

Principles of orchard planning:

An area in which perennial fruit crops are established in the field is known as an orchard. An orchard is a long time investment and deserves a very careful planning. Fruit trees are perennial and require proper environmental conditions and suitable management practices for their successful growing. Any mistake made initially in planning is likely to put the fruit grower to incur heavy losses throughout the life span of the orchard. It is, therefore important to plan properly before establishing an orchard. Before planning a model orchard, the selected site should be cleared of all vegetation, leveled and ploughed repeatedly and if possible, leguminous crops like sunhemp, cowpea, daincha, etc., are grown and incorporated into the soil. This helps to improve the organic content of the soil. Then the proposed orchard plan is prepared showing the area assigned to each fruit crops and marking the tree rows.

Principles of orchard planning:

1. Orchard should be established in the right location and site having suitable climate and soil conditions and for disposal of the produce.
2. Selected site should be cleared of all vegetation and leveled properly after deep tillage.
3. Minimum orchard space (< 10%) should be allotted for roads, paths and buildings. Suitable drains are laid out on either side of the roads.
4. The evergreen fruits should be planted in the front and the deciduous trees at the back.
5. Fruit trees of shorter stature should be planted in front and taller and more spreading trees behind, this will facilitate better watching of the orchard.
6. Plant the trees, which require frequent irrigation near the irrigation source.
7. Fruit varieties ripening at a time should be located in adjoining plots to facilitate proper orchard operation.
8. Fruits that attract birds and other animal pests should be located close to the watchman's shed.
9. Fertile areas of the orchard should be allocated to highly remunerative crops and heavy feeding fruit trees.
10. Adopt suitable system of planting grown either on level ground or on slopes.
11. Choice of suitable varieties should be based upon adaptability to the location with high quality.
12. Adopt optimum spacing for fruit trees.
13. Fencing around the orchard, hedges and windbreak are preferably raised before planting of trees.
14. Procurement of genuine plant materials from reliable source is essential.

Important points to be considered for planning an orchard are-

- (1) Selection of site ✓
- (2) Climate ✓
- (3) Soil ✓
- (4) Clearing and levelling the land ✓
- (5) Irrigation source ✓
- (6) Availability of finance ✓
- (7) Fencing ✓
- (8) Wind break ✓

Study of Orchard Layout Systems

The plan showing the arrangement of plants in an orchard is known as the orchard layout. Although several systems of planting are followed, selection of a suitable system depending on soil, climate, plant type, system of training and pruning is very important. Adoption of improper system results in over lapping of plant parts, competition for water, light, nutrient and unequal distribution of water etc, ultimately results in poor performance.

PRINCIPLES, PLANNING AND ORCHARD LAYOUT SYSTEMS

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PLANTING SYSTEMS IN ORCHARD

The plan showing the arrangement of plants in an orchard is known as the orchard layout. There are several systems of planting but square system, rectangular system, quincunx system, hexagonal system and contour system are common. The last one is suitable only on sloppy lands or hills and the others for plains.

1. Square system:

This is the simplest of all systems. In this case, the plants are arranged in regular rows, the distance between the rows and the plants in a row being the same, i.e., four plants are planted on the four corners of a square.

Procedure for laying out:

Step No.1: Select the base line and draw it on the ground. This base line should be parallel to the road or fence of the boundary of the orchard. This should be drawn at a distance of half the spacing that is to be followed. For example, if the spacing is 40', the base line should be drawn at a distance of 20' from the periphery of the plot.

Step No.2: Towards the end of the base line leave again a gap of half the spacing from the boundary or road or fence, etc., and put the peg on one end of the base line. This makes the position of the first plant on the base line. From this peg, measure one planting distance and put the second peg on the base line. Thus, continue placing pegs at each of the planting distances till the total length of the base line is covered. The distance from the last peg to the boundary also be at half of the spacing.

Step No.3: From the first peg and the last peg on the base line, draw perpendicular lines to the base line. The perpendicular lines may be drawn by adopting any of the following methods: (i) Cross staff, (ii) Carpenter's triangle or pythagorous theorem (iii) Bilateral or Isosceles triangle.

Step No.4: Mark the planting position on both these two perpendicular lines, fixing a peg at each position.

Step No.5: Join the positions of the last pegs on these two lines with a straight line to form a parallel line to the base line and mark the planting positions on this line also.

Step No.6: Join these positions of the pegs on one line with the corresponding positions of the pegs on the opposite line.

Step No.7: Fix pegs at all the points of intersection of these lines. The position of the pegs indicate the planting positions.

Merits and demerits: The possibility of cultural operations in two directions is the greatest advantage of this system. The major disadvantage of this system is that, a lot of space in the centre of each square is wasted in between the squares.

2. Rectangular system:

This system is similar to that of the square system in its layout except for the difference that the spacing between the rows and between the plants in a row are not equal.

Procedure for laying out:

Step No. 1, 2 and 3: Same as in square system.

Step No.4: Mark the planting position on both the perpendicular lines following the spacing adopted between the plants in a row.

Step No.5: It is same as in square system, but follow the spacing to be adjusted between rows for marking planting positions.

Step No. 6 and 7: Same as in square system.

Merits and demerits: This system is suited for such crops, which require some support like trellis, etc., and which are trained to grow in two directions only, e.g., grape. The major disadvantage in this system is that two way interculture is not possible.

