 128.7 |
| 1955-56 | 126.5 | | 7.9 | 134.4 |
| 1956-57 | 127.7 | | 8.0 | 135.7 |
| 1957-58 | 112.2 | | 4.3 | 116.4 |
| 1958-59 | 118.2 | | 7.8 | 126.0 |
| 1959-60 | 118.1 | | 7.5 | 125.6 |
| 1960-61 | 114.3 | | 9.9 | 124.2 |
| 1961-62 | 143.6 | | 10.2 | 153.8 |
| 1962-63 | 102.5 | | 5.2 | 107.8 |
| 1963-64 | 81.2 | | 8.6 | 89.8 |
| 1964-65 | 114.3 | | 9.4 | 123.7 |
| 1965-66 | 130.8 | | 10.2 | 141.0 |
| 1966-67 | 183.1 | | 11.9 | 195.0 |
| 1967-68 | 133.4 | | 10.9 | 144.3 |
| 1968-69 | 169.6 | | 12.5 | 182.1 |
| 1969-70 | 175.1 | | 13.9 | 189.0 |
| 1970-71 | 185.2 | | 14.5 | 199.7 |
| 1971-72 | 184.0 | | 16.5 | 200.5 |
| 1972-73 | 220.8 | | 7.4 | 228.2 |
| 1973-74 | (206) | 148-264 | (9.6) | (215.6) |
| 1974-75 | (212) | 142-278 | (10.2) | (222.2) |
| 1975-76 | (225) | 152-291 | (10.9) | (235.9) |
| 1976-77 | (229) | 150-304 | (11.6) | (240.6) |
| 1977-78 | (240) | 155-316 | (12.3) | (252.3) |
| 1978-79 | (244) | 152-329 | (13.0) | (257.0) |
| 1979-80 | (252) | 156-340 | (13.6) | (265.6) |

Source: [5, 9]

ranges as well as actual past production are presented in Table 1.

Total Picking Costs

Over the last two decades (1951-52 to 1971-72), average total picking costs per box have increased 149 percent for oranges, 169 percent for grapefruit, and 127 percent for tangerines (Table 2). The increases have been even more dramatic over the past ten years as average total picking costs for oranges and grapefruit have more than doubled (110 and 104 percent respectively) while tangerine picking costs have increased by 72 percent. Even in the last five years these costs have increased 53 percent for oranges, 39 percent for grapefruit, and 24 percent for tangerines (11).

Picking Wage Rates

Wages paid to citrus pickers represent the largest portion of the total cost associated with the picking operation. The average wage rate paid to pickers for oranges and grapefruit has doubled over the past ten years (108 percent and 100 percent respectively) and has increased by 39 percent for oranges and 32 percent for grapefruit over the past five years (1966-67 to 1971-72) (Table 3). For tangerines the wage rate has increased by 47

Table 2. Average cost per box for picking citrus fruits, 1950-51 through 1971-72.

| Season | Oranges | Grapefruit | Tangerines |
|-------------------------------|---------|------------|------------|
| - - - - cents per box - - - - | | | |
| 1950-51 | 28.36 | 18.62 | 56.93 |
| 1951-52 | 28.42 | 19.51 | 61.93 |
| 1952-53 | 29.12 | 21.98 | 59.62 |
| 1953-54 | 28.87 | 20.58 | 60.86 |
| 1954-55 | 28.93 | 20.91 | 64.72 |
| 1955-56 | 30.52 | 21.73 | 66.39 |
| 1956-57 | 31.36 | 23.46 | 73.96 |
| 1957-58 | 33.30 | 24.09 | 75.53 |
| 1958-59 | 33.30 | 24.16 | 74.90 |
| 1959-60 | 34.17 | 25.16 | 83.68 |
| 1960-61 | 34.96 | 26.69 | 83.53 |
| 1961-62 | 33.79 | 25.75 | 81.66 |
| 1962-63 | 39.57 | 28.32 | 95.97 |
| 1963-64 | 43.04 | 31.47 | 100.71 |
| 1964-65 | 43.43 | 33.08 | 102.63 |
| 1965-66 | 46.12 | 37.77 | 107.47 |
| 1966-67 | 46.25 | 37.65 | 113.47 |
| 1967-68 | 54.09 | 41.45 | 118.46 |
| 1968-69 | 57.77 | 42.99 | 120.55 |
| 1969-70 | 61.12 | 46.98 | 129.82 |
| 1970-71 | 64.86 | 48.61 | 134.51 |
| 1971-72 | 70.86 | 52.41 | 140.46 |

