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A Review on Orchard Management and Cultivation Practices

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

An orchard is a space where fruit trees are grown. It includes a variety of resources, including land, water, trees, and several outside inputs. It is important for us to comprehend the proper management of orchards in order to maximize yield while preventing loss of food, fertilizers, manure, and other plant protection agents. As a result, it is important to comprehend how to regulate these output and resource characteristics. For the effective and sustainable production of fruit crops like mango, citrus, pomegranate, banana, guava, ber papaya, sapota, grapes, and others, orchard management is the most crucial cultural instrument. Effective orchard management systems impact fruit quality, output, and development by using best practices in orchard culture, which also preserve moisture, reduce weed competition, and increase nutrient availability. Effective orchard management techniques include clean cultivation, mulching, intercropping, cover crops, clean strips, tillage, clean basin management, green manuring, and the use of herbicides. The following are the orchard floor management strategies for preserving moisture: ridge basin + grass mulch 9.31% > clean basin; black polythene mulch 13.51% > grass mulch 12.38% > ridge basin.

Keywords: Cultural practices; intercropping; orchard management; plant protection chemicals; sod mulch; sustainable cultivation.

1. INTRODUCTION

Horticultural crops play an important role with the economy. India common run 2nd in fruits and vegetables production with the world, after China. As per National Horticulture Database published by National Horticulture Board, (2018-19) India yielded 98,579.27 million MT of fruits and 185883.22 million MT of vegetables. For superior development and fruit production, young orchards require frequent fertilizer treatments, watering, trimming, and spraying. In young orchards, pruning should be done to improve tree structure, minimize wind damage, and increase fruit output. Nutrition has little bearing on production in trees unless there is a deficiency or surplus of nutrients. Trees that have been fertilized do not immediately produce new leaves, flowers, or fruit; instead, the tree uses its own internal reserves in place of the fertilizer to the soil. On the other hand, once nutrient concentrations fall below critical levels, it may take many years for tree health and productivity to fully recover. Leaf standards were created using high-yielding tree surveys conducted in Australia; these standards are currently in use in other areas. The amount and quality of fruit are not significantly affected by the time of fertilizer treatments, despite reports of reactions to certain nutrients. Applying nutrients to the soil is preferable than using foliar sprays on the leaves. Higher returns to the producer are always guaranteed by an effective orchard management program. All orchards, however, cannot benefit from the same management approach. A specific program is implemented based on variables such as terrain, climate, tree spacing, planting strategy, and orchard design.

1.1 Orchard

A place where a number of fruit crops have been planted in a systematic manner and are overseen to produce profits through consecutive yields. Depending on their intended purpose, orchards can have a wide range of sizes and forms.

1. **Commercial orchard:**

- Fruit farmers maintain them with the goal of selling their produce. In addition to other types, they might be dry orchards, low-density or high-density orchard.

a) Low density orchard: Since this kind of orchard system develops orchards on sturdy standard rootstocks with fewer trees per unit, it necessitates greater space between trees.

b) High density orchard: A higher number of fruit crop plants, such as mango, apple, citrus, pear, walnut, and others, are planted per unit area in high density orcharding using dwarfing rootstock. 8 × 8 m spacing followed (139 plants ha-1/ ha by triangle system; 156 plants/ha in squire system 178 plants/ha-1 by hexagonal system of planting,) for conventional planting [1]. Adopt high density planting at 8 × 4 m (312 plants ha-1) for high productivity in sapota.

2. Dry Orchard

- Using moisture-preserving techniques like mulching, contour or terrace planting, crescent bunding, and so forth, hardy fruit cultivars may be grown in dry orchards. Suitable crops for dry orcharding include mango, pear, sapota, ber, bael, guava, custard apple, cashew, jamun, and other fruits.

3. Progeny orchard

- Mainly continued by nurserymen with the intention of cultivating exceptional fruit tree kinds with all the desired traits. In these orchards, mother plants are the ones that are maintained alive.
- There are a number of disadvantages to this kind of orchard, such as the challenge of managing fruit crops that need different spacing, fertilizer, and water mixtures; the potential for the orchard to not be ready for harvest all at once; and the potential challenge of satisfying the cultural requirements of different varieties.