3. Quincunx system:

This is also known as **filler or diagonal system**. This is a modification over square system of layout, distinguished to make use of the empty space in the centre of each square by planting another plant. Generally, this tree will be of short duration and not be of the same kind as those planted on the corners of the square.

Procedure for laying out:

Step No.1: Layout the square system.

Step No.2: Draw the diagonals of each square.

Step No.3: Mark the planting position of the filler tree by fixing a peg at the point of inter-section of the two diagonals in each square.

Merits and demerits: The main advantage of this system is that the plant population is nearly double than the square system. The difficulty in intercultural operations on account of the filler tree is the greatest disadvantage.

4. Hexagonal system:

In this system, the trees are set at the corners of equilateral triangles. This system differs from the square system in which the distance between the rows is less than the distance between the trees in the row, but distances from tree to tree in six directions remains the same. In all, 7 trees per hexagon are planted.

The procedure for layout includes

Step No.1: Draw the base line and mark the plant position on it.

Step No.2: With the use of a prismatic compass, draw lines at 60° angle to the base line on either side from all the planting positions on the base line.

Step No.3: Mark the planting position by fixing pegs at all points of intersections of the lines drawn at 60° angle.

Merits and demerits: This system permits cultivation in three directions. The plants occupy the land fully without any waste as in square system. Beside this system allows planting of 15% more trees than can be planted by square system in a given area. But it is difficult to layout by this method and also the watch and ward becomes difficult as one cannot see in all the directions from a point.

5. Contour system:

This system of planting is usually followed on hills with high slopes. The layout is started from the lowest level and the tree rows are planted along a uniform slopes at right angles to the slope with a view to reduce loss of topsoil due to erosion.

6. 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 isosceles triangle. When compared to square system, each tree occupies more area and hence it accommodates few trees per hectare than the square system.

- 1) In this system, trees are planted as in the square system but the plants in the 2nd, 4th, 6th and other alternate rows are planted midway between the 1st, 3rd, 5th and such other alternative rows. This system provides
- 2) Plants in alternate rows are off set half the space between plants in a row.
- 3) Result in 9 % fewer plants than square and rectangular system.

Eg : Amrapali – 1600 plants / ha.

4. More open space for trees and for intercrop.

Calculation of plant population/unit area in different system of layout:

The number of plants that can be accommodated by each of the systems in a unit area are calculated by the formula shown against each system as under:

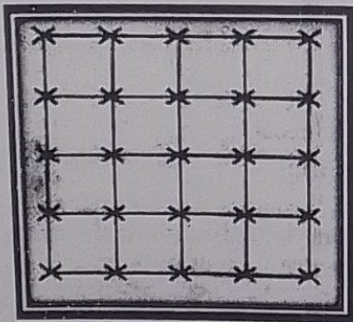
1. Square and rectangular systems: $\frac{\text{Area}}{\text{Spacing}}$
2. Quincunx system: $\frac{\text{Area}}{\text{Spacing}}$ (main trees) + $\frac{\text{Area}}{\text{Spacing}}$ (Filler trees)

$$\text{Area of filler trees} = (L-X) \times (B-X)$$

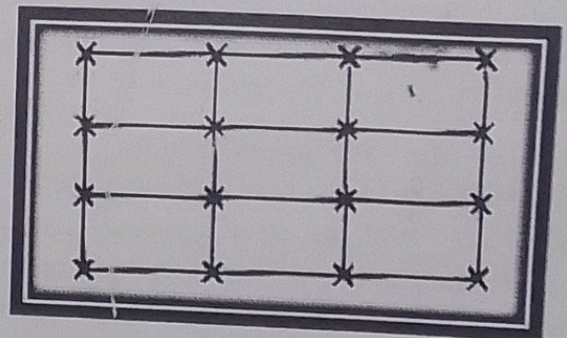
where L - length, B - breadth, X - spacing

