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Orchard Planning, Layout and Management

Orchard planning and layout make the foundation of an orchard. The scientific planning and execution results in optimum production, high returns and long orchard life. Proper planning includes evaluation of business goals, location, site characteristics, choice of crops, technical and management inputs, and market potential. Optimal site preparation and planting need to involve thinking in terms of managing tree roots for increased orchard performance at the first instance. Physical, chemical, and biological properties of the soil must all be considered as a holistic. A replant site necessarily requires two to three years of crop rotation in order to replenish organic matter, facilitate sapling establishment and avoid tree mortality or stunted growth. An ideal site needs to be located on the upper side of a gradual (4 to 8%) slope, on rolling or elevated land. Low lying areas, where cold air can accumulate during a calm, clear night, are prone to frost damage. Hilltops or ridges may expose trees to excessive winds or to arctic air masses. A southern-facing slope warms up faster in spring, while the opposite is true for a northern slope. Eastern-facing slopes are intermediate.

While selecting a site for an orchard, soil depth and soil texture needs to be taken into consideration. The deep (1 m) and well drained soils are ideal for orchards. Soil analysis reports provide useful information on soil texture, fertility, erosion levels, and water-holding capacity that are all crucial. A well designed and comprehensive soil analysis considers vital parameters such as pH, EC, organic carbon, nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, iron, manganese, zinc, copper, and boron. Similarly analysis of water quality used for irrigation of orchard crops is also very crucial, which normally considers parameters, like pH, EC, chloride, nitrates, sulphates, carbonates, bicarbonates, calcium, magnesium, sodium, RSC and SAR.

In normal as well as alkali soils, plants do not require liming; however, if the soil analysis shows lower pH than what is normally required (5.6-6.0) for wide range of fruit crops production, in such instances agricultural lime should be applied. If the soil is very acidic, heavy lime applications may be necessary based upon appraisal of the lime requirements. Two-thirds of the recommended quantity of lime need to be scattered over the area of planting mixed with the top soil, then the area ploughed as deep as possible and left for at least 9 to 12 months before planting. Calcium (lime) moves very slowly downwards into the soil and must therefore be applied into the depth of the root zone. If a lighter agricultural lime application (2-4 tonnes/ha) is required, the same could be applied into the soil at least three months before planting. It should only be applied when the pH is lower than the target soil (water) pH. In case of magnesium deficiency, dolomite should be used to amend the soil pH. In alkaline soils with a pH of 7-8, repeated applications of sulphur may be required at the rate of 500 kg/ha, until pH ranges from 5-6. In some problematic soils even after amendments, micronutrient deficiencies might occur that need proper diagnosis and corrected accordingly by using appropriate foliar applications.

Before disturbing the surface vegetation, spot treatments could be made to control perennial and other problem weeds. On replant sites, a cover-cropping system needs to be established and maintained for several years to suppress weeds, nematodes, and soil-borne fungi and to increase soil organic matter. Soil drainage problems if any should be corrected by establishing subsurface drainage systems or surface modifications such as ridging etc., as some crops/rootstocks are especially sensitive to water logging and associated diseases caused by *Phytophthora* species. There is a need to give considerable thought to the orchard design and tree quality. Experience has shown that branched trees on dwarfing rootstocks will produce early crops. In order to obtain the desired scion/rootstock combinations best suited to an orchard plan, it is important to ensure availability of quality trees at least a year ahead of planting. Planting of disease-free trees with healthy root systems ensures a good start for a sustainable production system. Well-hardened trees are desirable for early cropping and intensive systems. Windbreaks, if needed and pollinizers' trees also should be ordered early. Studies indicate that the best trees for windbreaks are

Casuarinas, Jack fruit, Jamun etc., depending upon the location that are evergreen and leaf out early and also hold leaves throughout. Fruit tree bloom periods vary from one region to another, and therefore, it is advisable to get advice from the horticulture specialists on choice of pollinizers for different crops in order to augment productivity.