4. Home orchard

- Orchards kept in private backyards to supply families with fruit; these are primarily kept in homes in rural and suburban areas. Fruit plants will be chosen based on personal preference and practicality.

5. Experimental orchard

- Orchards kept in universities and research facilities with the primary goal of carrying out various experimental trials for the benefit of fruit producers and farmers in a highly methodical and scientific manner.

1.2 Care and Management of Young Orchard

- Effective management should prioritize recognizing fundamental requirements while taking into account all available resources in order to maximize efficiency and generate greater revenues.
- These methods are essential to any effective orchard management program because they make establishing transplants in the orchard straightforward.

1.3 Objectives of Orchard Management

- To keep the soil at the proper moisture content during the critical phases of plant growth.
- Reduce or halt soil erosion.
- Boost soil organic matter, or at the absolute least, keep it in place.
- Boost nutritional status in the soil
- Get rid of the weeds in the orchard.
- Loosen and improve the soil structure to improve water percolation and soil aeration.
- To ensure extra income from the interspaces inside the orchard, especially in the pre-bearing season.
- Boost biocontrol and microbial activity.

2. SOIL MANAGEMENT / FLOOR MANAGEMENT

Keeping the soil in perfect condition or improving it as needed is the aim of soil management. This entails protecting against erosion caused by wind and rain. The open space needs to be used and preserved as efficiently as possible using a variety of management strategies, including high density planting, mulching and rotation, cover crops, intercropping, cultivation, sod culture, and so on. Two orchard management practices employed in sapota orchards include intercropping, which is the practice of growing annuals or relatively short-duration crops in the interspace during their formative years, and mixed cropping, which is the practice of growing perennials in the interspacing of perennials. "Multi-storey cropping" is the term used to describe a multispecies crop combination that consists of both annuals and perennials together with an established perennial stand. The goal of intercropping is to maximize the use of available land and space to generate extra income, particularly in the early stages. Through the use of nitrogen-fixing leguminous crops, it protects the interstellar medium from radiation, temperature, wind, water, weeds, and erosion. The other soil management techniques include cover crops and green manure crops. A crop cultivated in addition to the main crop with the intention of improving the soil with organic matter is referred to as a "green manure crop." A crop that is grown as a soil cover to stop erosion might also be considered a green manure crop. Important soil management practices usually followed are**:**

1. Clean culture

This involves tillage and weed clearance to maintain a clean area between plants. It comes with pros and cons of its own. The benefits include: It will lessen weeds' competition for nutrients, light, and water; also, it will prevent pests and illnesses from finding another host. It will break up clods and increase aeration, which will enhance soil biological activity and the physical condition of the soil. Additionally, it aids in the cracking of water-infiltration abstractions and hard tops. Its limits include the following: loss of organic matter; soil erosion caused by wind and water, especially on flat terrain; and excessive leaching of nutrients.

2. Clean culture with cover crops

In doing so, tillage and weed removal preserve a tidy plant border. It has advantages and disadvantages of its own.

The benefits are

- It will help lessen the competition that weeds have for nutrients, light, and water. It will also stop new hosts for pests and diseases from emerging.
- It helps remove hard tops and water infiltration abstractions; • It increases soil aeration by breaking up clods, which in turn improves soil physical condition and soil biological activity.

Its drawbacks include

- It will cause excessive nutrient leaching, erosion of the soil caused by wind and water, and loss of organic matter, even on flat terrain. This type of soil management involves removing the weeds and then planting a cover crop, often known as green manure.
- There's a good chance that intensive erosion occurs from clean farming during the rainy season.
- Planting a green manure crop among the trees early in the rainy season and tilling it into the ground at the conclusion of the monsoon season is probably the best course of action. India has a greater preference for green manure crops including sun-hemp, cowpea, daincha, lupins, and others.
- Using legume cover crops to grow grapes, mango, guava, and other fruit crops is becoming more and more common in orchard management.
- Under the shade of the guava and sapota trees, French and cowpea beans grow well.
- To prevent soil erosion, some locations use perennial cover crops such Peuraria phaseoloides, Calapogonium muconoides, and Centrosema pubescens.

