A review on Orchard Management and Cultivation Practices

ABSTRACT:

Orchard is an area which is devoted to the cultivation of fruit trees and it encompasses various resources such as land, water, trees, and many external inputs. We should also understand good management of orchard so that can get maximum output without any loss of manure and fertilizers, plant protection chemicals, produce etc. Therefore, one should understand the management of these qualities of both resource and output. Orchard management is the most important cultural tool for successful and sustainable cultivation fruit crops such as Mango, Citrus, pomegranate, Banana, Guava, Ber Papaya, Sapota, Grapes and others. Orchard management systems influence the growth, yield, and fruit quality through good orchard cultural practices which effects on the availability of nutrients, conservation of moisture and reduction of weed competition. Orchard management practices very effective such as clean cultivation, sod culture, sod mulch, use of herbicides, mulching, inter-cropping, cover crops, clean strips, Tillage, Clean basin Management, Green Manuring etc. The orchard floor management practices in moisture conservation are: black polythene mulch 13.51 %> grass mulch 12.38 % > ridge basin + grass mulch 9.31% > clean basin.

Keywords: Cultural practices, Intercropping, Orchard management, Plant protection chemicals, Sod mulch, Sustainable cultivation.

INTRODUCTION:

When orchards were first established, they were planted at lower planting densities of 100 to 200 trees per ha. These trees were later thinned down, and other crops were planted between the rows to maximize the use of the land while the young trees were still growing. Most nations are implementing high-density plantings with 300 to 1,500 trees per hectare to increase returns that are double that of conventional plantings, although these plantings must be clipped year after harvest to keep the trees small. Young orchards need regular fertilizer applications, irrigation, pruning, and spraying to promote better growth and excellent fruit output. Pruning should be done in young orchards to enhance fruit production, reduce wind damage, and improve tree structure. Unless trees have a shortage or excess in one or more nutrients, nutrition has little effect on productivity. New leaves, blooms, and fruit on trees don't appear right away after fertilization; instead, they depend on the tree's internal reserves rather than fertilizer sprayed on the soil. On the other hand, it can take several years for tree health and productivity to fully recover once nutrient concentrations drop below essential levels. Australian high-yielding tree surveys were used to produce leaf standards, which are now used in other regions. While there have been reports of responses to specific nutrients, the timing of fertilizer applications has minimal impact on fruit output or quality.The greatest way to apply nutrients is to the soil, not to the leaves with foliar sprays. Most orchards in the region rely on consistent rainfall because irrigation is either prohibitively expensive or unavailable. Drought can impact growth and fruit production in South Africa and Australia, according to research, but its significance in Asia has not been quantified. Although cover crops and mulching can help with water conservation, it is advised that new orchards be irrigated whenever possible. A yearly rainfall of 1,200 to 1,500 mm is needed for normal production in the absence of irrigation. In Florida and Hawaii, synthetic auxins

were utilized in the 1950s and 1960s to regulate growth and flowering. Although the treatments frequently enhanced yield, the reactions were frequently unpredictably. More recently, Australian horticulturists demonstrated how ethephon might be utilized in subtropical locations in May or June to reduce early red leaf flushes. Like the application of auxins or ethephon, girdling or cincturing can be employed to enhance flowering. It cannot, however, make up for cool temperatures at the beginning of flowering. Additionally, unless cool weather is immediately followed, chemicals applied at this time are unlikely to stimulate flowering.

Orchard:

A location where several fruit crops have been orderly planted and are managed to provide successive yields for profit. Orchards come in a variety of shapes and sizes, depending on their intended use.

1. Commercial orchard:

- These may include low-density orchards, high-density orchards, dry orchards, etc. and are maintained by fruit producers for commercial purposes, i.e., selling the produce.

a) Low density orchard:

- In this orchard system, there are fewer trees per unit and orchards are grown on powerful standard rootstocks, necessitating greater spacing.

b) High density orchard:

- High density orcharding with dwarfing rootstock are used and greater number of fruit crop plants are planted per unit area like mango, apple, citrus, pear, walnut, and others.