Trees planted in north-south oriented rows receive better light than those grown in the east-west rows. Important considerations are canopy light interception and its distribution to flowers and fruit. Decreasing the distance between rows and increasing tree height also increases light interception. With most tree forms, the thumb rule is, optimum tree height works out to half the row spacing plus 1 m. Maximizing production per unit area by planting trees in high densities requires careful assessment of the vigour potential of a site, use of a standard dwarfing rootstock and horticultural expertise. It may be helpful to evaluate tree size in a previous orchard or in an adjacent block before planning for such an effort. Other factors that affect decisions on tree arrangements include topography, equipment size, and worker access for critical cultural operations. The different components of orchard planning layout and management are dealt in depth in the foregoing paragraphs.

Planning of an orchard

Preparation of a blue print of orchard plan after taking into consideration different horticultural principles is necessary for ensuring the implementation of good horticultural practices (GHP) for optimizing production, sustained tree health, high orchard efficiency and profitability. While doing so, the following aspects are critical:

- Establishing site profile, outline decisions on soil amendments if required; green manuring and other approaches to improve soil fertility; site development by applying soil conservation and management principles, rain water harvesting and water conservation for efficient crop production.
- Central location of different orchard structures like farm stores, office building, water resources for efficient supervision.
- It is important to allot each kind of fruit crop to a particular block in the field based on fruits ripening time. Establish fence, wind breaks and roads to ensure convenience.

Planting live fence with tall growing trees as first row and small, bushy thorny plants such as *Carissa carandas*, *Gliricidia sepium* , *Moringa*, Flame of the Forest, Palmyra palm, babool, *Simarouba*, Jamun, Jangal jalebi, etc., can also be planted as fence along the boundary of orchard. Some hedge plants make a thicker and denser fence by planting agave, sisal, *Boradi*, karonda and *Mehandi* etc. In slopy lands, planting of vetiver grass helps in soil conservation.

Windbreaks: Tall trees are planted on the border of the orchard to reduce the impact of wind on the fruiting of trees. Trees suitable for windbreak should be erect, tall and quick growing, hardy and drought resistant and mechanically strong and having dense foliage to keep the surrounding atmosphere humid and offer maximum resistance to wind. Trees, which are generally used as windbreak, are seedling mango, jamun, mulberry, moringa, jackfruit, carambola, shisham, teak, gamhar, bamboo, *Casuarina equisetifolia*, *Pterospermum acerifolium*, *Polyalthia longifolia*, *Eucalyptus globulus*, *Grevillea robusta*, *Azadirachta indica* etc.

In the planting pattern, special attention needs to be given for accommodating pollinizer varieties for different fruit crops. Normally it is advisable to see that every third tree in every third row is planted with a pollinizer variety.

Irrigation channels/facilities for laying out drip irrigation systems also need to be planned well in advance of planting. Roads should occupy minimum space. Short growing trees should be allotted at the front and tall at the back for easy watch and to improve the appearance of the orchard. Evergreen trees should be in the front and deciduous ones behind. Fruits attracting birds and animals should be close to the watchman's shed.

Establishment of an orchard

Since establishment of an orchard is a long term commitment of land requiring investment, hence, it deserves a thorough and critical planning exercise. The selection of proper location and site, site appraisal for suitability (soil profile and soil analysis; water resources development and water analysis), allotment of suitable crops, planting system and planting distance, choosing the varieties and the quality and disease free nursery plants have to be carefully considered to ensure maximum orchard health and production.

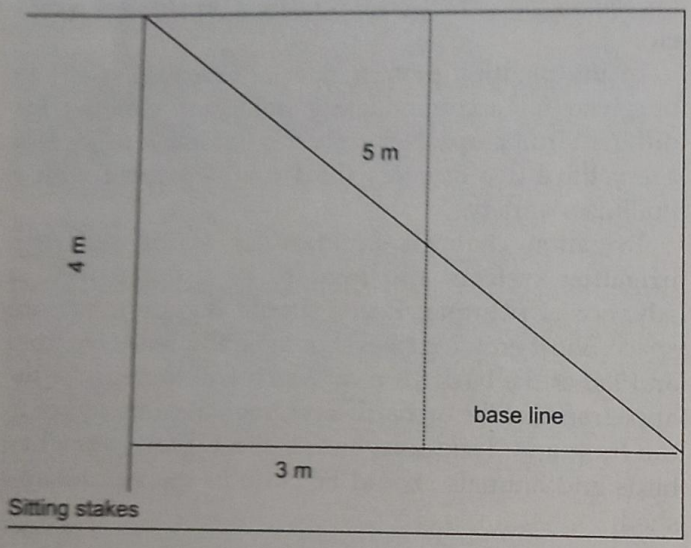
Location and choice of site: Proper selection of site for orchard establishment is made based on the following criteria:

- The location should be in a well established fruit growing area, near to the market.
- The climatic conditions are siuitable for growth and free from weather vagaries.
- Assured and adequate good quality water is available for irrigation.
- The soils are fertile and well drained with good soil depth.

Preliminary operations: The orchard site should be free from stumps, roots or shrubs. Deep ploughing

is essential to remove big roots. The land should be thoroughly ploughed, leveled and manured. In the hills, the land should be divided into terraces depending upon the slope.

Layout of an orchard on level land is simple and is practiced through establishing a straight baseline, usually next to a fence or roadway. Then, lines at right angles to the baseline are established at both ends of the plot and one or two places in the middle. An easy way to establish these angles is to use 3 ropes whose lengths are in 3:4:5 proportions. Put the 4 m rope along the baseline, then place the 3 m rope at approximately a right angle, and finally, close the triangle with the 5 m rope.



Contour layout for slopy land requires the use of a surveyor's level and rod. The first row is at the highest elevation, and is staked out on the level (i.e., all points on the line are at the same elevation). Next, the steepest slope along the first row is found and the distance that has been selected as the minimum distance between rows is measured down the slope. From that point the next row is laid out on a level line as before. Moving away from this steepest slope to less-steep slopes, the rows will be wider apart. Wherever the distance between two adjacent rows becomes twice the minimum distance, short contour row is laid out between them which points to the end of the plot.

Any method of layout should aim at providing maximum number of trees per hectare, adequate space for proper development of the trees and ensuring convenience in orchard cultural practices. The system of layout can be grouped under two broad categories viz. (a) vertical row planting pattern, and (b) alternate row planting pattern. In the former planting pattern (e.g. square system, rectangular system), the trees set in a row are exactly perpendicular to those trees set in their adjacent rows. In the latter planting pattern (i.e. hexagonal, quincunx and triangular), the trees in the adjacent rows are not exactly vertical instead the trees in the even rows are midway between those in the odd rows.

The different layout systems commonly adopted by the growers are described here.

Vertical row planting pattern: Different types of vertical row planting patterns are described here:

Square system: In this system, trees are planted on each corner of a square. This is the most commonly followed system and is very easy to follow. The central place between 4 trees may be advantageously used to raise short lived filler trees. This system permits inter cropping and cultivation in two directions.

Rectangular system: In this system, trees are planted on each corner of a rectangle. As the distance between any two rows is more than the distance between any two trees in a row, there is no equal distribution of space per tree. The wider alley spaces available between rows of trees permit easy intercultural operations and even the use of mechanical operations.

Alternate row planting pattern: Different types of alternate row planting pattern are decribed here.

Hexagonal system: In this method, the trees are planted in each corner of an equilateral triangle resulting in 6 trees form a hexagon with the seventh tree in the centre.

