CHAPTER 9

MECHANICAL HARVESTING OF FRUITS

OBJECTIVES

After studying this chapter, students will be able to:

- Understand about mechanical harvesting and its advantages in fruit cultivation
- Modes of mechanical harvesting and their uses
- Understand different modes of mechanical harvesting

INTRODUCTION

You might have sometime seen harvesting operation in some fruit orchards. In our country, fruits in general, are harvested manually by hands. For this, orchardists employ labourers for a specific period. For example, peak mango harvesting season in north India is May-June and for apple, it is August-September. During this period, you can see plenty of labourers in such orchards. Hand harvesting has certain disadvantages; hence for harvesting in a large holding or under high density plantings, it is done through machines in most of the developed countries. Even in our country, several machines/equipments have been developed for easy and safe harvesting of fruits. In this chapter, you will learn about mechanical harvesting of fruits, its advantages and different modes.

History of mechanical harvesting

The history of mechanical harvesting dates back to the 1950's and is associated with the cultivation of citrus in Florida. The idea of a mechanized harvesting system was developed from the struggle of the citrus industry, which was facing concerns about costs and availability of harvesting labour. Even today, fruit growers of large orchards, face two significant problems, which could determine the future of their business; (i) lack of adequate labour supply, and (ii) competitiveness in the global market.

Mechanical harvesting

Harvesting by use of machines is called 'mechanical harvesting'. It is very useful for rapid harvesting of a particular crop and at low cost. Special harvesting machines are designed for specific crops. In developed countries, mechanical harvesting is common for most of the crops, but in India, it is still very uncommon.

Advantages of mechanical harvesting

- Harvesting is rapid, thus there is lot of saving in time.
- Less dependency on labour. No risks of labour strikes and labour management related problems.
- Improved working conditions for workers.

Disadvantages of mechanical harvesting

- It requires skilled manpower for use of machine, therefore dependence on trained labour.
- Improper machine usage may result in huge economic losses.
- Machine requires regular maintenance.

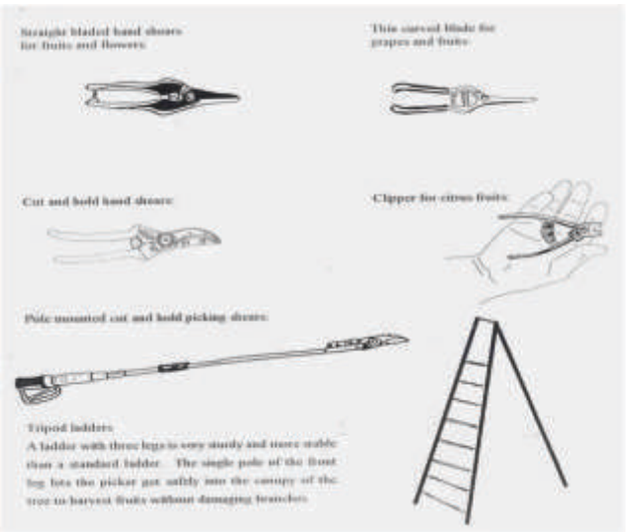
- Same machine cannot be used for harvesting in many other fruit crops.
- May cause damage to bark and branches of trees of perennial crops.
- Social impacts of low labour requirements and employment.

Modes of mechanical harvesting

There are basically three modes of harvesting by machines. These are labour-aids , labour saving machines and robotics & automation.

Labour aids

Labour-aids are aimed at reducing the drudgery of farm labour by reducing the effort and endurance required for the fruit-picking operation. The major examples are the power ladders, which are considered as the basic picking-aid. They eliminate the need for pickers to climb ladders and carry the fruit load on their shoulders. As the workload is eased and both hands are free when not maneuvering the platform, pickers can be more accurate and efficient. Usually fruit can be picked cleaner with less physical damage (bruising). Power ladders allow the picker to continually move to maintain fruit at the most comfortable position for picking. A safety frame surrounds the picker minimizing the chance of a fall and allowing the picker to concentrate on picking.



Some harvesting tools

Similarly, a self propelled hydraulically operated raised platform is also used for harvesting of fruits from large trees, sometimes, as in case of oil palm. Likewise, for efficient harvesting of mangoes a simple, low cost and portable mango harvesting device has been designed and developed at the Central Institute for Subtropical Horticulture, Lucknow; IARI, New Delhi and IIHR, Benguluru. Mango fruits are taken into the pouch and held between the divider and knife and as the device is pulled, the blade cuts the stalk. The fruit are then conveyed through a nylon chute to collecting boxes without bringing down the device every time. This saves time and protects fruits from mechanical damage due to impact. It also protects operator's hand from the sap, which oozes out from the point of detachment. Similarly, sapota harvester has also been developed in the country.

