

Orchard cultivation

Orchard cultivation refers to the careful management of the orchard soil in such a way that the soil is maintained in a good condition suitable to the needs of the tree with least expenses. This involves maintenance of the physical condition of the soil, its moisture and nutrient content. A good system of orchard cultivation should ensure:

1. Weed control and saving in moisture and nutrients
2. Very little disturbance to soil and preventing soil erosion
3. Reduced cost of cultivation

Methods of soil management practices

1. Clean culture

This type of cultivation is extensively followed in India. This involves regular ploughing and removal of weeds. The clean culture has many disadvantages. They are

- Humus will be completely depleted rapidly due to frequent cultivation.
- Frequent cultivation causes injury to the feeding roots, the trees may be short lived or stunted in growth.
- Clean cultivation aids in more aeration leading to the depletion of nitrogen. Hard pan is created in the soil.
- Frequent cultivation causes more soil erosion.

The above-mentioned defects in clean cultivation can be minimized by avoiding deep and frequent cultivation and also cultivation when the soil is too wet.

2. Clean culture with cover crops

This type of soil management involves raising of a cover crop or green manure after removing the weeds. If clean cultivation is attempted during the rains, considerable erosion is almost sure to occur. It is probably best to plant a green manure crop between the



trees early in the rains and plough it into the soil towards the end of monsoon season. In India, green manure crops like Sunhemp, Cowpea, Daincha, Lupins etc. are more commonly used. Legume cover cropping in grape, mango, guava and other fruit crops is becoming a common practice in the management of orchards. Cowpea and French beans grow well under guava and sapota tree. In some places to prevent soil erosion, certain permanent cover crops like *Calapogonium muconoides*, *Centrosema pubescens* and *Peuraria phaseoloides* are raised in the alley spaces. They are leguminous crops, establish in a short period, dry up during summer to conserve moisture. With summer showers they come up again because of their profuse seeding habit and spread themselves as a vegetative mat by the time the heavy monsoon starts pouring in. Such permanent cover cropping is a common feature in rubber plantations of Kerala and Kanyakumari district.

Mulching

This is one of the important soil management practices adopted in certain countries. Crop residues like straw, cotton stalks, leaves, saw dust, pine needles, coir dust and other materials like polythene films or certain special kinds of paper are spread in the tree basins and in inter spaces between trees. Main objective of mulching is to conserve soil moisture and to control the weed growth. The other advantages of mulching are:

- Keeps soil cool in day; warm at night hours
- Reduces surface run-off
- Adds humus to the soil
- Prevents soil erosion
- Fruits are protected and kept clean since they fall on the mulches
- It allows the absorption of more rain water and
- It reduces irrigation frequency.

The following are some of the disadvantages:

- Dry materials used as mulches encourage the risk of fire and consequent damage to trees.
- Thick mulches may act as places for mice and rodents to live and multiply. They may cause damage to tree trunks and roots by eating the bark and burrowing to the land. The mulching materials should be placed too close to the tree trunk and it should be spread in such a way that they give a good cover to the root system of the trees.

4. Sod

In this method, permanent cover of grass is raised in the orchard and no tillage is given. This type of orchard cultivation is followed in USA and Europe. This may be useful in slopy lands for preventing soil erosion. But they compete for soil moisture and available nitrogen. The drawbacks of this system are the need for increased manuring and water application. They are harmful to shallow rooted trees. Hence sod may be useful with deep rooted trees because soil moisture will be very low on the top layers.

5. Sod mulch

This is similar to sod with the only difference is that the vegetation is cut frequently and the cut material is allowed to remain on the ground. This is slightly

better than the previous one, as the moisture loss is not so great as in sod. In both sod and sod mulch, more nitrogen should be applied to the fruit trees than usual application because the vegetation utilises more soil nitrogen.

6. Intercropping

In young orchards, the question of how best one can use the soil between the trees arises. If the trees are properly spaced there is considerable land which will not be used by the permanent trees for several years. Similarly in the case of other long duration horticultural crops like tapioca, turmeric, ginger and banana some area between adjacent plants will be remaining unoccupied by the main crop for few months. It naturally appeals to the grower to get some return from this vacant land especially when he is getting no return in the early periods. The practice of growing any economic crop in alley spaces of the fruit trees in the first few years or in the 'unoccupied spaces of the long duration crop in the early periods is referred as intercropping. They also act as a covercrop and the land benefits by the cultivation, irrigation, manuring given to the intercrops. The following important principles should be observed while growing intercrops.

- Intercrops should not occupy the area where the roots of the fruit trees are concentrated.
- Soil fertility should be maintained or improved when intercrops are grown.
- Water requirements of the intercrops should not clash with those of the main fruit trees. The intercrop may require an irrigation at a time when it would be detrimental to the trees.
- Intercrops should be selected with reference to their effect on soil moisture. Grain crops remove excessive moisture to the detriment of fruit trees. The intercrops selected should not exhaust the soil water and nutrients and should not demand more water than is allowed for fruit trees.

Vegetables are the best inter crops when compared to millets. But whatever may be the intercrop grown, it should be kept well away from the main fruit trees and irrigated independently. The intercropping should be stopped when trees occupy the entire orchard space. Thereafter, green manuring or cover cropping should be only practiced.