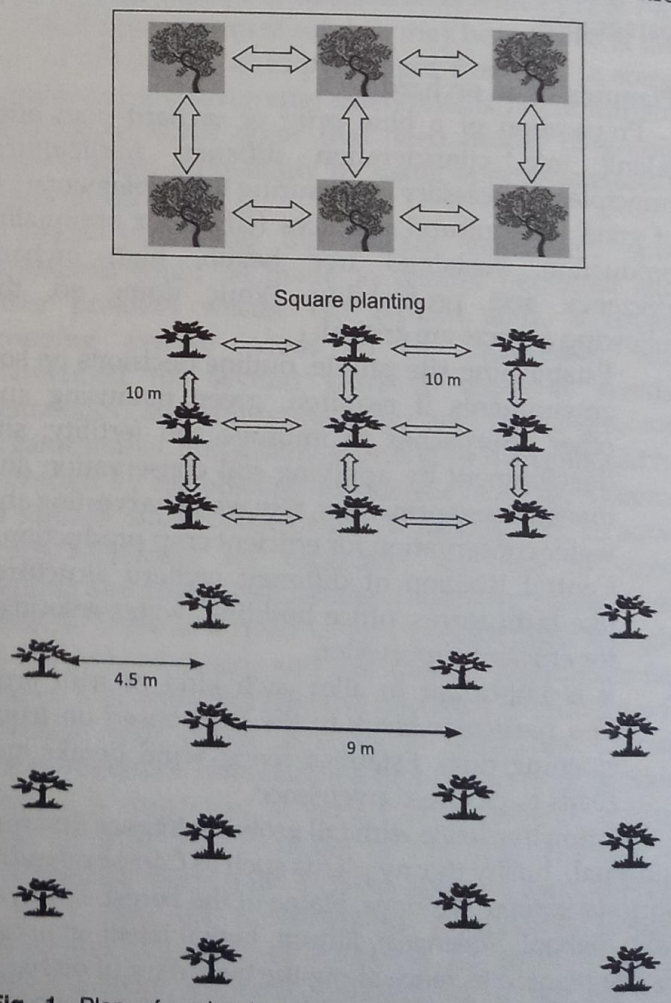
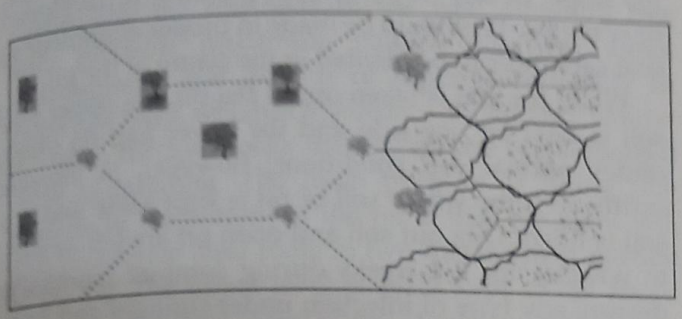


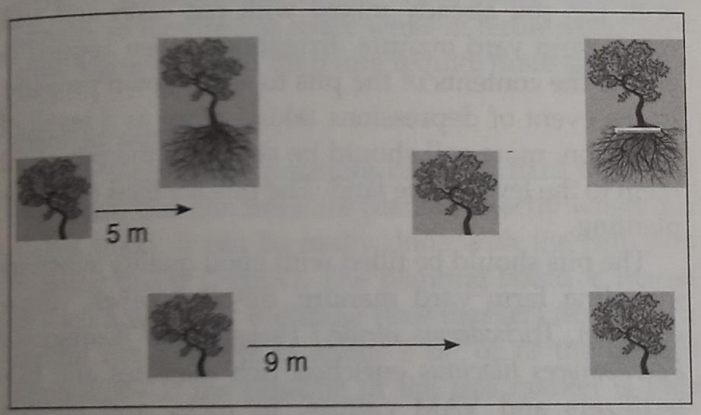
Fig. 1. Plan of orchards showing square system for traditional plantings (*top*) and double hedge row for closer plantings (*bottom*).

Therefore this system is also called as 'septuplet' as a seventh tree is accommodated in the centre of hexagon. This system provides equal spacing but it is difficult to layout. The perpendicular distance between any two



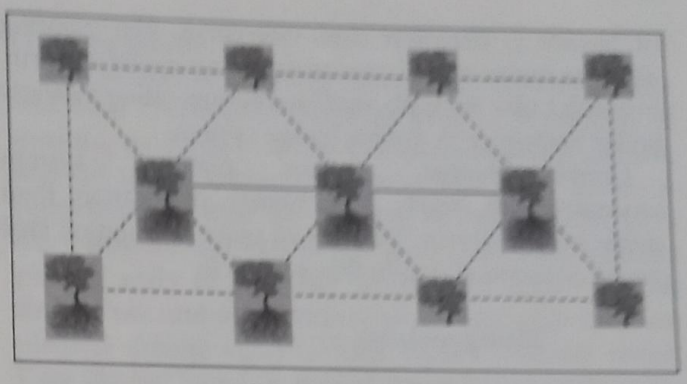
adjacent rows is equal to the product of 0.866 × the distance between any two trees. As the perpendicular distance between any two rows is less than unity, this system accommodates 15% more trees than the square system. The limitations of this system are that it is difficult to layout and the cultivation cannot be carried out so easily as in the square system.

