Orchard Management

1. Establishment of orchard
2. Orchard cultivation

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1. Establishment of orchard

Establishment of an orchard is a long term investment and deserves a very critical planning. The selection of proper location and site, planting system and planting distance, choosing the varieties and the nursery plants have to be considered carefully to ensure maximum production.

Location and site

Proper selection of site is important. Selection may be made based on the following criteria.
1. The location should be in a well established fruit growing region because one could get the benefit of experience of other growers and also get the benefit of selling the produce through co-operative organizations with other fruit growers.
2. There should be a market close to the area.
3. The climate should be suitable to grow the chosen fruit crops.
4. Adequate water supply should be available round the year.

Before a grower selects a site for establishing a new orchard, he must have assessed the following factors:
1. Suitability of soil, its fertility, the nature of subsoil and soil depth.
2. Site must have proper drainage and no water stagnation during rainy season
3. Irrigation water must be of good quality.
4. There must be proper transport facilities either by road or rail within the reach.
5. Whether the climatic conditions are suitable for the fruits to be grown and are whether site is free from the limiting factors such as cyclones, frost, hailstorms and strong hot winds.
6. Whether there are seasonal gluts or over production in any particular period of the year.
7. Whether there is assured demand in the market for the fruits to be grown.
8. Whether his orchard is a new venture or whether there are already other growers.
9. Availability of labour.

Preliminary operations

After selecting the suitable location and site, some preliminary operations have to be done. Trees are felled without leaving stumps or roots. The shrubs and other weedy growth are also cleared. Deep ploughing is essential to remove big roots. The lands should be thoroughly ploughed, leveled and manured. Leveling is important for economy of irrigation and preventing soil wash. In the hills, the land should be divided into terraces depending upon the topography of the land and the leveling is done within the terraces. Terracing protects the land from erosion. If the soil is poor, it would be advisable to grow a green manure crop and plough it *insitu* so as to improve its physical and chemical conditions before planting operations are taken up.

Planning of an orchard

A careful plan of the orchard is necessary for the most efficient and economic management. The following points should be borne in mind in preparing the plan.
1. Optimum spacing to accommodate maximum number of trees per unit area.
2. Stores and office building in the orchard should be constructed at the centre for proper supervision. .
3. Wells should be located at convenient places in different parts at the rate of one well for 2 to 4 hectares..
4. Each kind of fruit should be assigned in a separate block.
5. Fruits ripening at the same time should be grouped together.

6. Pollinators should be provided in deciduous fruits. In deciduous fruit trees, there are some varieties which require pollen from another variety to set fruits in them, otherwise, they will be barren. Such pollen donors are known as pollinators..Every third tree in every third row should be planted with a pollinator.
7. Irrigation channels should be laid along the gradients for most economical conduct of water. For every 30m length of channel, 7.5 cm slope should be given.
8. Roads should occupy minimum space for the economy of transport. The clearance between wind break and first row of trees is advantageous for the road.
9. Short growing trees should be allotted at the front and tall at the back for easy watching and to improve the appearance.
10. Evergreen trees should be in the front and deciduous ones behind.
11. Fruits attracting birds and animals should be close to the watchman's shed.
12. A good fence is essential. Live fencing is economic and cheap to other kind of fences. The plants suitable for live fencing should be drought resistant, easy to propagate from seed, quick growing, have dense foliage, should stand severe pruning and should be thorny. *Agave, Prosopis juliflora, Pithecolobium dulce* and *Thevetia* if closely planted in 3 rows would serve as a good live fencing.
13. Wind breaks, rows of tall trees planted close together around the orchard, are essential to resist velocity of wind which cause severe ill-effects particularly moisture evaporation from the soil. Since the wind breaks are very effective in reducing the wind velocity and minimizing the damage to the fruit trees and to other crops, their presence in regions where strong winds prevail is of paramount importance. A wind break ordinarily has its maximum effectiveness for a distance about four times as great as its height but has some effect over twice about that distance.

The most effective windbreak is a double row of tall trees alternately placed. There should be at least as much as space between the windbreak and the first row of the fruit trees as between fruit trees. It is preferable to dig a trench of 90 cm deep at a distance of 3m from the windbreak trees and prune and cut all the roots exposed and again fill up the trenches. This may be repeated for every 3 or 4 years in order to avoid the compe1ition between the wind breaks and fruit trees for moisture and nutrition.

Trees suitable for windbreak should be erect, tall and quick growing, hardy and drought resistant and mechanically strong and dense to offer maximum resistance to wind. The trees which are suitable for growing as wind breaks are *Casuarina equisetifolia, Pterospermum acerifolium, Polyalthia longifolia, Eucalyptus globulus, Grevillea robusta, Azadirachta indica* etc.