2. Dry Orchard.

- Dry orcharding is a technology where hardy type of fruit may be planted by adopting some moisture conservation methods like contour or terrace planting crescent bunding, mulching etc. crops for dry orcharding like mango, pear, sapota, ber, bael, guava, custard apple, cashew, jamun and others

3. Progeny orchard:

- kept up by nurserymen primarily for the goal of propagating superior varieties of fruit trees with all desirable characteristics. Mother plants are the plants that are kept alive in these orchards.
- This type of orchard has several drawbacks, including difficulty managing fruit crops that require different spacing, fertiliser, and water mixtures, the possibility that the entire orchard will not be ready for harvest at once, and the potential difficulty of meeting the cultural requirements of various varieties.

4. Home orchard:

- Orchards maintained at the backyard of a residential area to meet the fruit needs of the family.
- These are maintained mostly in rural and sub-urban homes.
- Selection of fruit plants will be according to convenience and one's own taste.

5. Experimental orchard:

- Orchards maintained in colleges and research institutions with the main aim of conducting different experimental trails for the benefit of the fruit growers /farmers in scientifically in very systematic manner.

Care and Management of Young Orchard:

- In order to maximise efficiency and yield more profits, good management should focus on identifying basic needs while considering all available resources.
- These techniques make it simple to establish transplants in the orchard and are a necessary component of any good orchard management.

Orchard floor management

refers to the management of the orchard soil such that the fruit trees produce better yields of high-quality fruits over time for long-term financial gains.

- Prior to planting an orchard, it is generally advisable to decide how the orchard will be handled. Throughout the orchard's lifespan, management procedures for managing the orchard should be carried out promptly.
- Before selecting a specific programme for an orchard, there are several possible systems for managing the orchard, each with benefits and drawbacks to consider.
- A successful orchard management programme always guarantees the grower a higher return.
- Nevertheless, no solitary management technique can be suggested for all orchards. Depending on variables such as climate, orchard location, terrain, tree spacing, planting strategy, orchard design, etc., a specific programme is followed.
- For the purpose of promoting precocity and high production, it should be paired with pruning, nutrition and water management, pollination support, fruit thinning, and disease and pest management in order to achieve the desired tree growth and vitality.

Objectives of Orchard Management:

1. To maintain the ideal soil moisture during the crucial stages of plant growth.
   Stop or lessen soil erosion.
2. Increase or at the very least retain soil organic matter.
3. Improve soil nutrient status
4. Eliminate weeds from the orchard.
5. Enhance soil aeration and water percolation by loosening and improving soil structure.
6. To guarantee additional revenue from the orchard's interspaces, particularly during the pre-bearing period.
7. Improve microbial activity and bio-control.

Soil Management / Floor management

The goal of soil management is to keep the soil in excellent shape or, if required, to make it better. This involves defence against the effects of wind and rainfall erosion. Through various management techniques, such as intercropping, cover cropping, cultivation, sod culture, mulching and rotation, high density planting, the open area must be effectively utilised and conserved. Intercropping, which is the practise of growing annuals or relatively short-duration crops in the interspace during their formative years, and mixed cropping, which is the practise of growing perennials in the interspacing of perennials, are two orchard management techniques used in sapota orchards. A multispecies crop combination that includes both annuals and perennials together with an established perennial stand is referred to as "multi-storey cropping." Intercropping is meant to increase the efficiency of the utilisation of land and space to provide additional revenue, especially during the early. Additionally, it enriches the interstellar medium via nitrogen-fixing leguminous crops and guards it from losses

brought on by weeds, erosion, the effects of radiation, temperature, wind, and water. Green manure crops and cover crops are the other soil management practises. Green manure crop refers to a crop planted in addition to the primary crop with the aim of enhancing the soil with organic matter. The crop that is cultivated to cover the soil and prevent erosion may also be a green manure crop.Important soil management practices usually followed are**:**

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:

- Frequent culture damages the feeding roots, which may result in shorter tree lifespans or stunted development.
- Humus will be totally exhausted quickly as a result of frequent cultivation.
- More aeration from clean cultivation promotes nitrogen depletion.
- The soil becomes hard pan;
- Repeated cultivation increases soil erosion. Avoiding deep, frequent, and cultivation while the soil is too moist can help minimize the aforementioned flaws in clean cultivation.