3. Mulching

Crop wastes including straw, cotton stalks, leaves, sawdust, pine needles, coir dust, and other materials like polythene films are used to cover the tree basins and the spaces between the trees. Reducing weed development and preserving soil moisture are the two basic objectives of mulching. The most important way to preserve soil moisture and enhance growth conditions for plants is to mulch the soil around them. Among the common materials used for mulching are sawdust, hay, straw, residual crop residue, leaves, and plastic. Bio mulching materials such as dry leaves, paddy straw, paddy husk, jowar trash, sawdust, dry grasses, and dry coconut leaves are used to minimize evaporation losses, control weed growth, and create a microclimate that regulates soil temperature, humidity, and microbial activity (Chaudary and Shukla, 2004). A thin coating of straw prevents the soil from drying up completely and also reduces competition for nutrients and weed growth. By stopping the growth of weeds and managing soil moisture, it helps save moisture. It will also improve soil structure, stabilize temperature oscillations in the soil, and increase soil organic matter. In addition to increasing nutrient availability because of improved soil conditions, microflora shields the primary crop from competition for moisture and nutrients. These materials were found to have defects and to be more costly than necessary, despite their usefulness. For this reason, plastic film is the most often used material for mulching. Any horticulture crop's quality and yield might be improved by mulching. In agricultural cans, plastic films aid in moisture conservation, soil temperature raising, and weed development inhibition. The loose, friable soil is not compacted by the mulch.

The greatest yield of sapota cv. Kalipatti under 200gauge black polythene film was obtained by Reddy and Khan [2] and was higher than that of the control (78 kg tree-1) and 400gauge black polythene film (128.6 kg tree-1). In order to better

understand how the sapota (Achras zapota) crop responded to drip irrigation and plastic mulch, Tiwari et al. [3] conducted an experiment. They found that the soil chemical analysis of the treated soil showed increases in organic carbon, organic matter, humic acid, microbial count, available potassium, available phosphorus, total nitrogen content, and C:N ratio. In the soil that had plastic mulch applied to it, a drop in pH and accessible nitrogen was seen. The Sapota plants' biometric measurements (canopy, height, girth, and number of branches) demonstrated the beneficial effects of the plastic mulch and irrigation systems. The increase in Sapota production attributable only to mulch ranged from 5.62% to 41% in various treatments.

Mulching also has the following advantages

- The benefits of mulches include: protecting and keeping fruits clean, when they fall on them; preventing soil erosion; reducing surface runoff; increasing the amount of precipitation that can be absorbed; and lowering the frequency of watering.

Following disadvantages of mulching

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

4. Sod culture

This method leaves the orchard with a continuous grass cover without any tillage. This type of orchard gardening is practiced in the USA and Europe. This might be useful to prevent soil erosion on sloping terrain. They compete with one another, though, for the moisture and available nitrogen in the soil. The higher requirements for watering and manuring are the drawbacks of this approach. They damage trees with shallow roots. With firmly rooted trees, sod could work well because the top soil layers won't have much moisture.

5. Sod mulch

The frequency of cutting and the length of time the chopped material is left on the ground are the only differences between this and sod. This is a little bit better than the last one since the moisture loss is not as great as it is with sod. Since vegetation takes up more nitrogen from the soil than it does, fruit trees should receive more nitrogen than usual from both sod and sod mulch.

6. Intercropping

When the soil is dry and erodes during the rainy season, plant intercrops there. When these crops are plowed into the soil, they contribute organic matter, lessen erosion, and enhance the soil's biological complexity and water-holding capacity. Because legumes fix atmospheric nitrogen in their nodules, they raise soil nitrogen levels and are therefore a good choice for cover crops. They limit the growth of weeds in the rainy season. Crops like green gram, black gram, cowpea, cluster bean, and soybean should be prioritized during the kharif season, although pea, fenugreek, broad bean, and lentil can be utilized as cover crops in the winter. In newly planted orchards, the soil between the trees is best used. If the permanent trees are properly spaced, they will not use a significant portion of the land for several years. Similar circumstances occur with other perennial horticultural crops, such as tapioca, ginger, turmeric, and bananas, in which a portion of the area between adjacent plants remains unoccupied for a few months. Given that he isn't initially generating any money from this vacant land, the farmer's desire to benefit from it seems sense. The practice of planting any profitable crop in the early alley spaces of fruit trees or in the early stages of unoccupied spaces for a long-term crop is known as intercropping. They also function as a cover crop, and the cultivation, irrigation, and manuring of the intercrops improve the soil.