3. Hexagonal system: $\frac{\text{Area}}{\text{spacing}} \times \frac{115}{100}$

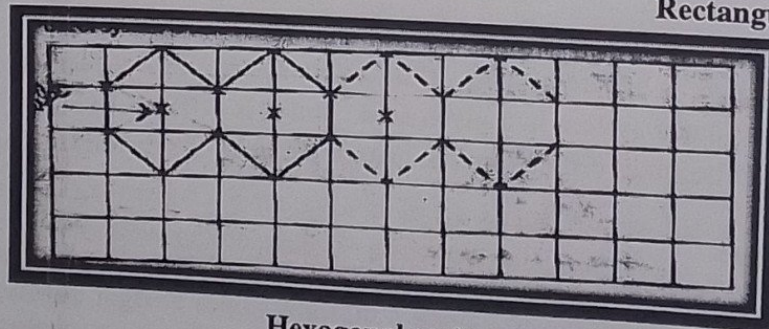
Different diagrams of planting system



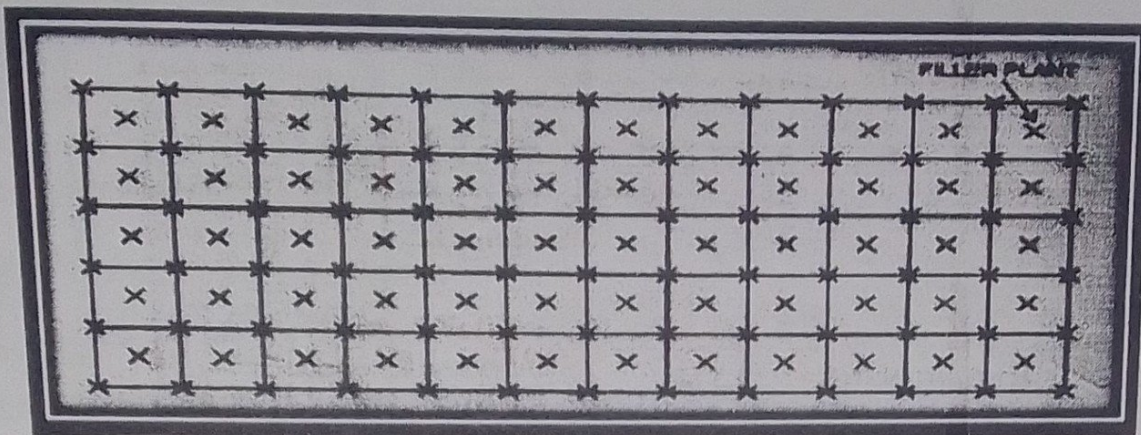
Square System



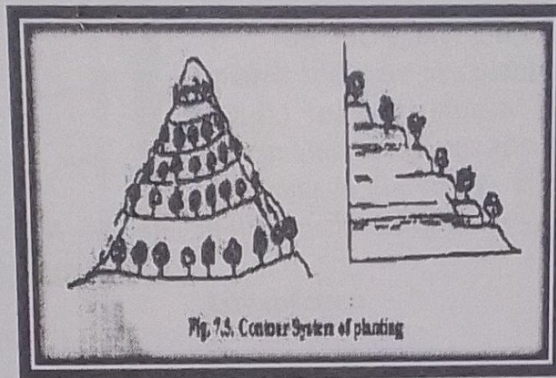
Rectangular system



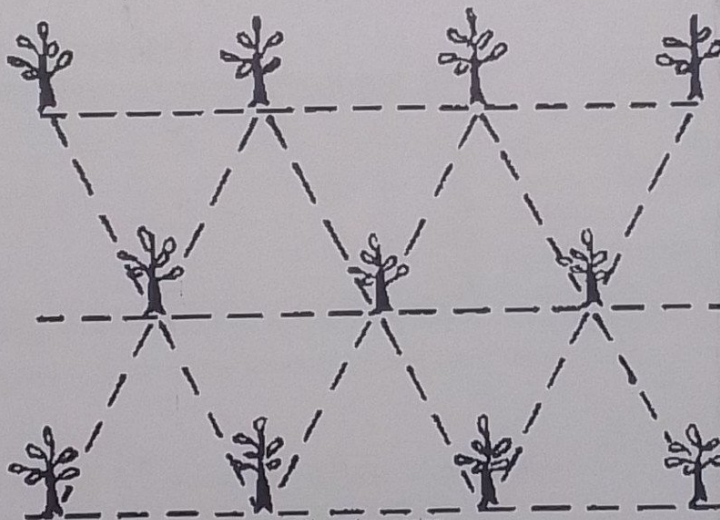
Hexagonal system



Quincunx system



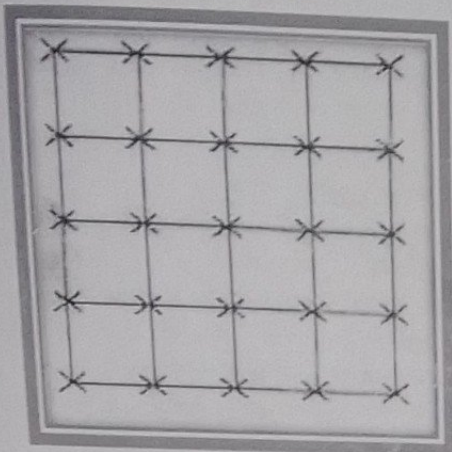
Contour system



Triangular System

The following are the important systems of planting generally followed on the basis of Agro-climatic conditions to improve aesthetic view of the land.

1. SQUARE SYSTEM



It is the most commonly used method and easy to layout in the field. In this system, plant to plant and row to row distance is the same. The plants are at the right angle to each other, every unit of four plants forming a square. This system facilitates the interculture in two directions after the orchard is planted.

Advantage:

- 1) Most easy and popular one.
- 2) In this row to row and plant to plant distance is kept similar.
- 3) Plants are exactly at right angle to each other.
- 4) Interculture operations can be done in both the directions.
- 5) Adequate space for inter-cultivation of remunerative crops like vegetables.

2. RECTANGULAR SYSTEM

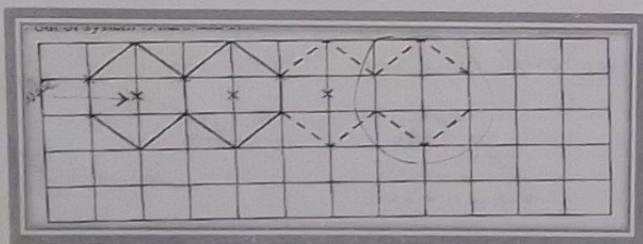


In this system, the plot is divided into rectangles instead of squares and trees are planted at the four corners of the rectangle in straight rows running at right angles. Like square system, this system also facilitates the interculture in two directions. The only difference is that in this system more plants can be accommodated in the row keeping more space between the rows.