2. **Clean culture with cover crops**

Tillage and weed eradication in this maintain a neat border between plants. It comes with perks and drawbacks of its own.

The benefits are:

- It will assist in reducing weed competition for nutrients, light, and water as well as in preventing the emergence of new hosts for pests and illnesses.
- By breaking up clods, it will increase soil aeration, which will in turn improve soil physical condition and soil biological activity.
- Additionally, it aids in the removal of hard tops and water infiltration abstractions.

Its drawbacks include:

- It will result in the loss of organic matter, soil erosion even on flat terrain from water and wind, and excessive leaching of nutrients.
- After eliminating the weeds, this kind of soil management calls for growing a cover crop or green manure.
- Clean farming during the rains almost certainly results in significant erosion.
- The best course of action is probably to plant a green manure crop amongst the trees early in the rainy season and then till it into the ground towards the end of monsoon season. Green manure crops like Sun-hemp, Cowpea, Daincha, Lupins, and others are more popular in India.
- Legume cover crops are increasingly being used in the management of orchards to grow grapes, mango, guava, and other fruit crops.
- French and cowpea beans thrive under the guava and sapota tree's shade.
- Certain perennial cover crops, such as Calapogoniummuconoides, Centrosemapubescens, and Peurariaphaseoloides, are grown in some areas to avoid soil erosion.

3. **Mulching**

This is one of the crucial soil management techniques used in several nations. The tree basins and the gaps between the trees are covered with crop leftovers such as straw, cotton stalks, leaves, sawdust, pine needles, coir dust, and other materials like polythene films or certain types of special paper. Mulching's two main goals are to reduce weed growth and maintain soil moisture. Mulching is the most crucial method of protecting the soil surrounding plants in order to improve growing conditions and maintain soil moisture. The typical mulching materials include sawdust, straw, hay, crop leftovers, leaves, and plastic, among others. To reduce evaporation losses, control weed growth, and create a microclimate that regulates soil temperature, humidity, and microbial activity, bio mulching materials such as dry leaves, paddy straw, paddy husk, jowar trash, sawdust, dry grasses, and dry coconut leaves are used (Chaudary and Shukla, 2004). The soil is effectively protected from evaporation by a loose layer of straw, which also inhibits weed development and lessens competition for minerals. It aids in moisture conservation by preventing weed development and controlling soil moisture. Additionally, it will increase soil organic matter, stabilise soil temperature oscillations, and enhance soil structure. Microflora prevents competition for nutrients and moisture with the main crop in addition to improving nutrient availability due to better soil conditions. Even though these materials were useful, it was discovered that they all had flaws and were more expensive than they needed to be. The most popular material for mulching as a result is plastic film. Mulching may increase the quality and production of any horticultural crop. Plastic films help to conserve moisture, raise soil temperature, and inhibit weed development in agricultural cans. The mulch does not compact the loose, friable soil.

. Mulching also has the following advantages. The benefits of mulching include:

- Keeping soil cool during the day and warm at night
- Reducing surface run-off
- Adding humus to the soil
- Preventing soil erosion
- Protecting and keeping fruits clean since they fall on the mulches
- Allowing more rainwater to be absorbed; and decreasing the need for frequent watering.

Following are some of the disadvantages:

- Thick mulches may operate as locations for mice and rats to dwell and breed, and they may harm tree trunks and roots by eating the bark and burrowing to the ground.
- Dry materials used as mulch promote the chance of fire and subsequent damage to trees.
- The mulching materials must to be spread out so that they adequately cover the tree roots and should not be positioned too near to the tree trunk.