Source: [11]

percent over the past ten years and 11 percent in the past five years (12). These trends are expected to continue in the future.

Labor Supply and Demand

Available pickers are not expected to increase over the next decade. In fact, it is unlikely that a sufficient number of pickers will be available to harvest the increasingly larger crops in the future. In recent years, increasing difficulty has been encountered in recruiting labor from other states. In addition, the migrant labor force, a major factor in peak harvesting periods, is actually declining.

During the 1966-67 through the 1969-70 seasons, the number of domestic citrus pickers during the peak week of the season ranged from approximately 23,300 to 24,300 (Table 4). The number increased slightly to the 26,600 level in 1970-71 and 1971-72 but decreased this season (1972-73) by over 5,000 to 21,350 pickers (1).

From the actual 1972-73 peak week level, estimated picker requirements are expected to in-

Table 3. Average wage rate per box paid to pickers.

| Season | Oranges | Grapefruit | Tangerines |
|---------|-------------------------------|------------|------------|
| | - - - - cents per box - - - - | | |
| 1950-51 | 17.61 | 10.22 | 38.48 |
| 1951-52 | 17.63 | 10.94 | 43.67 |
| 1952-53 | 18.29 | 12.16 | 44.58 |
| 1953-54 | 17.87 | 12.09 | 45.78 |
| 1954-55 | 17.26 | 11.58 | 47.21 |
| 1955-56 | 17.95 | 12.05 | 46.35 |
| 1956-57 | 18.33 | 13.03 | 51.22 |
| 1957-58 | 18.76 | 13.04 | 50.12 |
| 1958-59 | 19.02 | 13.58 | 51.57 |
| 1959-60 | 18.99 | 13.55 | 58.06 |
| 1960-61 | 18.90 | 13.84 | 57.11 |
| 1961-62 | 19.64 | 14.31 | 59.79 |
| 1962-63 | 22.50 | 15.11 | 66.86 |
| 1963-64 | 24.24 | 17.19 | 69.83 |
| 1964-65 | 26.38 | 18.78 | 73.57 |
| 1965-66 | 28.54 | 21.18 | 75.03 |
| 1966-67 | 29.53 | 21.75 | 79.55 |
| 1967-68 | 33.42 | 24.21 | 82.66 |
| 1968-69 | 37.51 | 25.39 | 83.73 |
| 1969-70 | 38.54 | 26.86 | 91.02 |
| 1970-71 | 38.70 | 26.73 | 87.52 |
| 1971-72 | 40.92 | 28.68 | 87.99 |

Source: [12]

crease approximately 5,000 by 1974-75 (two years) and 7,000 by 1977-78 (five years) without mechanical harvesting systems (9, 10). If the present system of manual harvesting is continued, the labor requirements of the industry by 1980 would be nearly 40 percent higher than the present (1972-73) labor supply. Current trends suggest that the available labor supply will not be able to satisfy the demand for labor.

