

## Mechanization in Fruit Crops

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Fruit is the essential food in human daily life, which plays an important role in the human dietary structure. Human demand for fruit is increasing. All kinds of fruits are grown in huge areas worldwide. Moreover, fruit cultivation is the labour-intensive work with strong seasonality. In the fruit production process, the labour force accounts for 30%-45% (Chen Du *et al*, 2011). With the development of society and the construction of urbanization, more and more young laborers leave the countryside and flock to the cities. Especially in orchards, human resources for fruit production decrease drastically, the population is aging, and the labor costs are rising. Therefore, fruit production urgently needs to transform from the backward traditional mode to the advanced modern mode. One such advance modern mode is agricultural mechanization, which is spreading rapidly. Mechanization of fruit crops has involved the partial or full replacement of human energy and animal-powered equipment by engine-driven equipment. It aims to increase efficiency, productivity, and profitability in horticulture by reducing labor requirements, improving precision, and streamlining operations. The modern day horticultural mechanization includes various growing techniques and production processes, working operations, technical procedures, appropriate techniques for soil management systems, orchard tractors, machines for working the soil, machines for mulching and mowing grass, post hole diggers, spreaders, sprayers, front-fitted knife trimmers, harvesting machines, transporting equipment, shakers, harvesters etc. (Khandetod, 2019).

Benefits of Mechanization in Horticultural Crops:

- Increased productivity and efficiency
- Reduced labor dependency
- Improved precision and accuracy
- Time-saving in various operations
- Better crop quality and uniformity
- Cost reduction and increased profitability

- Minimized crop damage and losses
- Improved working conditions for laborers

#### Operations in which mechanization is utilized:

**Land preparation:** Land preparation is important for tree's performance, promote healthy and new growth. Deshi ploughs bakhar and patela were the most popular traditional implements for seed bed preparation prior to 1960's. Mould board plough, disc plough, rotavator and laser land leveler, disc harrow, operated by animal and tractor are the improved implements which have been adopted by farmers.

**Pit Digging:** Pit digging is an important step in the cultivation of fruit crops, especially when establishing new orchards or planting individual fruit trees. The pit serves as the initial growing space for the fruit tree's root system. By digging a pit, you create loose and aerated soil that facilitates root penetration and development. The loose soil allows the roots to establish quickly and spread out, which promotes nutrient uptake and water absorption. Digging of pits can be done with the help of claws, hands, or mechanized tools to remove material from a solid surface, usually soil or sand on the surface of the earth. In the process of digging, manual and hydraulic drive augers are used. Generally, augers consist of rotating helical screw blade causes the material to move out of the hole being drilled.



**Mould board plough**



**Disc plough**



**Power tiller**



**Power weeder**



**Auger**



**Tractor operated hydraulic auger**

**Canopy management:** Canopy management is the development and maintenance of the structure in relation to the size and shape, orientation of branches and light interception for the maximum productivity and quality of fruits, also called as canopy management. Now's-a-day some modern equipment like pruning shear and folding pruning saw are being used for training and pruning in horticultural fruit crops. Pruning shear is easier to use, ideal for small farmers for pruning young trees. Its short blades facilitate closer cutting to the stem of the plant. Tools and equipments for canopy management include secateurs, pruning saw, tree pruner, chain saw etc. Pruning shear is easier to use, ideal for small farmers for pruning young trees. Its short blades facilitate closer cutting to the stem of the plant.