4. **Sod culture**

This approach does not provide any tillage and raises a permanent blanket of grass in the orchard. In the USA and Europe, this kind of orchard gardening is practised. In sloping terrain, this might help stop soil erosion. However, they face competition for the soil's moisture and available nitrogen. The disadvantages of this method are the increased manuring and watering requirements. Trees with shallow roots are harmed by them. Because the upper layers of the soil will have very little moisture, sod may be effective with deeply rooted trees.

5. **Sod mulch**

The sole distinction between this and sod is how frequently the vegetation is cut and how long the chopped material is permitted to stay on the ground. Since the moisture loss is not as high as in sod, this is somewhat better than the previous one. Fruit trees should get more nitrogen than normal in both sod and sod mulch because vegetation consumes more nitrogen from the soil.

6. **Intercropping**

It is advised to intercrop in locations where soil erodes during the rainy season and when the soil is dry. When these crops are ploughed into the soil, they not only improve the soil's biological complexity and ability to hold water, but they also provide organic matter and reduce erosion. Legumes should be used as cover crops because they increase soil nitrogen levels by fixing atmospheric nitrogen in their nodules. They prevent weeds from growing during the wet season. While pea, fenugreek, broad bean, and lentil can be used as cover crops in the winter, crops lik e green gram, black gram, cowpea, cluster bean, and soybean should be favoured during the kharif season. The ideal way to utilise the soil in between the trees occurs in new orchards. There is a big area of land that the permanent trees won't utilize for several years if the trees are correctly spaced. Similar situations arise with other long-lasting horticultural crops including tapioca, turmeric, ginger, and banana, where some space between neighboring plants will stay vacant for a few months. The farmer is understandably interested in making a profit from this unoccupied property, especially because he isn't making any at the beginning. Intercropping is the practise of planting any economic crop in the early years of fruit trees' alley spaces or in the early periods of a long-term crop's vacant spaces. They serve as a cover crop as well, and the ground benefits from the intercrops' cultivation, irrigation, and manuring. The following crucial guidelines should be followed when cultivating intercrops.

- When growing intercrops, soil fertility should be preserved or increased. • Intercrops shouldn't be planted where fruit trees' roots are heavily concentrated.
- The intercrops' water needs shouldn't conflict with those of the primary fruit plants. A period when watering would be harmful to the trees may be necessary for the intercrop.
- The impact of intercrops on soil moisture should be taken into consideration while choosing them. Fruit trees suffer as a result of the excessive moisture removal from grain crops.
- The intercrops chosen shouldn't deplete the soil's water and nutrients or require more water than what is permitted for fruit trees.
- In terms of intercrops, vegetables outperform millets. However, whatsoever intercrop is cultivated, it should be maintained.
- When the entire orchard area is covered with trees, intercropping should be halted. Following that, only use green manuring or cover cropping.
- Many farmers like to cultivate some fast-growing fruit trees as intercrops.
- For this use, satisfactory fruits are available. Peaches are frequently cultivated alongside apple trees in temperate countries. Similar to mango trees, guava trees may be planted in correctly spaced mango orchards to bear in two to three years and will produce numerous crops before needing to be removed. These quickly dying trees are referred to as "fillers." As fillers in orchards, papayas, bananas, or phalsa may do well to be cultivated.

- Using fillers might be risky if they are kept in the orchard for an excessive amount of time. The roots of the permanent trees come into touch with the roots of the fillers before there is any crowding above ground because the roots often develop more quickly than the branches. As a result, the fillers should be removed after a few years, often as soon as the primary fruit trees start to yield.

Table 1. Taking intercrops with major fruit crops.