Another dimension of the labor supply problem relates to voluntary underemployment. A survey of employers of citrus harvesting labor (3) indicates that pickers do not work as many hours or days as they are offered, thus suggesting the existence of voluntary underemployment in the picking operation. Of those employers surveyed, 74 percent indicated they had problems obtaining a five-day work week from pickers. Data from a survey of labor conducted by the University of Florida (8) indicate that, on a daily average, 14 percent of citrus pickers surveyed did not work at least one day between Monday and Friday, ranging

Table 4. Domestic citrus pickers working in the Florida citrus industry.

| Season | Citrus pickers (peak week) |
|---------|-------------------------------|
| 1962-63 | 25,181 |
| 1963-64 | 15,000 (post freeze) |
| 1964-65 | 17,800 |
| 1965-66 | 20,600 |
| 1966-67 | 23,321 |
| 1967-68 | 23,383 |
| 1968-69 | 23,823 |
| 1969-70 | 24,291 |
| 1970-71 | 26,402 |
| 1971-72 | 26,620 |
| 1972-73 | 21,352 |

Source: [1]

from 7 percent on Tuesday to 22 percent on Thursday. When asked why they had not worked particular days between Monday and Friday, an average of 22 percent per day responded that they had "taken the day off" and an average of 12 percent refused to give a reason. This situation causes considerable difficulty with respect to harvest planning as employers often have an inadequate supply of pickers without any advance notice.

Theoretically, voluntary underemployment represents a potential solution to the labor supply problem. However, the majority of incentive programs designed by employers have proved to be unsuccessful as witnessed by continued voluntary underemployment.

The Need for Mechanical Harvesting

During the past season there was an inadequate supply of picking labor to harvest the 1972-73 citrus crop on schedule. In the absence of commercially and economically feasible mechanical harvesting systems, the labor deficit will continue to increase in the next decade given that the supply of picking labor remains in the 21,000 to 25,000 range. If the current supply of pickers (21,352) remains constant, by 1974-75 (two years) the supply of pickers will represent 80 percent of the demand for pickers and by 1977-78 (five years)

supply will be 75 percent of demand (see Figure 1). Even if picker numbers reach the maximum of the past decade of 26,620, the Florida citrus industry will be barely able to harvest the estimated 1974-75 crop and will be unable to harvest all of the estimated 1975-76 crop without viable mechanical harvesting systems.

One of the reasons why the adoption of mechanical harvesting methods has not yet taken place is that until very recently the citrus industry has been able to recruit the necessary harvesting labor from among both Florida residents and migrants from other states. Considering the foreseen increase in citrus production, however, the recruiting situation of the past is not likely to continue in the future. This is witnessed by the labor supply in the 1972-73 season and estimates of the future labor supply-demand situation. Manual labor has been available at wages that, although increasing rapidly, have been competitive with expected per box costs for mechanical systems.

Based on the current situation and the stage of mechanical harvesting development, it is doubtful that a sufficiently large segment of the industry will be mechanized in time to fill the anticipated

gap between the supply of manual harvesting labor and the demand for such labor. The point at which mechanical harvesting will move from the experimental to the commercial stage is uncertain. It is difficult to estimate the willingness of industry personnel to undertake large investments in equipment, the capabilities of which are, to a certain extent, unknown to them. Furthermore, the adoption process is influenced by a combination of such factors as the stage of mechanical harvesting development, cost of mechanical equipment, cost of manual labor, available labor supply, and size of crops to be harvested.

Although the basic engineering technology has been developed, additional refinements and improvements are apparently necessary. Increased research input and field operation appear to be the keys to commercially and economically feasible mechanical harvesting systems.

Considering the estimated future crop sizes, the increases in manual picking rates, and the harvest labor supply-demand situation, a definite need exists for mechanical harvesting systems in the Florida citrus industry.