According to Pandy et al. [8], the fieldwork was carried out in Navsari Agricultural University in Navsari, Gujarat, under support irrigated circumstances. Based on the current study, it was proposed that growing ginger under Sapota + Jatropha based agro-forest systems produced the highest fresh rhizome output and that the total number of fingers on each ginger plant was registered under these agro-forestry systems.

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

2.1 Impact of Intercropping Systems on Sapota

Rai [4] discovered that in chikoo orchards, cereal crops like wheat and rice were frequently cultivated as intercrops. These crops yielded returns ranging from around 1135 to Rs 10, 354 ha-1. Sugarcane yields increased returns when interplanted with chikoo. Growing tree mixes, such as sapota + leucaena and sapota + casuarina, in tropical alfisols is recommended by Swaminathan [5] as a sustainable source of income. When cultivated in combination with leucaena, sapota can develop 17% faster [6]. Ramaswamy (2008) used a variety of micro water harvesting techniques, including V-ditches, semi-circular bunds, compartmental bunding, scatter pits, coirpith composting, and control, to perform a field research in farmers' fields in the dryland of Sapota with three medicinal intercrops. Rai [4] discovered that in chikoo orchards, cereal crops like wheat and rice were frequently cultivated as intercrops. These crops yielded returns ranging from around 1135 to Rs 10, 354 ha-1. Sugarcane yields increased returns when interplanted with chikoo. Growing tree mixes, such as sapota + leucaena and sapota + casuarina, in tropical alfisols is recommended by Swaminathan [5] as a sustainable source of income. When cultivated in combination with leucaena, sapota can develop 17% faster [6] Ramaswamy (2008) used a variety of micro water harvesting techniques, including V-ditches, semi-circular bunds, compartmental bunding, scatter pits, coirpith composting, and control, to perform field research in farmers' fields in the dryland of Sapota with three medicinal intercrops.

In comparison to solitary harvests of basil, kalmegh, and mint, the greater organic carbon content, N, P, K, Ca, Mg, and micronutrients in the leaf were detected under the Sapota-Jatropha cropping system [7]. At the Agronomy Farm, Navsari Agricultural University, Navsari (Gujarat), Vishnu et al. (2014) performed field tests to determine the performance of tuber medicinal crops (kalihari, kali musli, and safed musli) under a three-tier agroforestry system based on sapota jatropha during the rainy season. In comparison to a solitary crop, the economic yield (q ha-1) was greater under intercrops such as kalihari (1.79), kali musli (1.38), and safed musli (1.81). According to Pandy et al. [8] the field trials were carried out in Navsari Agricultural University in Navsari, Gujarat, under support irrigated circumstances. Based on the current study, it was proposed that growing ginger under Sapota + Jatropha based agro-forest systems produced the highest fresh rhizome output and that the total number of fingers on each ginger plant was registered under these agro-forestry systems.

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

7. Mixed cropping

It explains the process of growing particular perennial crops in the main pathways for perennial crops. The farm's improved net revenue per unit area and effective utilization of the available space are the main advantages. CPCRI, Kassargode conducted several studies on mixed cropping in arecanut and coconut plantations. The results showed that clove and nutmeg could be grown as mixed crops in between four arecanut palms in alternate rows,

while cocoa, pepper, cinnamon, clove, and nutmeg could be grown as mixed crops in coconuts. In all of the above situations, there is a gain in yield (up to 10%) for the main crop because to the synergistic effects of the crop combinations produced by beneficial microorganisms in the rhizosphere and the increased availability of nutrients.