Advantages:

- 1) Lay out in rectangular shape.
- 2) More space between row to row.
- 3) Inter-cultural operations can be done in both the ways.
- 4) Plants get proper space and sunlight.

3. HEXAGONAL SYSTEM



In hexagonal system, the trees are planted in the corners of equilateral triangles. Six trees thus form a hexagon with another tree at its centre. This system, though a little difficult for execution but accommodates 15 percent more plants. Cultivation of land between the tree rows is possible in three directions with this system. This system is generally followed where the land

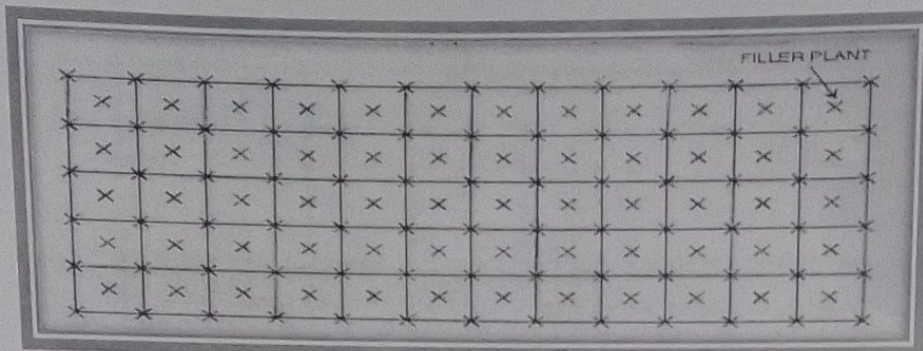
is costly and very fertile with ample provision of irrigation water.

Advantages:

- 1) Accommodates 15 % more plants than the square system.
- 2) Plants are planted at the corner of equilateral triangle.
- 3) Six trees are planted making a hexagon.
- 4) The seventh tree is planted in the centre and called septule.
- 5) This requires fertile land.

Disadvantage: Lay out is difficult and cumbersome.

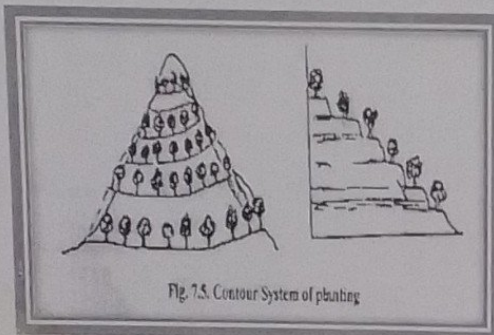
4. QUINCUNX SYSTEM



This system is exactly like the square system but one additional tree is planted in the centre of each square. The number of plants per acre by this system is almost doubled than the square system. Fruit trees like papaya, kinnow, phalsa, guava, peach, plum etc. can be planted as fillers in the permanent trees

provides an additional income to the grower in the early life of the orchard. The filler trees are uprooted when the main orchard trees start commercial fruiting.

5. CONTOUR SYSTEM



This system is usually followed in the hilly areas with high slopes but it is very much similar to the square/rectangular system. Under such circumstances, the trees may be well planted in lines following the contour of the soil with only a slight slope. Irrigation and cultivation are then practiced only across the slope of the land as this practice reduces the chances of soil erosion. In this system layout is done as in square/rectangular system, first by establishing the base line at the lowest level and then marking for the trees should be done from the base to the top. Bench terraces are used where the slope is greater than 10 per cent.

TRIANGULAR SYSTEM

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Planning and Layout of Orchard

Orcharding is a long term investment. Fruit plants once planted remain devoted to the land for many years. Being perennial in nature, any mistake committed during initial year, on the part of planning, is hard to rectify. Hence, all the factors having bearing on growth, production and overall performance of the orchard should be given top priority. The following considerations of successful planning of orchard may be taken into account while setting orchard.

LOCATION AND SITE

Location denotes the situation in relation to a well-known place. The site indicates the specific place where orcharding is to be practised. The following requirements favour selection of suitable location and site :

- The orcharding in already established fruit belt should be preferred. In established area the government aids, subsidies etc. become easily available to the growers. All the technical advice, technical labour, equipment etc. can be easily approached/hired/procured in such areas.
- The orchard produce is highly perishable in nature. Quick disposal of the produce is necessary to prevent losses. For this, the site should be well-connected by road or rail or other means of transportation. The market should be in the vicinity of orcharding site. It reduces transportation cost.
- The orchard crops being intensely cared, the availability of labour should be properly understood.
- The orcharding should not be located in hot spot area (pest/disease prone area) which makes the plant vulnerable to pest or disease.
- The selected site should be away from industrial establishment. The wastes and emissions of industrial origin badly affect the growth and production of the orchard.
- The site should not be a wind or flood prone area.