Labour-saving machines

The main characteristics of such machines are their ability to remove fruits in multiples i.e., mass harvesting. Few examples are machine operated mass-harvester for grapefruit in Israel and mass-harvesting system for olives in Italy. A Shake & Catch System for harvesting oranges, apricot & cling peaches are being used in U.S.A. at commercial orchards. The system consists of a long sloping padded

Clipper for harvesting of Kinnow and strawberry

platform mounted on a trailer. The platform catches the fruit and runs it into bins or boxes carried underneath. Typically there are two catching surfaces, one large and one small, forming a valley. The trailer is drawn up alongside the tree with its lower side (the smaller platform) close to the trunk. The operators stand on the larger platform and shake the branches individually with a hooked metal rod or tap them gently with rubber mallets to shake the ripe fruit on to the padded platforms. The fruit rolls down the slope into shallow trays held beneath the platforms.

Kinnow harvesting with clipper

Mango harvester

Likewise, grapes and soft fruits for processing, such as black currants, may be harvested by tractor-mounted machines which have combing fingers which are run up the stems pulling, off the fruit bunches. However, these mechanical harvesters cannot harvest selectively, leading to heavy losses of overripe and green fruits.

On the other hand, advances made in this area have enabled machines to help mitigate specific problems associated with particular crops. For instance, problems with raspberry harvesting is that fruit matures over a period of 20–40 days and requires 5–10 pickings or more if each fruit is to be picked in prime condition. To overcome this problem, a machine was developed in Scotland, which shake the canes at such a frequency that only the ripe fruit fall off. This is coupled with an effective catching device. Apple trees grown on a hedgerow system could be harvested with combing fingers giving 85% Grade-1 fruit.

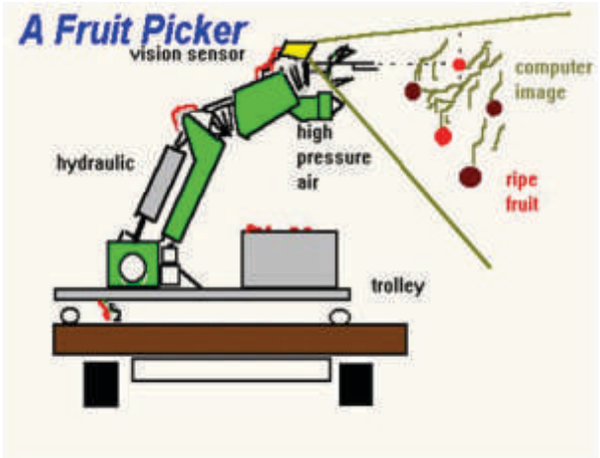
Mechanical harvesting of citrus

As stated earlier, the feasibility of employing such high-input machines is possible only under high-density planting system. In the meadow orchard system of growing apples, peaches and guavas, the whole of the tree is harvested just above the ground each year or every other year. The fruits are then separated from the stems by machines in the pack house. Using this method, trees are planted very close together with densities in the order of 10,000 trees per hectare compared with conventional densities of 87–125 trees per hectare.

Robotic fruit harvesting

A robotic fruit picker was first developed in France for harvesting apples. Robotic fruit harvesting aims to automate the fruit picking process by using a system that emulate the human picker for decision making and picking. Conceptually, it should provide the same or better quality, at a much faster rate. Unfortunately, although remarkable and encouraging results have been already obtained (with apple & citrus), robotic harvesting is yet not feasible and can't be considered as a competitive solution due to high investment incurred.

The major advantage of mechanical harvesting is reduced labour cost through reduction in the number of pickers required to be employed. Further, with fewer pickers, the quality of the fruit coming into the cutting shed can be more easily monitored and controlled.



A robotic harvester

ACTIVITIES/EXERCISES

- If you are living in an area where some orchards are there, visit those orchards in harvesting season. Observe the harvesting practices followed by the workers. Make a list of difference in fruits harvested by hand or by instruments (harvester).

CHECK YOUR PROGRESS

1. What is mechanical harvesting? What are its advantages and disadvantages over manual harvesting?
2. What are different modes of mechanical harvesting? Describe them briefly.

WRITE TRUE (T) OR FALSE (F) FOR THE FOLLOWING STATEMENTS

i) Robotic harvesting is commonly followed for harvesting apples.

ii) Mango harvester has been developed at CISH, Lucknow.

iii) Mechanical harvesting saves lot of labour.

iv) Hand harvesting is done by skilled manpower.

v) Labour-aids are aimed at reducing the drudgery of farm labour

SUGGESTED FURTHER READINGS

- Hui, Y.H. (2008). Handbook of fruit and vegetable processing. Wiley India Pvt. Ltd., New Delhi.
- Sharma, S.K. (2010). Postharvest management and processing of fruits and vegetables. New India Publishing Agency, New Delhi.
- Sharma, S.K. and Nautiyal, M.C. (2009). Postharvest technology of horticultural crops. New India Publishing Agency, New Delhi
- Wills, R.B.H, McGlasson, W.S, Graham, D. and Joyce, D.C. (2009). Postharvest: An introduction to the physiology and handling of fruits, vegetables and ornamentals. CABI International, Cambridge, USA.

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