Diagonal or quincunx system: This is just a square method, with one more plant in the centre of the square. This will accommodate double the number of plants,



but does not provide equal spacing. The central (filler) tree chosen may be a short lived one. This system can be followed when the distance between the permanent trees is more than 10 m. As there will be competition between permanent and filler trees, the filler trees should be removed after a few years when main trees come to bearing.

Triangular system: Triangular system is based on the principle of isolateral triangle. The distance between any two adjacent trees in a row is equal to the perpendicular distance between any two adjacent rows. However, the vertical distance, between immediate two trees in the adjacent rows, is equal to the product of 1.118 × distance between two trees in a row. When compared to square system, each tree occupies more area and hence it accommodates few trees per hectare than the square system.



Triangular planting

Table 1. Total number of trees/ha

Crop	Planting distance (m)	No. of trees per hectare		
		Square	Hexagonal	Triangular
Acid lime	5 × 5	400	461	357
Clove	6 × 6	277	320	248
Guava	6 × 6	277	205	159
Mango	10 × 10	100	115	89
Sapota	8 × 8	156	118	139

Contour system: It is generally followed on the hills where the plants are planted along the contour across the slope following contour survey (Fig. 2.). The main purpose of this system is to minimize land erosion and to conserve soil moisture so as to make the slope fit for growing fruits and plantation crops. The contour line is so designed and graded in such a way that the flow of water in the irrigation channel becomes slow and thus finds time to penetrate into the soil without causing erosion. Terrace system on the other hand refers to planting in flat strip of land formed across a sloping side of a hill, lying level along the contours. Terraced fields rise in steps one above the other and help to bring more area into productive use and also prevent soil erosion. The width of the contour terrace varies according to the nature of the slope. If the slope becomes stiff, the width

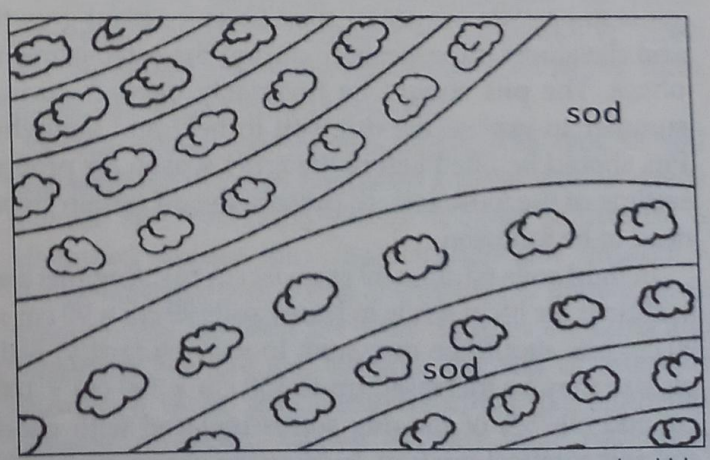


Fig. 2. Contour planting using parallel rows or terraces should be used where soil erosion is a problem (Source: www.aces.edu)

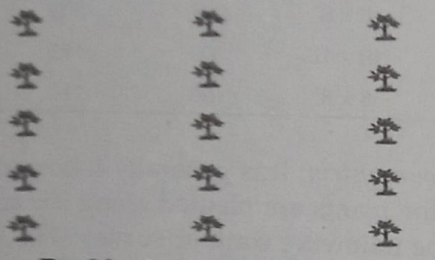
of terrace is narrower and vice-versa. The planting distance under the contour system may not be uniform. In South India, tea is planted on contours either in single hedge system or in double hedge system.