Crop	Age	Intercrop
Mango	Up to 7 years	Leguminous vegetables, Papaya (filler)
Grapes	Up to 8 months	Snake gourd or bitter gourd in pandal
Apple, pears	Up to 5 years	Potato, Cabbage
Banana	Up to 4 months	Sun-hemp, onion
Tapioca	Up to 3 months	Onion, beans, lab-lab, black gram
Turmeric	Up to 3 months	Small onion, coriander
Arecanut	Up to 10 years	Pineapple
Coconut	Up to 3 years	Banana, tapioca, vegetables

7. **Mixed cropping**

It describes the practise of cultivating specific perennial crops in the major perennial crops' alleyways. The major benefit is the increased net revenue of the farm per unit area and efficient use of the available space. Numerous studies on mixed cropping in coconut and arecanut plantations carried out by CPCRI, Kassargode revealed that cocoa, pepper, cinnamon, clove, and nutmeg can be cultivated as mixed crops in coconuts while nutmeg and clove can be grown as mixed crops in between four arecanut palms in alternate rows. Due to the synergistic effects of the crop combinations created by advantageous microorganisms in the rhizosphere and the increased availability of nutrients, an improvement in yield (up to 10%) is attained in each of the aforementioned scenarios for the main crop.

8. **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. A compatible companion of crops with different morphological frames and rooting habits is said to be intercropping or mixed cropping. These crops are grown together so that their canopies intercept solar energy at various heights and their roots forage the soil at various zones. The key idea here is that sunshine, water, and land should all be used wisely. The following crops make up an optimal mix for multitier cropping in coconut and arecanut plantations:

Table 2. Multiplier crops.

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

9. Organic farming

To increase our food production, we have utilised chemical pesticides and fertilisers excessively, which has had a negative impact on the environment and our soil health. Many environmentalists have lately criticised this. Many specialists in environmentally sound, viable, and sustainable farming techniques, sometimes known as organic farming, have been drawn to this.It is a method of manufacturing that mostly forgoes or completely rejects the use of synthetically created inorganic compounds. To maintain soil productivity and tilth, supply nutrients, control insects, weeds, and other pests, this system solely depends on crop rotation, crop residues, animal manures, legumes, green manures, off-farm organic wastes, biofertilizers, mechanical cultivation, etc. and aspects of biological pest control. The terms "biological farming," "regenerative farming," "sustainable farming," "eco-friendly farming," etc. are frequently used to describe this technique. Organic fanning is essential because:

- Chemical fertilisers are expensive, do not provide humus, and can negatively impact the physical, chemical, and biological aspects of soil. They can also have a negative impact on soil life.
- Pesticide residues might develop from indiscriminate pesticide use in horticulture crops, which we mostly consume uncooked.
- There is a premium for horticultural products that are grown using organic farming methods.
- The continued use of pesticides is environmentally unsustainable as pests develop resistance.

Essential features of organic farming

- Utilisation of organic manures such as FYM, compost, vermicompost, and coir compost, among others.
- Utilisation of biofertilizers.
- The use of cereal legumes and green manures.
- Chemical-free weed control.
- The use of botanicals and biological pest control agents.

Wherever premium rates are offered for organically farmed high-quality food, organic farming in horticultural crops, particularly in vegetable and spice crops, is gradually increasing in India. A blend of inorganic and organic farming methods may be used in some horticultural crops to avoid known hazardous inorganic chemicals when productivity and overall production cannot be sacrificed by strictly adhering to organic farming practises.

10. **Tillage:**

It refers to the earth being ploughed and hoed. The purpose of tillage is to break up and loosen the soil so that fruit trees' roots may more readily delve into it. It makes it easier for water to absorb and for air to circulate. Tillage aids in fertiliser mixing, weed removal, and weed control. Through the activity of the microorganisms, it releases the food material for the plants that was locked up.

11. **Clean Basin Management:**

The basin is kept weed-free manually to perform this procedure. It is the most typical approach of managing apple orchard floors. In this approach, weeds are managed annually with 4-6 cultivations. After harvest, basin cultivation makes it easier to apply fertiliser throughout the winter. It is advised that young apple trees establish deeper root systems and stay away from weeds that compete with the plants for nutrients or water. However, owing to its impact on the feeding root system and soil moisture levels, this technique is not advised for bearing trees. The main goal of orchard soil culture is to provide the conditions necessary for the fruit plant to develop successfully while making the most use of the soil's moisture and nutrient supply. Only when the soil is loosened can manures be properly integrated into the soil. Additionally, this is required to include green manures and leftover mulch, intercrops, and cover crops to aid in the decomposition process. The orchard soil culture is particularly detrimental on sloped ground. The typical methods used to stop soil erosion on such area include growing permanent cover crops there or putting strips of grass in between the cleanly tilled, thin rows of fruit trees on the contours. The cultural customs of the orchard are influenced by both the type of fruit and the surroundings. In mango, soil culture is mostly carried out during the orchard's non-bearing stage. Growing cover, inter, or green manure crops is a popular practise. Only an annual tillage is usually performed since trees develop and cover a large portion of the landscape, usually a month or two before to blossoming. In citrus, a few shallow ploughings are required to keep the weeds down and repair the irrigation systems, particularly in June through July and from October to December.