8. Multitier system of cropping

In a certain area, some horticultural plants, such as coconut and arecanut, are cultivated for around fifty years. The aforementioned trees need around 4 to 7 years to reach the bearing stage. These trees have enough alley gaps (about 75%) between them, and because they are palm trees, their root systems won't expand more than one meter in diameter. Therefore, it is profitable to raise other crops in these empty regions, which will increase profit and job prospects. This is the main goal of the multitier cropping system. Intercropping, often known as mixed cropping, is the practice of growing crops alongside one another that are compatible yet have distinct morphological frames and rooting patterns. Together, these crops are produced such that their roots may browse different zones of the soil and their canopies can absorb solar energy at different heights. The main takeaway from this is that land, water, and sunshine should all be managed responsibly. An ideal combination of crops for multitier cropping in plantations of coconut and areca nuts is as follows:

9. Organic farming

Our overuse of chemical pesticides and fertilizers to boost food production has had a detrimental effect on the ecosystem and the health of our soil. Recently, a lot of environmentalists have criticized this. This has attracted the attention of many experts in ecologically sound, commercially successful, and sustainable agricultural methods, commonly referred to as organic farming. It's a manufacturing process that largely avoids or rejects the usage of artificially produced inorganic substances. This system only uses crop rotation, crop residues, animal manures, legumes, green manures, off-farm organic wastes, biofertilizers, mechanical cultivation, etc., along with some biological pest control techniques to maintain soil productivity and tilth, supply nutrients, and control insects, weeds, and other pests. It is common to refer to this method as "biological farming," "regenerative farming," "sustainable farming," "eco-friendly farming," etc. Organic fanning is necessary because to:

- Chemical fertilizers can have detrimental effects on the physical, chemical, and biological properties of soil in addition to being costly and lacking in humus. They could also be detrimental to the life in the soil.
- Pesticide residues may arise from the careless application of pesticides on horticulture crops, the majority of which we eat raw. Horticultural products grown organically command a higher price. The use of pesticides is unsustainable for the environment because pests become resistant to them.

Essential features of organic farming

- Making use of organic manures, including coir compost, FYM, compost, and vermicompost.
- Applying biofertilizers.
- Using green manures and cereal legumes.
- Weed control without chemicals.
- The use of biological and botanical pesticides.

In Al-Nubaria, Behira governorate, apple orchard cv. Anna/MM106 rootstock was planted in 2003 at a size of 4 x 3 m. In the 2009 and 2010 growing seasons, the interrow areas were treated by: 1) Check plots, designated as CP (Control); 2) Black polyethylene film, designated as BPF (applied from February to October each season), 3) White polyethylene film, designated as WPF (applied from February to October each season), 4) Alfalfa straw mulching, designated as MAS; 5) Rice straw mulching, designated as MRS; and 6) a single application of compost of organic matter, designated as COM (15m3/Fed.), applied in December. A 7.6 pH sandy loam was used for tree planting, and drip watering was used. The findings showed that, when compared to the check plot treatment in both seasons, all mulching treatments using plastic films, covering crops, and composting organic matter enhanced fruit weight (g), tree yield (Kg), fruit length, fruit diameter, and fruit firmness. At all polyethylene film applications, fruit color percentages exhibited higher light intensity than light reflected from untreated trees, composted organic matter, and other covering crops. Regarding the anthocyanin content of fruits in both seasons, the similar pattern was observed [9].

10. Tillage

It alludes to the act of hoeing and plowing the ground. Tillage is done to break up and loosen the soil, allowing the roots of fruit trees to more easily penetrate it. It facilitates air circulation and water absorption. Tillage helps with weed management, weed eradication, and fertilizer mixing. The bacteria' action releases the food stuff that was previously locked up for the plants.

3. CLEAN BASIN MANAGEMENT

To carry out this process, the basin is manually kept clear of weeds. It's the most common method for overseeing apple orchard flooring. This method involves four to six yearly cultivations to control weeds. Basin cultivation facilitates winter fertilizer application after harvest. Young apple trees should dig deeper root systems and avoid weeds that compete with the plants for water and nutrients. However, this method is not recommended for bearing trees due to its effect on the feeding root system and soil moisture levels. Making the most of the moisture and nutrient availability in the soil while creating the ideal environment for fruit plant development is the primary objective of orchard soil culture. The proper integration of manures into the soil requires first loosening the soil. In order to facilitate the decomposition process, it is also necessary to use cover crops, intercrops, and residual mulch in addition to green manures. On sloping terrain, the orchard soil culture is very harmful. Putting strips of grass in between the neatly tilled, narrow rows of fruit trees on the contours or planting permanent cover crops there are common techniques used to limit soil erosion in such areas. The kind of fruit and the surrounding environment have an impact on the orchard's cultural traditions. The majority of soil culture in mango orchards occurs during the non-bearing period. Growing crops that include cover, inter, or green manure is a common practice. Since trees grow and cover a lot of the terrain, generally a month or two before they flower, just an annual tillage is normally done. A few shallow ploughings are necessary in citrus, especially in June through July and from October to December, to keep the weeds under control and maintain the irrigation systems.