Double hedge contour planting system accommodates nearly 22% higher population than single hedge system. Number of plant population that can be accommodated in this system is:

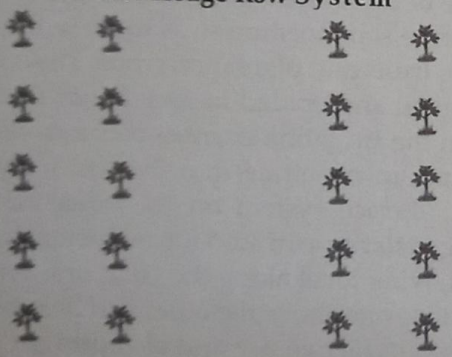
$$\text{Plant population} = \frac{N \times \text{Unit Area}}{D\,(y + z)}$$

where, N, number of hedges; D, distance between plants; y, distance between hedges; z, vertical distance between row.

Single hedge row planting: In this system, the plants are spaced closely in rows. The distance between trees in a row is usually one half to one-third the distance between rows. This is practiced only for high density plantings.



Double Hedge Row System



Digging of pits: The pits are dug 1 or 2 months prior to planting. The main purpose of digging and filling the pit is to provide congenial conditions for plant growth and development, especially during the establishment phase. The pits should be invariably opened during summer to expose the dug soil to heat and sunlight. Pits should be filled before the rainy season for proper settling of the loose soil. To prepare the pit certain steps need to be followed.

In light soils 60 cm × 60 cm × 60 cm planting pits are sufficient for litchi while in heavy soils 90 cm × 90 cm × 90 cm pits should be prepared. In *murrum* (gritty) soil, pit size may be increased up to 150 cm × 150 cm × 100 cm and 60-75% of the dug soil is replaced with good soil and compost mixture. In locations, where the soil is loamy and deep, pits of 50 cm × 50 cm × 50 cm may be dug at desired distances. At hill slopes, the pits should be of 1 m × 1 m × 1 m size along the contour. At sloppy places, the pits are prepared in form of trench by cutting the upper side of slope and leveling the lower side of the slope. In this way a leveled platform is developed near the pit. Pit should be made in proper alignment so that saplings can be planted in the centre of the pit.

When the soil is taken out of the pit, the upper half soil is kept on one side and the lower half on other, under normal soil conditions; however, in *murrum* (gritty soil) the whole soil of pit is kept aside and top soil is filled. Dug out soil and open pit are left as such to weather for 2-4 weeks during summer months to destroy any type of infection under sunlight and heat. In stony soils, it is better to separate all the stones from the excavated materials and left over soil should be mixed with manure and scrapped soil available in the field. Using a JCB machine for pit digging specially in hard and murrum soil is advisable because the pressure exerted by bucket of JCB cracks the hard pan which could allow the roots to penetrate.

Pit filling

The pits are allowed to weather for few weeks before planting in some cases. The pits are then filled with top soil already mixed with red earth and well rotten farm yard manure. Irrigation is then applied to enable the contents of the pits to settle down properly. In the event of depressions taking place as a result of irrigation, more soil should be added to the pits to fill them to the level of the land. The pits are then ready for planting.

The pits should be filled with good quality substrate including farm yard manure, de-oiled cakes, vermi-compost, *Trichoderma viride* / *Pseudomonas flourescens* / *Paecilomyces lilacinus* enriched rich manures and bio-fertilizers and VAM culture. In rocky and *murrum* soils, which are almost zero in their inherent nutrient capacity, the initial substrate supplied in the pit governs the performance of the plant later. As a common dose, 30-40 kg *Trichoderma* enriched FYM, 2 kg neem/karanj cake, 250 g SSP or bone meal is sufficient for one pit in normal soil. In problematic soils however, pit soil should also be replaced with good soil. In highly acidic situation, application of 1-2 kg slaked lime, 250 g each of zinc and boron (agriculture grade) is helpful to restore initial vigour of plant. Where, magnesium deficiency is found to occur, 500 g dolomite should also be incorporated in pit filling mixture. Where, soils are very sandy or infertile, the single super phosphate may be replaced by a 12-12-17 or similar type fertilizer mixture not less than two weeks prior to planting and, if possible, three to five months in advance. Fertilizers carefully mixed with top soil should be placed at the bottom of the pit. If the soil is having infestation of