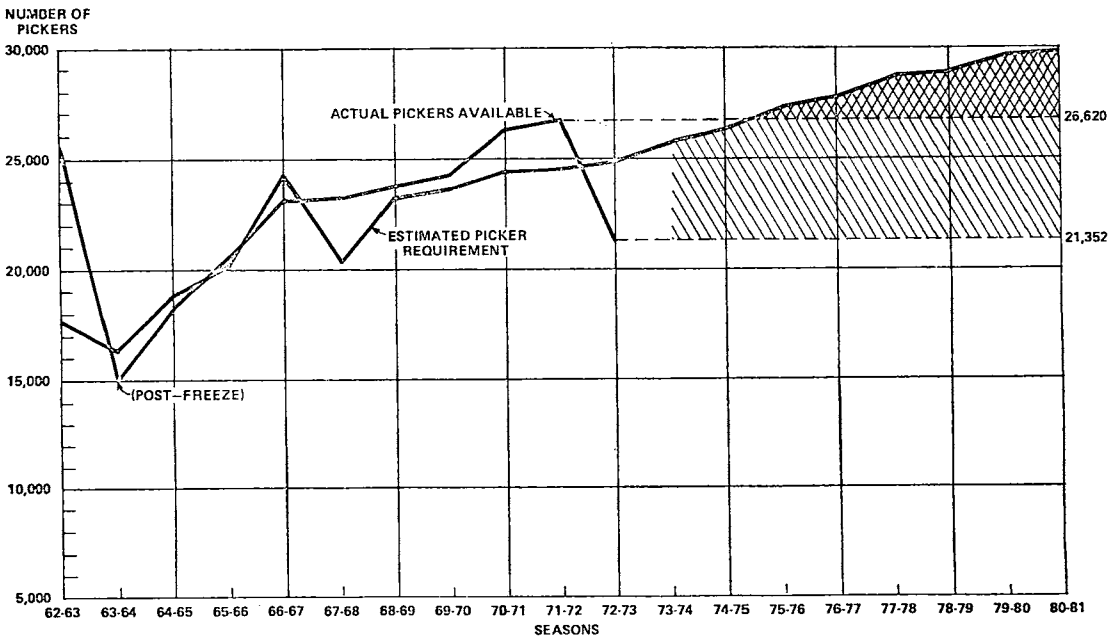


Fig. 1. Actual pickers available and estimated picker requirements during peak period without mechanical harvesting systems.

Implications for Harvesting Labor

The estimated effect of mechanical harvesting on labor in the Florida citrus industry is by no means comparable to the impact which has occurred in some industries. The primary reason is that the increases in labor productivity resulting from mechanization will be partially offset by anticipated increases in total production. Furthermore, the current trends in the supply of harvesting labor imply that mechanical harvesting will not displace a substantial portion of the labor force.

The effect of mechanical harvesting systems on the demand for labor will be twofold. First, they will decrease the amount of labor needed to harvest a given crop. Second, they will alter the skill structure of the labor force required. A larger percentage of workers with higher skill levels will be needed to harvest a crop by mechanical means than if it was harvested by manual methods.

A 1970 University of Florida study on the anticipated impact of mechanical harvesting (2) concluded that in approximately the next ten years the demand for less skilled workers will be reduced by about 15 percent while that for skilled and semi-skilled workers will almost double. Although the demand for harvesting labor will remain highly seasonal, it seems that enough opportunities will exist for the employment of the skilled labor during the off-season in production, repair and maintenance of machinery, and tree-conditioning activities. However, year-round job opportunities for less skilled workers will not increase substantially from the present situation.

Technological changes that substitute capital for labor always have an impact on the labor market and unless preventive measures are taken they usually adversely affect some of the workers involved. The magnitude of the impact depends on how substantial the change is in the capital-labor ratio. For a given technological change, however, it is the characteristics of the workers affected along with the general market conditions which ultimately determine the adjustments that will take place.

Mechanization will tend to affect more adversely those workers whose job mobility is lower. Major determinants of job mobility are age, education, race, migratory status and work experience in other fields. These factors affect the ability of workers to adjust to the changes in demand for their services.