SOIL

Soil serves as a base for growing of plants. The suitable soil for fruit growing should possess following properties :

- It should be fertile, deep and well-drained. In Rajasthan, especially in western part, the soil is underlaid with hard layer of Murram or CaCO_3 . Such soils do not favour proper growth of many plants.
- It should be free from waterlogging. (Waterlogging is especially harmful for peach, papaya and citrus). (Tamarind, Jamun, date-palm, coconut etc. can sustain waterlogging condition to some extent). In waterlogged soil, majority of fruit plants fail to grow due to choked aeration in root zone.
- The soil should preferably be neutral in reaction (7.0 pH). The pH above 7.0 restricts the scope of fruit cultivation and (plants like date, ber, aonla, grape, guava, karonda, mulberry can grow with proper care under high pH soil)
- Soil moisture condition is another major consideration for the growth of the plants. Soil retentive of moisture favours growth and production of plant. In sandy soil water-holding capacity is very poor. The applied water moves away from the root-zone of the plant very quickly. Light textured soil can be used for fruit cultivation by improving water retention capacity of the soil.
- Problematic soils such as eroded, mined, gullied, ravined etc. create problem in fruit cultivation. Severely affected soils are very difficult to bring under cultivation for fruit plants.

CLIMATE

It is an important determinant of selecting a site for the cultivation of a particular type of fruit plants. Fruit plants have a different type of adaptability to different types of climatic condition. As per climatic adaptability, fruit plants have been classified into three groups; tropical, sub-tropical and temperate types. Selection of a particular type of climate for a particular fruit plant is necessary for successful orcharding.

PLANNING

Planning deals with overall aspect of orcharding. Orchard buildings, roads, path, fencing, wind-breaks, layout, system of planting, spacing of planting etc., are especially emphasized in planning. Generally (10 per cent of the total area is left aside for building, roads, paths, tubewells, channels etc.)

At the very entry of the orchard, provision of watch-hut should be made. Farm building should be located in the centre of the orchard. Provision of storage house, packing etc. should be made while planning the orchard. Roads approaching every corner of the orchard should be provided and preferably the cut roads should be at right angle. Generally, a road of 10 to 15 feet inside the orchard serves the purpose of movement of carts, motors and machinery inside the orchard.

Provision of irrigation in the orchard should be made properly. If it is a bore-well, it should be dug at a place suitable to feed the water requirement of entire orchard. In some areas, the grower use canal water to irrigate the orchard. In these areas construction of farm pond is necessary to have a regular supply of irrigation water as per need of the orchard. The pond should be sufficiently deep and of adequate storage capacity. Facility of water supply is essential in view of installation of drip irrigation system also.

Orchard crops are intensely cared ones. Once damaged, fruit plants hardly recover properly. Their protection from stray animals is necessary. Temporary fencing may be created using Carissa carandus, Inga dulcis and other thorny plants. Preference should be given to permanent fencing which is created using angle iron pole and barbed wire. Poles of 8-10 feet height are sufficient for the purpose. These poles are drilled at an interval of 150-200 cm through which barbed wires are stretched to create fence.

Windbreak is very important aspect of orchard planning. It consists of planting of tall trees along with the boundary of the orchard. Windbreak helps the orchard in following ways :

- It converts the windward side into leeward side and reduces the velocity of the wind.
- Maintains favourable micro-climate in orchard by reducing moisture removal and minimizing rate of transpiration.
- Prevents dropping of flowers and fruits.
- Prevents the orchards during winter from cold waves.

At the most two rows of windbreaks are planted in the orchard. (Windbreaks are planted normally in north-western side of the orchard) These sides are sensitive for cold and hot wind waves respectively. Generally, windbreaks are planted at five metres interval. Tall trees of Jamun, Desi Mango, Neem, Shisham, Kamrakh, Chilbil, Bakain, Karanj, Chiraunji, Shahtoot etc. are suitable for windbreak planting in the orchard. The first row of plants should be planted five metres away from the second row of the windbreak trees.

LAYOUT

The orchard is laid out as per following system of planting :

1. Square system

It is the most easy and popular method of planting fruit plants. In this system row to row and plant to plant distances are kept similar. The plants are planted exactly at right angle at each corner (Fig. 9.1). Thus, every four plants make one square. Intercultural operations can be done in both directions as the distances between trees and rows are similar. Adequate space is there to go for inter-cultivation of remunerative crops like vegetables.

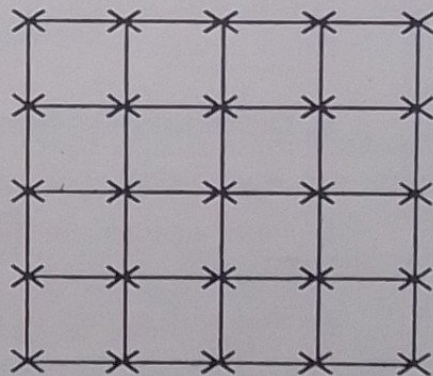


FIG. 9.1. Square system of planting.

2. Rectangular system

The field is laid out into rectangular shape plot keeping more space between row and row. The plant to plant distance is kept comparatively less (Fig. 9.2). Thus, rectangular system accommodates more plants in rows. Inter-cultural operations can be carried out through both ways. The plants get proper space and sunlight for their growth and development.