Laying out of orchards
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 is 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 various layout systems used are the following:
a) Vertical row planting pattern
1. Square system: *In* this system, trees are planted on each comer of a square whatever may be the planting distance. This is the most commonly followed system and is very easy to layout. The central place between four trees may be advantageously used to raise short lived filler trees. This system permits inter cropping and cultivation in two directions.

2. *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.

b) Alternate row planting pattern

3. *Hexagonal System:* *In* this method, the trees are planted in each comer of an equilateral triangle. This way six trees form a hexagon with the seventh tree in the centre. Therefore this system is also called as 'septule' 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 x the distance between any two trees. As the perpendicular distance between any two row 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 is not so easily done as in the square system.

4. *Diagonal or quincunx system:* This is the square method but 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 10m. 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.

5. *Triangular system:* The trees are planted as in square system but the difference being that those in the even numbered rows are midway between those in the odd rows instead of opposite to them. 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 x 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.

6. *Contour system:* It is generally followed on the hills where the plants are planted along the contour across the slope. It particularly suits to land with undulated topography, wh~re there is greater danger of erosion and irrigation of the orchard is difficult. 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 to prevent soil erosion. The width of the contour terrace varies according to the nature of the slope. If the slope becomes stiff, the width of terrace is narrower and vice-versa. The planting distance under the contour system may not be uniform. In South India, tea is planted in 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
This system in tea helps to get early, high yield, conserve soil and suppress weed growth.

In South Indian hills, peas and beans are sown under paired row system which is almost similar to double hedge planting system. The seeds are sown at 10 cm interval in each double row of 30 cm apart with the distance of 1.5m between each pair of rows.

Planting distance

The minimum vertical distance between any two trees or plants is referred as the planting distance and

this varies depending upon many factors. The principles in deciding the planting distances are the following.
1. Trees when fully grown, the fringes of trees should touch each other but the branches should not interlock.
2. Trees root will spread over a much larger area than top and there should be proper room for the roots to feed without competition.

Factors which decide the planting distance are the following.
1. Kind of fruit trees - mangoes are planted at a distance of 10m x 10m, guavas at a distance of 5m x 5m while papayas are planted at a distance of 2m x 2m.
2. Rainfall - wider spacing should be given in low rainfall areas than the high rainfall areas for a kind of tree.
3. Soil type and soil fertility - in heavy soils less spacing should be given because the top and root growth are limited.
4. Rootstocks - trees of the same variety grafted on different root stocks will grow to different sizes and as such require different planting distances. eg. Apple
5. Pruning and training - trees trained on head system requires closer spacing than the other type of training system. 6. Irrigation system
In general, if the spacing is too wide, it is obvious that the yield per unit area would be greatly reduced. Only in very, exceptional cases would this be justifiable. Ordinarily it is more profitable to plant the trees closer together and supply the needed water and food materials. If the trees are too close together, the trees grow tall rendering pruning,
spraying and harvesting difficult. There is root competition and inadequate nutrition and the trees as such give less yield and produce smaller fruits of poor colour. Cultivation also becomes difficult in the closely planted orchards. Close planting results in a greater yield per unit area in the early life of the tree but less in the more important later years. Close planting .is therefore a false economy.

The total number of trees per hectare for various important horticultural crops under a) square b) hexagonal and c) triangular system of planting are given below:

Crop	Planting distance (in m)	No. of trees per hectare		
		Square system	Hexagonal system	Triangular system
Mango	10 x 10	100	115	89
Sapota	8 x 8	156	118	139
Clove	6 x 6	277	320	248
Acid lime	5 x 5	400	461	357
Coconut	7.5 x 7.5	177	205	159

It may be seen that hexagonal accommodates 15% more number of plants while triangular system accommodates 11% lesser number of plants. The calculation of the number of trees per hectare when planted under square or rectangular system is very easy, and is obtained by dividing the total area 'by the area occupied by each tree (a x a in square system or l x b in rectangular system). The theoretical and the actual number of possible trees which can be planted in an orchard depends upon the shape of the field. In practice, in large fields, the percentage difference between the theoretical number and the actual number possible will be less.