white ants, fenvalerate / chloropyriphos dust is mixed with upper as well as lower soil of the pit. The upper soil of pit along with substrate is filled first followed by lower soil mixture. High quality soil mixture particularly the soil beneath the well grownup tree with probable *Mycorrhiza* culture improves initial establishment and growth of saplings especially in crops like litchi, which is *Mycorrhiza* dependent. Similar in citrus, the rootstocks themselves are pre-colonized prior to budding. The main purpose of filling rich mixture in the bottom of the pit is that the plant will first proliferate their roots in two-thirds lower portion of the pit. The upper level of pit is kept 15 cm above from the field level. After filling, if rain is not there, the pits should be irrigated to settle down the soil.

Planting distance

Minimum vertical distance between any two fruit plants is referred as the planting distance and this varies depending upon different factors. The optimum planting distance is required for the most efficient and profitable use of land. Distance of planting is need based and dependent upon the nature and fertility level of soil; cultivar vigour, growing conditions and purpose of orchard establishment. In poor soils, plants make slow growth, so require less space while in fertile soils, plant grow vigorously and therefore require more spacing.

Planting methods

After locating the positions of the orchard trees, it is important that the trees are planted exactly where the stakes stood. It can be easily done with the help of a planting board (Fig. 3.). The planting board is placed in such a way that the stake (tree marker) fits into the central notch. A pit of about 1 m^3 or of the desired dimensions at the position of the tree marker is then dug.

Tree guard and staking

Newly planted trees should be provided with a tree guard of bamboo or wood in a round or rectangle or square shape installed at the time of planting. It ensures protection from winds, bright sunlight and frost burn of main stem and branches.

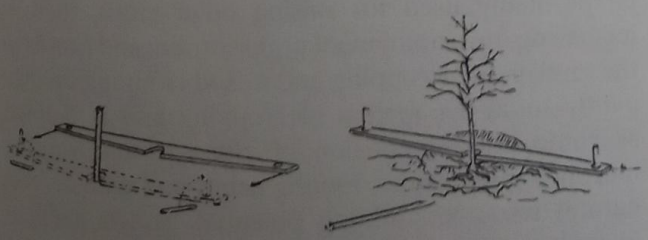


Fig. 3. Use of planting board helps in setting up a plant at the right point during planting time while establishing the orchard (*Source*: Web resources)

Planting season

The season of planting varies with different fruits and local conditions. There are two main seasons of planting in vogue in India: (i) monsoon (June-August), and (ii) spring (February-March). Monsoon season is considered the best for planting evergreen fruit trees like citrus, mango, sapota and guava etc. If the trees are planted early in the rainy season they soon establish themselves and grow vigorously. Deciduous trees are planted during the dormant period without shock. Care should be taken that planting is done before the growth starts, otherwise trees suffer severely and will be in poor condition to withstand the next hot weather.

Transplanting

The trees should be planted approximately where the original pegs had been placed. The trees are irrigated soon after planting. This consolidates the soil and helps the roots to establish contact with it and to secure a supply of water quickly. A small basin may be made around the tree for this purpose. Planting if taken up during the rains, basin should be demolished within a day or two so that water does not collect around the tree. This is more dangerous on heavy than light soils.

Soil management practices

Clean culture: This type of cultivation is extensively followed in India. This involves regular ploughing and removal of weeds. The clean culture often has many disadvantages–

- Humus will be depleted rapidly due to frequent cultivation.
- Frequent cultivation causes injury to the feeding roots and facilitates entry of nematodes and pathogens, and 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 disadvantages in clean cultivation could be minimized by avoiding deep and frequent cultivation especially with heavy farm machinery when the soil is too wet.

Clean culture with cover crops: This type of soil management involves raising of a cover crop or green manure after removing 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, dhaincha, lupines 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 pubescence* and *Peuraria phaseoloides* are raised in the alley spaces.

Mulching: This is one of the important soil management practice 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 objectives of mulching are to conserve soil moisture, control the weed growth, keep soil cool in day and warm at night hours, reduce surface run-off, add humus to the soil, prevent soil erosion, keep fruits clean, and reduce irrigation frequency.