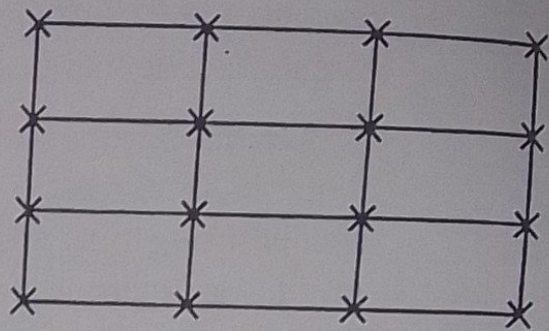
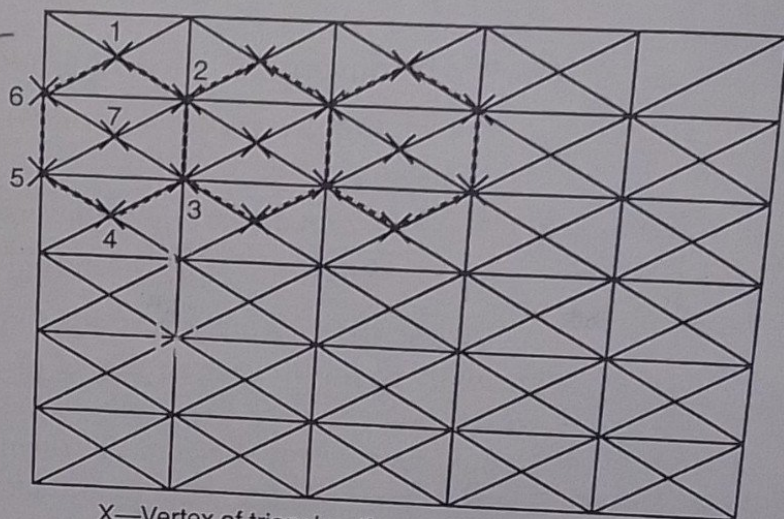


FIG. 9.2. Rectangular system of planting.

3. Hexagonal system

This system accommodates 15 % more plants than square system. It allows three directional cultivation in the orchard. In this system, the orchard is laid out similar to rectangular system. The diagonals of rectangles are intersected to form equilateral triangles. The trees are planted at the vertex of each equilateral triangle. Thus, six trees form hexagon with the seventh tree in the centre (Fig. 9.3). Hence, this system is also called as 'septule' as it accommodates seventh tree in the centre.



X—Vertex of triangle—the position of planting tree

FIG. 9.3. Hexagonal system of planting.

The hexagonal system is considered as a grid of contiguous equilateral triangle in which the length of each arm of the triangle is desired tree to tree distance. This is very intense method of planting and hence requires fertile land. In the suburb of cities where land is costly, this system is worth adoption. However, the laying out of system is hard and cumbersome.

4. Quincunx system

This system is similar to square system except one additional plant is planted in the centre of each square (Fig. 9.4). The plants that are planted in the centre of each square along with tall growing plants at the corners of squares are termed as 'filler' plants. These plants are planted with a view to generate income when the main orchard plant is under non-bearing stage. Filler plants also ensure proper utilization of otherwise left space between rows of trees. (These plants are usually short-statured and early bearing.) When main plants of the orchard resume their proper shape, the filler plants are uprooted. (Guava, Kinnow, Phalsa, Plum, Peaches, Papaya etc. are important filler plants.)

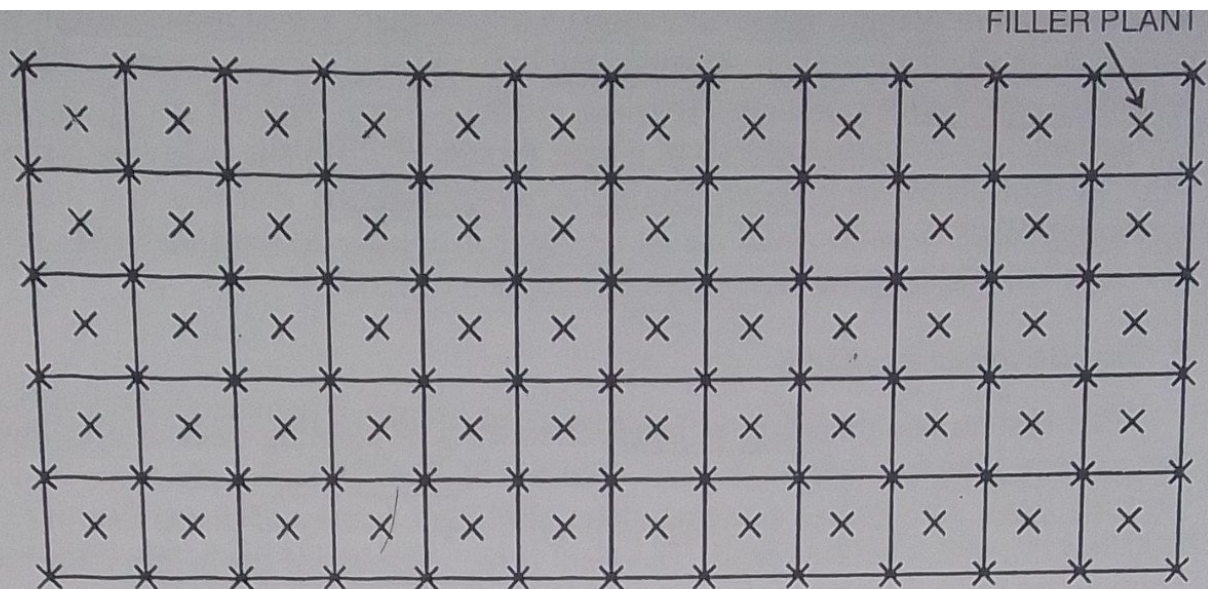


FIG. 9.4. Quincunx system of planting

5. Contour system

It is adopted in hilly areas for planting fruit plants where land is undulated and soils erosion is a great threat. Under such circumstances, contour terrace is developed by scratching and levelling the hill-slope. The width of contour terrace varies according to the slope of the hill. At stiff hill slope, the width is kept narrower.