High density planting system
Planting of fruit trees rather at a closer spacing than the recommended one using certain special techniques with the sole objective of obtaining maximum productivity per unit area without sacrificing quality is often referred as 'High density planting' or HDP. This technique was first established in apple in Europe during sixties and now majority of the apple orchards in Europe, America, Australia and New

Zealand are grown under this system. In this system, four planting densities are recognized for apples viz., low HDP (< 250 trees/ha), moderate HDP (250-500 tree/ha), high HDP (500 to 1250 trees/ha) and ultra high HDP (>1250 trees/ha). Recently, super high density planting system has been also established in apple orchards with a plant population of 20,000 trees per ha. In some orchards, still closer, planting of apple trees is followed (say 70,000 trees/ha) which is often referred as 'meadow orchards'.

Advantages of HDP are:
(i) Early cropping and higher yields for a long time; the average yield in apple is about 5.0 t/ha under normal system of planting and it is about 140.0 t/ha under HDP
(ii) Reduced labour costs
(iii) Improved fruit quality

Characteristics of HDP are:
a. The trees ofHDP should have maximum number of fruiting branches and minimum number of structural branches.
b. The trees are generally trained with a central leader surrounded by nearly horizontal fruiting branches. .
c. These branches should be so arranged and pruned in such a way that each branch casts a minimum amount of shade on other branches.
d. The height should be one and half its diameter at the base. A key to successful HDP depends upon the control of tree size.

This is achieved by
(a) Use of size controlling root stocks. In apple, dwarfing root stocks and intermediate stocks like MM 106, MM 109, and MM 111 are used to control the size of the plant. In pears, Quince A, Adam and Quince-C are commonly used as dwarfing root stocks.
(b) Use of spur type scions - In temperate fruit crops like apple, the cultivars can be classified into a spur type or non-spur type. The spur types which have restricted annual growth are alone suitable for HDP.
(c) Training and pruning methods to induce dwarfness - under Indian conditions, apple trees trained under spindle bush, dwarf pyramid, cordon systems are found to contain the growth of the trees appreciably for HDP systems.
(d) Mechanical device and use of chemicals to control size – Growth regulators such as daminozide, ethephon, chlormaquat and paclobutrazal are extensively used to reduce shoot growth by 30 to 0 %. This results in increased flowering in the subsequent years and may be useful in encouraging earlier commercial fruit production in strongly
vegetative fruitful young trees. Besides chemical manipulation, mechanical devices employing the use of spreaders and tying down the branches to make them grow from near horizontal to an angle of 45° from the main stem are also some of the standard practices to control tree size.

Planting system for HDP: The success of HDP depends upon the right choice of planting system. Generally, rectangular planting with single, double and three row plantings are followed. In single row planting, the distance within the row is close, whereas the distance between the row is wide (4x2m). In double row planting, a wider spacing is given after every two rows (4+2x2m) whereas in three row planting, a wider spacing is given after every three rows (4+2x2x2m). In meadow orchard system, a bed of 10 to 15 rows is closely planted *(nay* 30x45cm) and separated by alleys of 2.5m width between beds. This system is also called bed system.

Planting season
The season of planting varies with different fruits and local conditions. There are two seasons of planting in vogue in India.
i) Monsoon (June - August) and
ii) Spring (February - March)
Monsoon season is considered to be the best for planting evergreen fruit trees like citrus, mango, sapota and guava. If the trees are planted early in the rainy season they soon establish themselves and grow vigorously. Deciduous trees may be 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.

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. The planting board is usually of 15m long, 10 cm wide and 2.5cm thick with a central notch and one hole on either end, the central notch and the two holes (one on either end) are in a straight line. The planting board is placed in such a way that the stake (tree marker) fits into the central notch. Two small stakes are inserted one in each end hole. The planting board along with the tree marker is then lifted straight up without disturbing the end stakes. A pit of about 1m cube or of the desired dimensions at the position of the tree marker is then dug.

The pits are allowed to wither 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 sett1e 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.

Transplanting
The trees should be planted approximately where the original pegs were placed. This is achieved by replacing the planting board in position with the help of the guide pegs and the stem of the trees is brought to the central notch with the help of a hand hoe.

One of the most common mistakes is that of planting the trees too deep. The plants should be sent in such a way that the bud union remains slightly above the ground level. The trees in the field should be planted as deep as they stood in the nursery. The trees are irrigated soon after p1anting.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, this basin should be demolished within a day or two so that water will not collect around the tree. This is more dangerous on heavy than light soils.

Spring winds cause damage to the growing p1ants by giving a constant shaking. To prevent this, plants should be staked when p1anted. Some young plants are subject to considerable injury from sunburn particularly if tbey have been trained to single stem with no branches for 45cm or more from the ground. Such trunk can be protected by wrapping them with paper or other material or by painting them with white wash. The latter is probably best, as most materials wrapped around the trunk would be subject to termite attack.