1. Green Manuring Crops

These crops, which include cowpeas, guara, senzi, and daincha, are planted during the rainy season and, after a few months of development, are buried in the ground to assimilate the organic matter. To expedite decomposition, all green materials must be plowed under while still soft or succulent. As soon as the green manure crops start to bloom, they are often picked and put to the soil. Green manuring crops also help to improve the physical condition of the soil by adding organic matter to the soil. When used as cover, intercropping, or green manuring crops, legumes may fix nitrogen from the atmosphere. Using green manure on a regular basis can also help reduce the expense of manuring and fertilizing orchards.

2. Weed management

Weed should be eliminated often since it competes with other plants for nutrients and moisture, which can also host pests and illnesses. Herbicide sprays, manual weeding, and mulching are some methods for controlling weeds. Mulching Sapodilla trees enhances the soil close to the surface and reduces weed issues around the tree stem. 5-8 ml l-1 of glyphosate spray is advised for the management of grass weeds. Pre- and post-monsoon interculture is advised in established orchards to improve aeration and effectively manage weeds. Till the field completely both at the beginning of the monsoon and again afterward. Weed hazards are widespread in young orchards. For a duration of 10–12 months, pre-emergence spraying with 2 kg of Bromacil with 2 kg of Diuron ha-1 is also beneficial.

3. Establishing Wind Break

The hot, dry wind, blazing heat, and cold may all harm young plants. Planting tall, thick-growing trees on the windward side of the orchard, particularly in the west and north, will create a powerful windbreak.

4. High Density Plantation (HDP)

In general, planting density is determined by the type of fruit tree, its growth pattern, training rainfall in the region, trimming of the rootstock, and soil composition. In the early stages of an orchard's existence, recommended planting densities for fruit crops lead to underutilization of interspatial space. This renders orchards unsightly, especially on small estates due to their lengthy gestation time before yielding returns and difficult soil maintenance in empty spaces. In order to maximize land use and provide high yields throughout the early stages of an orchard's life while also making management easier, high density planting—which involves more plants per

unit area than is ideal—is being examined as a soil management method. Fruit crops including apple, pear, banana, pineapple, mango, guava, citrus, ber, and pomegranate have all benefited from this. One of the following methods—dwarf genotypes, interstock, pruning, training, retardant application, altering planting geometry, and inducing viral infection—can be used to accomplish this. Similar to mangos, sapota is often grown with a spacing of 8 to 9 meters. However, because it takes several years for the plants to acquire the complete canopy covering, it is recommended to employ a spacing of 5 to 6 m2 in either direction under HDP. Because of their distinct growth behaviors—such as columnar tree form and dwarf tree stature—PKM-1 and PKM-3 sapota have enabled HDP in these crops. Typically, sapota is planted with a broad 8 x 8 m spacing. Findings indicate that after 15 years of planting in PKM-1, a high plant density of 312 plants per ha (8 m × 4 m) is achievable, generating 15.35 t ha-1 [10]. Because of their upright growth habit, freshly released cultivars such as CO-3 sapota and PKM 4 sapota may be planted under HDP [11]. Plants are spaced 8.5 meters apart, on average, with 130 plants planted. Up till the age of 13, high density planting with a 5 x 5 m spacing has been effectively implemented [12]. Conventional planting is done with an 8 × 8 m spacing (139 plants ha-1/ha by triangular system; 156 plants/ha in squire system; 178 plants/ha-1 by hexagonal system of planting) [13] For maximum yield, use high density planting at 8 × 4 m (312 plants ha-1).

