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Harvesting Systems

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The goals of harvesting are to gather a commodity from the field at the proper level of maturity with a minimum of damage and loss, as rapidly as possible, and at a minimum cost. Today, as in the past, these goals are best achieved through hand-harvesting in most fruit, vegetable, and flower crops.

HAND-HARVESTING

Hand-harvesting (fig. 7.1) has a number of advantages over machine harvest. People can accurately determine product quality, allowing accurate selection of mature product. This is particularly important for crops that have a wide range of maturity and need to be harvested several times during the season. Properly trained workers can pick and handle the product with a minimum of damage. Many fresh-market products have a short shelf life if they are bruised or damaged during harvest and handling. The rate of harvest can easily be increased by hiring more workers. This allows a grower to match harvest capacity with the cropping cycle without idling expensive machinery. Hand-harvesting also requires a minimum of capital investment, although some growers do provide housing for their employees.

The main problems with hand-harvesting center around labor management. Labor supply is a problem for growers who cannot offer a long employment season. Labor strikes during the harvest period can be costly. In recent years, costs associated with complying with U.S. and state government labor regulations have increased significantly. In spite of these problems, quality is so important to marketing fresh-market commodities successfully that hand-harvesting remains the dominant method of harvest of most fruits and vegetables and for all cut flowers.

Effective use of hand-labor requires careful management. New employees must be trained to harvest the product at the required quality and at an acceptable rate of productivity. Employees must know what level of performance is expected of them and must be encouraged and trained to reach that level. Well-managed employees enjoy their jobs more and can be more productive than those who are poorly managed. Benefits such as paid vacations and health insurance help ensure the return of already-trained employees.

Maintaining product sanitation requires that workers be provided with regularly cleaned, supplied, and emptied toilet facilities. Workers also need a source of potable water and washing supplies and must be trained in proper hygiene procedures. Complete documentation of worker hygiene procedures is needed in case of a sanitation problem with a batch of product.

Machines are used to aid hand-harvest in some commodities. Belt conveyors are used in vegetable crops such as lettuce and melons to move them to a central loading or in-field handling station. Scoops with rods protruding from the end are used by workers to comb through some berry crops. Platforms or moveable worker positioners have been used in place of ladders in crops such as dates, papayas, and bananas. Lights are used in California for night harvest of some crops, when temperatures are cool and when worker effectiveness and product quality are at their best. Numerous other mechanical aids have been tried, but few increase productivity enough to warrant their expense.

Figure 7.1

Hand-harvesting, shown here for strawberries, is the primary method for harvesting fresh-market horticultural commodities in the United States.

MECHANICAL HARVESTING

Mechanical harvest is currently used for fresh-market crops that are roots, tubers, or rhizomes and for nut crops. Vegetables that are grown below ground (radishes, potatoes, garlic, carrots, beets, and others) are always harvested only once (once-over), and the soil can be used to cushion the product from machine-caused mechanical injury. Tree nuts and peanuts are protected by a shell and easily withstand mechanical handling. A number of products destined for processing such as tomatoes, wine grapes, beans, peas, prunes, clingstone peaches, olives, and some leafy green vegetables are machine harvested because harvest damage does not significantly affect the quality of processed product. This is often because the product is processed quickly after harvest. These crops have also been amenable to new production techniques and breeding that allow the crop to be better suited to mechanical harvest.

A main advantage of mechanical harvest equipment is that machines can often harvest at high rates. Tree nut harvesters, for example, attach a shaking mechanism to the tree and remove most of the nuts in a few seconds. The nuts are either caught on a fabric-covered frame or picked up from the ground by other machines. This allows an orchard to be harvested very quickly compared to hand-shaking with poles.

Machine harvest also reduces management problems associated with workers. In some cases the need for workers is reduced to the point where full-time employees can do the bulk of the work. This eliminates problems associated with locating and training a temporary work force during harvest. Machines usually improve working conditions because the strenuous jobs of product lifting and transporting are mechanized. Workers are needed mainly for operating the equipment and perhaps for sorting. This may allow a greater employment pool because physically weaker people will be able to function well in the mechanized job.

Effective use of mechanical harvesters requires operation by dependable, well-trained people. Improper operation results in costly damage to expensive machinery and can quickly cause great crop damage. Both regular and emergency maintenance must be performed. The commodity must be grown to accept mechanical harvest. For example, trees must be pruned for strength and to minimize fruit damage caused by fruit falling through the tree canopy. Maximum and uniform stand establishment is necessary for vegetable crops. Cropping patterns must also be set up to use the expensive equipment as long as possible to pay for the high capital investment. This can severely limit the production choices of some farmers.

MECHANICAL HARVEST PROBLEMS

Machines are rarely capable of selective harvest. This often means that mechanical harvest will not be feasible until the crop or production techniques can be modified to allow once-over harvest. Harvest machinery often causes excessive product damage to perennial crops (e.g., bark damage from a tree shaker). Also, it is often quite expensive, and there can be concern that the machines may become obsolete before they are paid for. Handling capacity may not be able to cope with the high rate of harvest. For example, in many vegetables, box filling and product preparation such as trimming and plastic film wrapping may be much more time-consuming than picking. Automating picking alone may not significantly reduce the amount of labor required.

There may be unintended social impacts to lower labor requirements. For example, eliminating harvest jobs during one part of the year may reduce employment in the general area enough so that farmworker families

leave to find a location with greater seasonal employment.

The prospects for increased mechanized harvest in the future are uncertain. Equipment has already been developed for the easiest crops to mechanically harvest, and much of this machinery was successfully tested many years ago. Since the 1960s there have been very few additional crops that have been successfully machine harvested, in spite of considerable research in the intervening years. Even robotics have not been effective in successfully adding new crops to those that can be machine harvested. High labor costs or lack of labor availability were thought to be factors that would force mechanization; but it may be that they cause crop production to move to countries that do not have these constraints.

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