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2. Orchard cultivation

Orchard cultivation refers to the careful management of the orchard soil in such a way that the soil is maintained in a good condition suitable to the needs of the tree with least expenses. This involves maintenance of the physical condition of the soil, its moisture and nutrient content. A good system of orchard cultivation should ensure:
l. Weed control and saving in moisture and nutrients
2. Very little disturbance to soil and preventing soil erosion and
3. Reduced cost of cultivation

Methods of soil management practices

1. Clean culture

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

i. Humus will be completely depleted rapidly due to frequent cultivation.

ii. Frequent cultivation causes injury to the feeding roots, the trees may be short lived or stunted in growth.

iii. Clean cultivation aids in more aeration leading to the depletion of nitrogen.

iv. Hard pan is created in the soil.

v. Frequent cultivation causes more soil erosion.

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

2. Clean culture with cover crops

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

Mulching

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

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

The following are some of the disadvantages:

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

4. Sod

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

5. Sod mulch

This is similar to sod with the only difference is that the vegetation is cut frequently and the cut material is allowed to remain on the ground. This is slightly better than the previous one, as the moisture loss is not so great as in sod. In both sod and sod mulch, more nitrogen should be applied to the fruit trees than usual application because the vegetation utilises more soil nitrogen.

Intercropping

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

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. The intercrop may require an irrigation at a time when it would be detrimental to the trees.
4. Intercrops should be selected with reference to their effect on soil moisture. Grain crops remove excessive moisture to the detriment of fruit trees. The intercrops selected should not exhaust the soil water and nutrients and should not demand more water than is allowed for fruit trees.

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

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

The recommended intercrops for some important horticultural crops are given.

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

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

Multitier system of cropping
Certain horticultural plants like coconut and arecanut are grown for about 50 years in a particular land. It takes nearly 4 to 7 years for the above trees to reach the bearing stage. Adequate alley spaces (nearly 75%) are available in between these trees and being the palm trees, their root system will not also spread beyond one metre in diameter.

Hence, these vacant spaces can be profitably used for raising other crops, thereby increasing the employment opportunities and profit. This is the chief objective of the multitier system of cropping. Intercropping and mixed cropping involve jointly multitier system of cropping and is defined as a compatible companion of crops having varying morphological frames and rooting habits, grown together in such a manner that their canopies intetercept solar energy at varying heights and their roots forage the soil at different zones. The main principle here is that the land, water and sunlight should be effectively used. An ideal combination of crops for multitier cropping in coconut and arecanut plantations is as follows.

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

Organic farming
Excessive use of chemical fertilizers and pesticides as a mean of intensive cultivation to boost up our food production have caused considerable damages to our soil health and the environment. This has been criticized recently by many environmentalists. This has focused the attention of several experts in ecologically sound viable and sustainable farming systems, known as organic farming.

It is a production system which avoids or largely excludes the use of synthetically compounded inorganic chemicals. This system entirely relies on crop rotation, crop residues, animal manures, legumes, green manures, off-farm organic wastes, biofertilizers, mechanical cultivation etc. and aspects of biological pest control to maintain soil productivity and tilth to supply nutrients and to control insects, weeds and other pests. This system is often, referred as 'biological farming' 'regenerative farming' and 'sustainable farming' 'eco friendly farming' etc.

Organic fanning is essential because
1. Chemical fertilizers may have an adverse effect on soil life-they do not supply humus, have an adverse effect on physical, chemical and biological properties of soil
2. Chemical fertilizers are costly.
3. Indiscriminate application of pesticides could lead to residues in horticultural crops which are consumed mostly in raw state by us.
4. The continuous use of pesticides is ecologically unsutainable as pests acquire resistance.
5. There is a permium for the horticultural produces which are raised under organic fanning.

Essential features of organic farming

1. Use of organic manures like FYM, compost, vermicompost and.coir compost etc. 2. Use of biofertilizers. 3. use of green manures and grain legumes. 4. Non-chemical weed management. 5. Use of botanicals and bio control agents in the control of crop pests.

In India, organic farming in horticultural crops especially in vegetable and spices crops are slowly picking up, wherever premium prices are available for organically grown quality produces. In certain horticultural crops where productivity and total productions cannot be compromised by following strict organic farming practices, a combination of inorganic and organic farming practices may be followed possibly avoiding known toxic inorganic chemicals.

Source

1. Dr. N. Kumar. 1997. **Introduction to Horticulture**. Rajalakshmi Publications, 28/5 – 693, Vepamoodu Junction, Nagercoil. Pp: 15.47- 15.50.