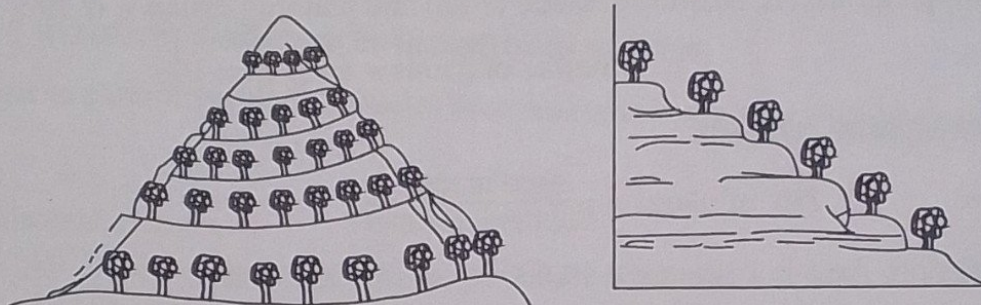


FIG. 9.5. Contour system of planting

INTENSIVE PLANTING SYSTEM FOR ORCHARDING

1. High density planting

(Accommodating more number of plants per unit area than what is accommodated under normal planting system is referred to as high density planting (HDP).) It is one of the most efficient methods of hastening productivity per unit area of land. In fruit crops, which are perennial in nature, HDP is more useful as it helps in efficient utilization of land and other resources, better canopy management, farm mechanization, convenient spray of pesticides, harvesting high yield of improved quality and consequently in getting higher net return. HDP is achieved by (i) using dwarf rootstock/inter-stock (ii) resorting to dwarf scion variety (iii) following spray of growth regulators (iv) regulating shape of plant and (v) adopting suitable managemental practices.

In India, good success has been reported in HDP in fruit crops like apple, peach, pear, plum, sweet cherry, banana, papaya and pineapple. HDP has also been successfully

demonstrated in mango, guava and citrus and two-three times more yield has been realized. However, in plantation crops, like coconut and arecanut the concept of HDP is realized by opting to multi-crop species cropping system. Such type of cropping system favours accommodation of more number of plants, though of different crop species, per unit area of land. In fruit crops, lack of availability of dwarf planting material is a major constraint in promoting HDP. Besides, HDP being intensive in nature, demand for high capital investment proves another constraint in commercial adoption of HDP.

2. Meadow orcharding

This system has its origin in Israel. It consists of planting trees at ultra-low spacing. In this system, planting is followed at a distance of $45 \times 75 \text{ cm}^2$ within row and $210\text{-}270 \text{ cm}^2$ between rows. The system accommodates ultra high density of plants varying from 30,000-1,00,000 trees on a hectare basis. The plant is cut regularly at the height close to the ground. This system relies heavily on the use of growth regulators.

CALCULATION OF NUMBER OF PLANTS IN DIFFERENT SYSTEMS OF PLANTING

1. Square and Rectangular system

$$\text{No. of plants} = \frac{\text{Area in metre}}{\text{Planting distance}}$$

e.g. Suppose, area is 10,000 sq. metre (1 ha) and planting distance is 10×10 metre, then

$$\text{Number of plants} = \frac{10,000}{10 \times 10} = 100$$

2. Hexagonal system

$$\text{No. of plants} = \frac{\text{Area in metre}}{\text{Planting distance}}$$

Suppose Area is 1 hectare = 10,000 sq. m. or $100 \times 100 \text{ m}$

Planting distance, if plant to plant distance is 10 m then row to row distance appears to 8.66 metre (from Fig. 9.6) as specified under the head calculation of planting distance in hexagonal system ahead.

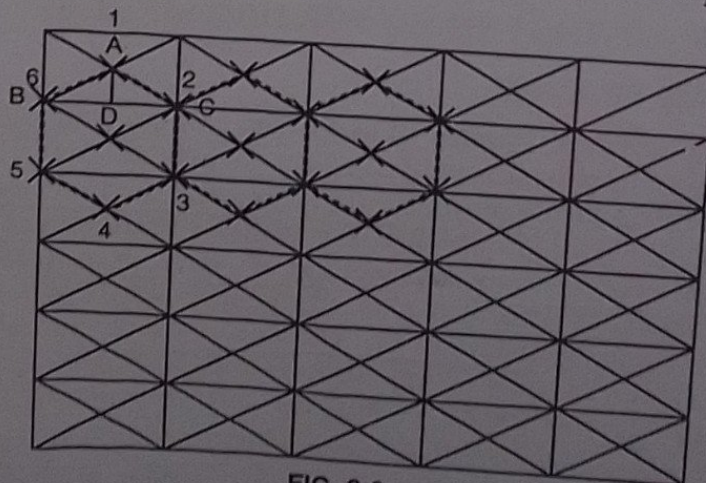


FIG. 9.6

Hence, number of plants = $\frac{100 \times 100}{10 \times 8.66} = 115$ approx.