The following are some of the disadvantages: (i) Dry materials used as mulches encourage the risk of fire and consequent damage to trees. In some soils these aggravate the incidents and buildup of termites. (ii) Thick mulches may also 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 the land. The mulching materials should not be placed too close to the tree trunk and should be spread in such a way that they provide a good cover to the root system of the trees.

Intercropping: The question of how best, one can use the soil in the interspaces of the trees arises in young orchards. If the trees are properly spaced there is considerable land available in the interspace of rows not being 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 remain unoccupied by the main crop for few months. It naturally appeals to the grower to get some returns from this vacant land especially when he is getting no returns during the early period of planting. 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. Intercrops also act as cover crops and the land benefits by the cultivation, irrigation, manuring given to the intercrops. The following important principles should be observed while growing intercrops.

1. Intercrops should not occupy the area where the roots of the fruit trees are concentrated.
2. Soil fertility should be maintained or improved when intercrops are grown.
3. Water requirements of the intercrops should not clash with those of the main fruit trees i.e., the intercrop may require irrigation at a time when it would be detrimental to the trees.

Table 2. Recommended intercrops for given horticultural crops

Crop	Age	Intercrop
Apple, Pears	Up to 5 years	Potato, cabbage
Areca nut	Up to 10 years	Pineapple, cocoa, black pepper, banana
Banana	Up to 4 months	Sunhemp, onion, ginger, turmeric, colocasia
Coconut	Up to 3 years	Banana, tapioca, vegetables
Grapes	Up to 8 months	Snake gourd or bittergourd in pendal
Mango	Up to 7 years	Leguminous vegetables, papaya (filler)
Tapioca	Up to 3 months	Onion, beans, lab-lab, black gram
Turmeric	Up to 3 months	Small onion, coriander

4. Intercrops should be selected with reference to their effects on soil moisture.

The recommended intercrops for some important horticultural crops are given in Table 2.

Mixed cropping: It refers to the practice of growing certain perennial crops in the alley spaces of the main perennial crops. The main advantage here is the effective utilization of available area and increase in the net income of the grower from unit area. Extensive research conducted by CPCRI, Kasaragod on mixed cropping in coconut and arecanut plantations showed that cocoa, pepper, cinnamon, clove and nutmeg could be grown as mixed crops in coconut while, nutmeg and clove as mixed crops in between four arecanut palms in alternate rows. In all the above cases, increase in yields (up to 10%) was obtained in the main crop due to the synergistic effects of the crop combinations arising out of the beneficial micro-organisms in the rhizosphere and increased availability of major nutrients in the active root zone of the crop mix as compared to the pure stands.

Multi-tier system of cropping: Certain horticultural crops like coconut and areca-nut are grown for about 50 years or so in a particular land. It normally takes 4 to 7 years for these 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 would not have extended beyond 1 m in diameter. Hence, the available vacant spaces could be profitably used for raising other crops, thereby increasing the employment opportunities and profits to the grower. Intercropping and mixed-cropping involve jointly multi-tier system of cropping and is defined as compatible companion of crops having varying morphological frames, rooting habits and with diverse natural resources' mining potential, grown together in such a manner that their canopies intercept solar energy at varying heights while their roots explore the soil at different zones for water and nutrients. The

main principle here is that the land, water and sunlight should be effectively used. An ideal combination of crops for multi-tier cropping in coconut and arecanut plantations is given in Table 3.

Table 3. Ideal crop combination for multi-tier cropping

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

Water management

Efficient orcharding, to a great extent depends upon optimum use of water especially during critical stages of plant growth and development. '*More crop per drop*' is the approach now. Main sources of irrigation are either open wells or bore-wells with pipelines laid out along the gradient connecting various blocks preferably availing the expertise of a water management specialist. Necessary care is required to avoid water-logging. Addition of silt, clay, organic matter etc., increases field capacity and also raises wilting point to marginal increase. Rainwater harvesting for utilization later for different situations has become a dire necessity in the emerging context of water becoming a scarce resource input. The same under *in situ* orchard conditions which is crucial especially for dry land orcharding could be optimized through different ways. ■