12. **Green Manuring Crops:**

These crops, such as guara, senzi, daincha, and cowpeas, are grown during the rainy season and buried into the soil after a few months of growth to incorporate the organic matter. All green materials must be ploughed under while still tender or succulent in order to speed up decomposition. The green manure crops are often harvested and added to the soil as soon as they begin to blossom. By contributing organic matter to the soil, green manuring crops also aid in enhancing the physical state of the soil. Leguminous crops have the ability to fix atmospheric nitrogen when employed as cover, inter, or green manuring crops. Regular use of green manure may also assist to lower orchard fertilisation and manuring costs.

13. Weed management

Weed competes for nutrients and moisture which will also harbor the pest and diseases, hence it should be removed frequently. Weeds may be controlled by herbicide applications, hand weeding, and mulching. Mulching Sapodilla trees helps in reduction of weed problems adjacent to the tree trunk, and improves the soil near the surface. For control of grass weeds spray of Glyphosate @ 5-8 ml l-1 is recommended. In established orchards, pre-monsoon and post–monsoon inter cultivation is recommended for better aeration and effective weed control. Plough the field thoroughly during onset of monsoon and once later. In young orchards, weed hazard is common. Use of 2 kg Bromacil + 2 kg Diuron ha-1 as pre-emergence spray is also effective for a period of 10-12 months.

14. Establishing wind break

Young plants are likely to damage due to the scorching sun, dry and hot wind and frost. A strong windbreak should be established by planting tall and thick growing trees on the windward especially in West and North directions or on all the sides of the orchard.

15. High density plantation (HDP)

Planting density in general depends on kind of fruit tree, its growth habit, rootstock pruning and training rainfall of the area and soil type. However, recommended planting densities in fruit crops results in underutilization of inter-space during early stage of orchard‘s life. This makes orchard unattractive, particularly on small holdings because of long gestation period before giving returns and soil management problematic for vacant space. Therefore, high density planting with more than optimum number of plants per unit area is being-considered as soil management strategy for making maximum use of land to achieve high yields in the early periods of orchard life along with ease in its management. This has been successful in fruit crops like apple, pear, banana, pineapple, mango, guava, citrus, ber and pomegranate. This can be achieved through the use of one of the following factors like dwarf genotypes, dwarfing rootstock, inter-stock, pruning and training, use of retardants, adjustment of planting geometry and induction of viral infection. Sapota is similar to mango, sapota is usually planted at 8 to 9 m2 spacing conventionally. However, it is advisable to use a spacing of 5 to 6 m^2 either way under HDP as it takes many years for the plants to assume the full canopy coverage. PKM-1 and PKM-3 sapota have made HDP possible in these crops due to its growth behaviour as like columnar tree shape and dwarf tree stature respectively. Sapota is normally planted at a wide spacing of 8 × 8 m. Results have shown that high plant density of 312 plants per ha (8m × 4m) is possible yielding 15.35 t ha-1 after 15 years of planting in PKM-1 (Anon., 2007).

Conclusion:

Orchard management plays the key role in production of fruits from initial stage of orchard to their economic stage of fruit plants because it ensures better fruit cultivation by using various practices such as mulching, cover cropping, green manuring, intercropping, clean cultivation, sod culture, organic farming, and many other practices. These management practices not only improve fruit quality but also correct the physically, chemically, and biologically properties of soil health.

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