Secateur



Tree pruner



Bush cutter

### **Plant protection equipment:**

Spraying is another important operation during fruit production, traditionally orchardists spray insecticides, pesticides and fungicides applications using foot sprayers or gun sprayers, that causes improper utilization and more than 50 per cent loss of insecticides, pesticides and fungicides. Now, air blast sprayer and electrostatic sprayers are used to overcome these problems. Air blast sprayers operate by using a relatively low pressure pump to deliver the spray mixture into an air stream. Air stream is produced by a large fan that serves to carry the spray to the target. Electrostatic sprayers spray insecticides, pesticides and fungicides vertically. Spray delivered rapidly in the form of median drops (500 micron) vertically to entire volume of tree and automatic target-detecting orchard sprayer which is the combination of both air blast and electrostatic sprayer based on automatic sensor device. Sensor devices help to locate the target (tree). Its gives an efficiency of 50-70 per cent. This technique is more efficient than other mentioned techniques but it is still under experimental purpose and not commercialized yet.



Weeds in irrigated and rain-fed agriculture during Kharif is a serious problem and the yield is affected to the extent of 20-60 %, if not controlled. Weeding is generally done to uproot the unwanted plants and expose the soil to aeration. Khurpi is the most popular tool used for removal of weeds but it takes 300-700 man-hours to cover one hectare. Use of long handle wheel hoe and peg type weeders, reduce weeding time to 25-110 hours. Bullock operated weeder and cultivator are also used for control of weeds. These processes are time consuming and required labour. Now, some equipment's like power weeder (self propelled machine and with 2-3 hp engine), bush cutter (light weight engine operated and suitable for cutting dry and fresh grass) are available for cutting of grasses from the orchard fields in less time.

#### **Irrigation:**

Mechanization plays a crucial role in improving irrigation practices for fruit crops. It helps optimize water usage, ensures timely irrigation, and reduces labor-intensive tasks. Earlier, irrigation is generally done by flood system and fertilization through broad casting method, but presently it is done by using drip irrigation and sprinkler irrigation. Drip irrigation systems deliver water directly to the plant's root zone, minimizing water loss through evaporation or runoff. This method involves a network of pipes with emitters placed near each plant, delivering water in small, controlled amounts. Its application rate is 1- 12 litre/hour. It can save 90 per cent of the water (Brylaet *al.*, 2005). Sprinkler irrigation is a method of applying irrigation water equivalent to natural rainfall. Its application rate is 25-30 litre/hour.

#### **Harvesting:**

Fruits are mainly harvested by traditional methods like hand picking after climbing on trees or by using ladders which is a tedious, time-consuming operation which accounts for the largest part of the labor employed in the production of fruit crops. Fruit picking requires decisions for selective harvesting (color, size and maturity) and maintaining high fruit quality throughout the picking process. Mechanization can reduce harvesting costs and dependence on seasonal labor so growers can stay competitive in the future by increasing harvest productivity in a timely fashion. Mechanical harvesting utilizes shaking of limbs, trunks and foliage of all nut crops, olives for oil, citrus for juice and grapes for wine, as well as

deciduous fruit destined for processing that can tolerate a high level of mechanical stress including prunes, cling peaches and blueberries.

### Post-Harvest Handling:

Decentralized value addition of farm produce helps in better waste management, less transportation, and more employment in rural areas. Primary processing facilities need to be created in rural areas for on farm processing of farm produce to use available raw materials for processing in the catchment area at reduced cost and also reduce cost of processing due to availability of labour, reduced cost of handling, and transport. Equipment like sorting machines, conveyors, washing systems, and packaging machines help automate these processes, improving efficiency and reducing labor requirements.



Types of sprayers

### Problems of Agricultural Mechanization

- 1) **Taxes and duties on imported machinery:** The lifting of imports bans together with the withdrawal of taxes and duties had made import of power tillers and pumps with engines so cheap that the local manufacturers are now out of production.
- 2) **High price of imported machinery:** Prices of this machinery are very high. So, it is beyond capacity of purchase of poor farmers.
- 3) **Lack of applied research on agricultural mechanization:** Development of market for local products is very slow. The most urgent needs of the country are for problem oriented applied research and commercially oriented machinery design and development.

**Limb shaker****Trunk shaker****Fruit and vegetable washer****Fruit and vegetable sorting machine****References:**

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