Many growers prefer some quick growing fruit trees to grow as intercrops. A satisfactory fruits are available for this purpose. In temperate regions peaches are often grown between apple trees. Similarly, in properly spaced mango orchard, guava trees can be planted to bear in two or three years and will produce a number *of* crops before it is necessary to remove them. Such short-lived trees are known as '**fillers**'. Papayas, bananas or phalsa may be well grown as fillers in orchards. The danger in using fillers is when they are allowed to remain in the orchard for too long periods. As normally root system makes a faster growth than the branches, the roots *of* the permanent trees come in contact with the roots *of* the fillers before there is any crowding above ground. Therefore, the fillers should be removed after a few years usually immediately after the main fruit trees have commenced bearing.

The recommended intercrops for some important horticultural crops are given.

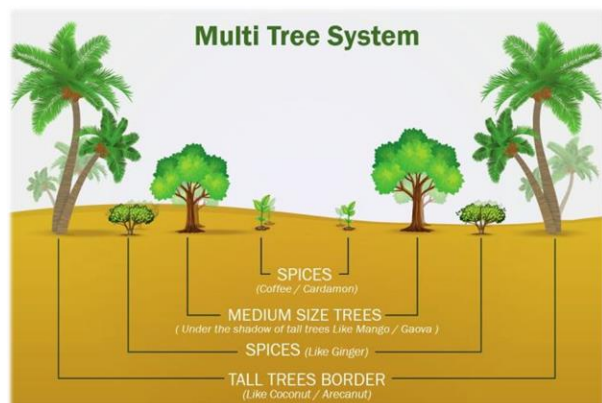
Crop	Age	Intercrop
Mango	Upto 7 years	Leguminous vegetables, Papaya (filler)
Grapes	Upto 8 months	Snake gourd or bitter gourd in pandal
Apple, pears	Upto 5 years	Potato, Cabbage
Banana	Upto 4 months	Sunhemp, onion

Mixed cropping

It refers to the practice of growing certain perennial crops in the alley spaces of the main perennial crops. The main advantage is the effective utilization of available area and increase in the net income of the farm per unit area. Extensive research conducted by CPCRI, Kassargode on mixed cropping in coconut and arecanut plantations showed that cocoa, pepper, cinnamon, clove and nutmeg can be grown as mixed crops in coconuts while nutmeg and clove as mixed crops in between four arecanut palms on alternate rows. In all the above cases, increase in yield (upto 10%) is obtained in the main crop due to the synergistic effect of the crop combinations arising out of beneficial micro-organisms in the rhizosphere and the more availability of major nutrients in the active root zone of the crop mix as compared to the pure stand.

Multitier system of cropping

Certain horticultural plants like coconut and arecanut are grown for about 50 years in a particular land. It takes nearly 4 to 7 years for the above trees to reach the bearing stage. Adequate alley spaces (nearly 75%) are available in between these trees and



being the palm trees, their root system will not also spread beyond one metre in diameter. Hence, these vacant spaces can be profitably used for raising other crops, thereby increasing the employment opportunities and profit. This is the chief objective of the multitier system of cropping. Intercropping and mixed cropping involve jointly multitier system of cropping and is defined as a

compatible companion of crops having varying morphological frames and rooting habits, grown together in such a manner that their canopies intercept solar energy at varying heights and their roots forage the soil at different zones. The main principle here is that the land, water and sunlight should be effectively used. An ideal combination of crops for multitier cropping in coconut and arecanut plantations is as follows.

Tier	Crop
First (Top)	Coconut or arecanut
Second	Pepper trained over the trunk of coconut or arecanut trees
Third	Cocoa or cloves planted at the centre of four arecanut or coconut
Fourth (ground)	Pineapple, ginger and dwarf coffee

Irrigation

Water is a crucial input for establishment of orchard. Assured availability of water and appropriate irrigation system is the most important aspect in a commercial fruit orchard. The type of irrigation system can be decided on the basis of water availability and available budget. Flood, basin, check basin and furrow system are the common methods; however, drip sprinkler, microjet methods can also be used for orchard establishment. Under tree, drip or micro sprinkler system is the best on account of water saving but the requirement of power, technical expertise and high initial cost makes the system most expensive as well.

Drainage

Drainage of excess water is a problem in litchi orchards which is accumulated in heavy soils or low-lying flood prone areas. In these areas, poor provisions are reflected by the poor growth, sickly appearance or death of the young plants. Building up of a persistent water table may damage root growth

and the functioning of roots is affected. High water tables and high soil moisture at critical stage of plant establishment and production cycle have been found harmful. Water logging affects growth of young plants and flowering in grown up trees and subsequent productivity of orchard. The main objectives of a proper drainage system is to remove the excess water from the active root zone during rainy months and as far as possible to keep the water table in the orchard below the active root zone, (1.80-2.40 m below the ground level). Soils with too much of slope are prone to erosion and too much of drainage in such soils also get moisture depletion quickly and require frequent irrigations.

Windbreak

Tall trees are planted on the border of the orchard to reduce the impact of wind on the fruiting of the trees. Windbreak is commonly tall trees having dense foliage and keeps the surrounding atmosphere humid. These trees help in minimizing the wind velocity, impact of high temperatures which adversely affect the young plants and cause excessive fruit drop. Trees, which are generally used as windbreak, are seedling mango, jamun, mulberry, moringa, jackfruit, carambola, teak. These can also be used as live fencing posts.