4. CANOPY MANAGEMENT

Since sapota trees are evergreens, their growth and development are ongoing processes. The lateral branches of a well-grown sapota tree typically occur in tiers. The tree generates a dense canopy at the top if it is not trained or trimmed, which reduces sunlight penetration and lowers productivity in the middle and bottom tiers. Harvesting sapota requires the use of a specialized tool to remove the fruits from branches reaching beyond the third or fourth tier after a specified number of years of establishment. Using appropriate canopy management, which includes early training and careful pruning practices, is one approach to prevent this issue [14]. The harvesting issue can be resolved by beheading the growth point to remove any leader shoots that emerge above the third or fourth tier. Generally speaking, for better control of sunshine penetration and canopy aeration, giving the tree the right architecture from the beginning and lightly cutting side branches are crucial. The goal of canopy control is to increase the number of fruiting branches and the amount of sunlight that reaches the interior sections of the canopy, which will increase the amount of area that can produce high-quality fruits. Since sapota flowers are produced on the tips of the stalks, trimming is grudgingly recommended for this crop [15-17].

5. CONCLUSION

Using a variety of techniques like mulching, cover cropping, green manuring, intercropping, clean cultivation, sod culture, organic farming, and many more, orchard management ensures better fruit cultivation, which is crucial to the production of fruits from the orchard's early stages to their commercial stage of fruit plants. By correcting the physical, chemical, and biological aspects of soil health, these management techniques also enhance fruit quality.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Usha K, Madhubala Thakre, Amit Kumar Goswami, Nayan Deepak G. Fundamental of fruit production, division of fruits and horticultural technology, Indian Agricultural Research Institute, New Delhi. 2015; 180.
2. Reddy YT, Khan MM. Effect of mulching treatments on growth, water relation and fruit yield of sapota (*Achras sapota*). Ind. J. Agric. Sci. 1998;68(10):657-660.
3. Tiwari KN, Mukesh Kumar, Santosh DT, Vikas Kumar Singh, Maji MK, Karan AK. Influence of drip irrigation and plastic mulch on yield of Sapota (*Achras zapota*) and Soil Nutrients. Irrigation and Drainage Systems Engineering. 2014;3(1):1-8.

4. Rai T, Bathra MS, Lal M, Pathak GM. Economic return through intercropping in chikoo orchards. Annals of Agricultural Research. 1993;14(2):159- 162.
5. Swaminathan C. Sustainable tree mixtures: Optimum species combination for a tropical alfisol of southern India. An International Journal for Sustainable Production Systems. 2001;18(3).
6. Pandey DN. Multifunctional agroforestry systems in India. Current Science. 2007;92(4):25.
7. Solanki VK, Jadeja DB, Yadav MK. To study the nutrient status in soil and plant after the harvesting of the herbal crops under three-tier agroforestry system. African Journal of Agricultural Research. 2014;9(51):3679-3686.
8. Pandey SBS, Mukta Pandey, Jadeja DB, Tandel MB, Dileshwar Nayak. Growth and yield of ginger (*Zingiber officinale* L) under Sapota- Jatropha based agroforestry systems in south Gujara. Journal of Pharmacognosy and Phytochemistry. 2017;6(6):247-251.
9. Aly MA, Nagwa A, Abd El-Megeed, Afaf MA. Yousif. Organic fertilization, cover crops and plastic mulching effects on soil temperature and moisture, vegetative growth, yield, and fruit quality of Anna Apple trees. Alexandria Science Exchange J. 2010;31(4):394-403.
10. Anonymous. Report of the working group on horticulture, plantation crops and organic farming for the xi five year Plan 2007-12; 2007.
11. Anonymous. Crop production techniques of horticultural crops 2013. Horticultural college and research institute TNAU. 2013;477.
12. Anonymous;2010.Available:http://nhb.gov.in/report_files/sapota/SAPOTA.htm.
13. Usha K, Madhubala Thakre, Amit Kumar Goswami, Nayan Deepak G. Fundamental of Fruit production, Division of Fruits and Horticultural Technology, Indian Agricultural Research Institute, New Delhi. 2015;180.
14. Gopu B, Balamohan TN. Canopy management in sapota (*Achras Sapota L.).* Global Journal for Research Analysis. 2015;4(3):51-53.
15. Anonymous. Indian Horticulture Database, National Horticulture Board, Gurgaon; 2017-18.
16. Kumar N. Introduction to horticulture. Oxford and IBH publishing co. pvt. Ltd, New Delhi; 2010.
17. Pandey SBS, Jadeja DB, Narendra SM, Tandel MB. Economic comparison of intercropping of ginger and turmeric under Sapota-Jatropha based agro-forestry systems in South Gujarat; 2016.

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