Younger workers should be less affected by

mechanization since it is easier for them to adopt new skills required by the adoption of mechanical systems or to acquire employment in other industries. A recent study (8) indicates that nearly two-thirds of all citrus pickers were 45 years or younger, while 40 percent were 35 years or younger. It appears that age would be a favorable factor in the adjustment process for many workers.

A worker's occupational mobility is greater the higher his level of education. The average citrus picker surveyed had completed seven years of schooling. One-third of the citrus pickers surveyed had less than a sixth grade education, while over one-fourth had completed some high school. Although this indicates a low education level in general, the younger groups tended to be better educated. Education, coupled with age, will probably result in one group of younger, better-educated workers who will be able to adjust to the new skill requirements and another group of the older, less educated who will fill positions for which few or no skills are required.

The ethnic or racial distribution of those citrus pickers surveyed was approximately 60 percent black, 30 percent white, and 10 percent Mexican. This distribution may result in a lower job mobility potential with respect to industries where racial discrimination exists.

Estimates of the percent of citrus pickers who tend to be migratory in nature range from 25 to 40 percent (3, 8). Of those citrus pickers surveyed, the average migratory worker had worked at least part of the year in Florida for nearly ten years. Eighty-six percent of the migratory pickers in the survey stated they would stay in Florida the entire year if they could earn a steady income, while 14 percent replied that they preferred to travel regardless of steady employment opportunities.

Although the average citrus picker surveyed has been engaged in farm work for wages for 18 years, nearly 70 percent have at some time been employed in non-farm work, indicating a degree of work experience in non-agricultural fields.

The reasons for workers choosing agricultural versus non-agricultural employment may also have an effect on labor mobility. When citrus pickers were asked an open-ended question about their reasons for doing farm work rather than non-farm work, 37 percent replied that they enjoyed farm work, 16 percent thought they could earn more money in agriculture, and 20 percent said they had always done farm work or that it was the only work they knew. Twenty-three percent replied that no other work was available. When asked direct

questions concerning the money and enjoyment associated with farm versus non-farm work, 73 percent considered farm work more enjoyable and 48 percent believed they could earn more money in farm work. However, in response to direct questions, 45 percent replied that no other work was available and 36 percent that farm work was all they knew. Therefore, it appears that while some citrus pickers feel trapped in agriculture, many have chosen farm work over non-agricultural employment.

Conclusions

The citrus industry and other horticultural industries in Florida are faced with increasing labor problems. The competition for labor by non-agricultural industries has increased in recent years. Despite increasing mechanization, labor problems will continue in the near future. Mechanical harvesting systems in the Florida citrus industry will serve to balance the supply-demand relationship for harvesting labor rather than replace existing labor. Other horticultural industries in Florida cannot expect to witness increased labor availability as the result of mechanization in the citrus industry in the near future.

LABOR POLICIES AND FLORIDA VEGETABLE PRODUCTION

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Abstract. Sixty million dollars were expended for labor by vegetable producers in 1969. This was by far their largest single expense, representing 38 percent of total production expenses.

Several labor policies are examined which are of current interest at the state and federal level. If enacted these will affect the cost and availability of labor. Regulations of the Occupational Safety and Health Administration are likely to restrict labor usage as related to alternative cul-

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tural practices. Agricultural workers are likely to become covered by unemployment insurance for the first time. Minimum wage laws as applied to agriculture have been under reconsideration. Various programs are and have been aimed at inducing migrants to leave the migrant stream, a major source of labor for vegetable producers.

A recent survey of the Florida Farm Labor Force revealed an estimated 66,778 hired farm workers for the period of November 1970-February 1971 (4, p. 20). Of these, 20,168 or 30 percent reported that they had worked on a vegetable farm during the week prior to interview. An economic and demographic description of these workers is contained in Table 1. A few features of the labor population surveyed should be emphasized before proceeding to a discussion of various policies under consideration. First, the majority of the workers are black with only a small minority who are white. The average income appears to be highly

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