3. Quincunx system

As the plants are planted additionally in the centre of the square, hence, first the number of plants is calculated for square system of planting and then number of additional plants planted in the centre of each square is calculated. Both the numbers are summed up to get total number of plants planted in Quincunx system of planting.

$$\begin{aligned} \text{No. of plants in square system of planting} &= \frac{\text{Area in metre}}{\text{Planting distance in metre}} \\ &= \frac{100 \times 100}{10 \times 10} = 100 \end{aligned}$$

$$\begin{aligned} \text{Additional plants planted in centres of squares} \\ &= (\text{No. of rows lengthwise} - 1) \times (\text{No. of rows widthwise} - 1) \end{aligned}$$

In 100×100 sq. metre field, if planting distance is 10×10 m, then number of rows lengthwise and widthwise will be 10

$$\begin{aligned} \text{Hence, No. of the plants} &= (10 - 1) \times (10 - 1) \\ &= 9 \times 9 = 81 \end{aligned}$$

$$\begin{aligned} \text{Total number of plants} &= \text{Plants planted in square systems of planting} + \text{Additionally} \\ &\quad \text{planted plants in the centre of square} \\ &= 100 + 81 = 181 \end{aligned}$$

Thus, in quincunx system of planting almost two times plants (181) are accommodated in comparison to square system of planting (100).

Calculation of planting distance in hexagonal system

Suppose plant to plant distance is 10 metre then row to row distance will be calculated as under :

See Fig. 9.6

ABC is equilateral triangle.

Hence $BC = AB = AC = 10$ m.

A perpendicular line AD is drawn on BC which divides it into two halves. Its means $BD = DC = 5$ m

Now, see the triangle ADC

As per Pythagoras theorem

$$\begin{aligned} AC^2 &= AD^2 + DC^2 \\ \text{or } AD^2 &= AC^2 - DC^2 \\ &= 10^2 - 5^2 \\ &= 100 - 25 \\ &= 75 \end{aligned}$$

$$AD = \sqrt{75} = 8.66$$

Thus, row to row distance will be 8.66 metre.

Other method of calculating number of plant per unit area

Square system

$P = \frac{A}{l^2}$ Where, P = Plant population, A = Area, l = Arm of square or Distance of planting

Rectangular system

$P = \frac{A}{L_1 \times L_2}$ Where, P = Pant population, A = Area, L_1 = Row distance, L_2 = Plant distance

Triangular system

$P = \frac{S}{d^2} \times 0.866$ Where, P = Plant population, S = Area, d = Length of the triangle arm

Planting

Depending upon planting distance, spot is marked in the field. Appropriate size pit ranging from 30-60 cm³ size depending upon growth stature of tree to be planted, is dug out. While digging pit, the upper half portion of excavated soil is left one side and the bottom half another side. The pit after digging is left exposed to sun for about 15 days. The exposition help facilitates the killing of harmful microbes living inside the soil. The pit is filled using a portion of upper part of excavated soil, a portion of well rotted FYM and a handful of Malathion/Endosulfan/Quinolphos dust. The pit is filled five cm high from ground level. A peg is inserted in between the centre of pit and it is left out as such which gets settled after receipt of monsoon rains. It is better to dig out the pit during hotter month of May. The planting is done during monsoon. Of course, pit preparation if undertaken during winter, planting may be undertaken during February-March too. (Deciduous plants may be planted bare rooted preferably during February-March and those the evergreen along the root ball intact during rainy season.)

Planting distance

The plants are planted at proper spacing so as to favour proper growth of shoot and growth. A properly spaced plant grows and develops in a proper canopy and produce proper yield and quality of produce. Closely spaced plants suffer a lot from pests/diseases and fail to produce proper crop in want of adequate nourishment and also exposure to solar radiation. Depending upon soil, climate, type of plant, technique of cultivation etc. proper spacing for different fruit crops are as under :

Apple	:	5-6 × 5-6 m	Cashewnut	:	8 × 8 m
Aonla	:	8 × 8 m	Citrus	:	5-6 × 5-6 m
Avocado	:	7 × 7 m	Coconut	:	7.5 × 7.5 m
Bael	:	8 × 8 m	Custard Apple	:	6 × 6 m
Banana	:	1.8 × 1.8 m	Date Palm	:	6 × 6 m
Ber	:	6 × 6 m	Fig	:	5 × 5 cm

Guava	:	6 × 6 m	Mango	:	8 × 8 m
Grape	:	3 × 3 m	Mango (HDP)	:	2.5 × 2.5 m
Jackfruit	:	8 × 8 m	Mulberry	:	6 × 6 m
Jamun	:	8 × 8 m	Papaya	:	2 × 2 m
Kair	:	3 × 3 m	Phalsa	:	2.5 × 2.5 m
Karonda	:	2 × 2 m	Pineapple	:	25 × 25 × 90 cm
Khirni	:	6 × 6 m	Pomegranate	:	5 × 5 m
Litchi	:	8 × 8 m	Sapota	:	8 × 8 m
Loquat	:	6 × 6 m	Tamarind	:	8 × 8 m

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