TRAINING AND PRUNING

- Training is a practice in which tree growth is directed into a desired shape and form.

- Training young fruit trees is essential for proper tree development. It is better to direct tree growth with training than to correct it with pruning.

- Training includes summer training and summer pruning as well as dormant pruning.
- The goal of tree training is to direct tree growth and minimize cutting.

- **Pruning is the proper and judicious removal of plant parts such as shoots, spurs, leaves, roots or nipping away of terminal parts etc. to correct or maintain tree structure and increase its usefulness.**
- **It is done to**
  - **make the plant more productive and bear quality fruits,**
  - **increase longevity of the tree,**
  - **make it into manageable shape and**
  - **to get maximum returns from the orchard.**
- **Pruning is a dwarfing process and can be used to maintain any desired tree size.**
- **Removal of a branch removes not only stored carbohydrates but reduces the potential leaf surface as well.**

- **Pruning increases fruit size, nitrogen per growing point and stimulates growth near the cut.**
- **Excessive pruning reduces fruitfulness especially with young vigorous trees that may already be developing too much vegetative growth.**
- **Large cuts results in excessive stimulation of sprouts near the cut, while well distributed small cuts spreads the stimulus better over the entire tree.**
- **The severity, kind and amount of pruning to be done on a tree depend on the**
  - **age,**
  - **existing framework,**
  - **condition of bark and wood,**
  - **Growth characteristics**
  - **Fruiting habit of the variety**
  - **Whether tree is permanent or filler**

- **Pruning is most often done during the winter, commonly referred to as dormant pruning.**

TRAINING

- Mainly concerned with giving a form or shape to the plant.
- Determines the general character and even details of the plant's outline and of its branching and framework.
- Training includes summer training and summer pruning as well as dormant pruning.
- The goal of tree training is to direct tree growth and minimize cutting

PRUNING

- Pruning is the removal of a portion of a tree to correct or maintain tree structure.
- It has an effect on the function of the plant.
- It is meant to assist more in determining what the tree does in respect of fruiting.
- Pruning is most often done during the winter, commonly referred to as dormant pruning. Also done during summers, referred to as summer pruning.

Objectives of Training

- To admit more sunlight and air to the centre of the tree and to expose maximum leaf surface to the sunlight.
- To direct the growth of the tree so that various cultural operations, such as spraying and harvesting are performed at the lowest cost.
- To protect the tree from sunburn and wind damage.
- To secure a balanced distribution of fruit-bearing parts on the main limbs of the plant.

Principle of Training

- **The principle object in training a young tree is to develop strong framework of scaffold branches.**
  - **All methods of training must stand or fall by their ability to achieve a tree capable of bearing high yielding fruits without undue breakage.**

- Trunk: Main stem of the plant.
- Head: Point on the trunk from which first branch arise
- Scaffold branches: Main branches arising from the head are known as scaffold branches.
  - Low headed tree: Trees in which scaffold branches arise within 0.7-0.9 m height from ground level. Low headed trees come into bearing comparatively much earlier, are able to resist stormy winds more effectively and their spraying and harvesting expenses are less.
  - High headed tree: Trees in which scaffold branches come out from the trunk above 1.2 m. In the tropical climate, high headed trees are unsuitable as their exposed trunks are subjected to sunscald in summer.

- Crotch: The angle made by scaffold limb to the trunk or the secondary branch to scaffold limb is called crotch. The crotch should be broad and not narrow.
- Leader: The main growing branch from ground level upto the tip dominating all other branches.
- Spur: Numerous shoot growth which are abundant over the fruit trees and upon which most of the fruit is borne.

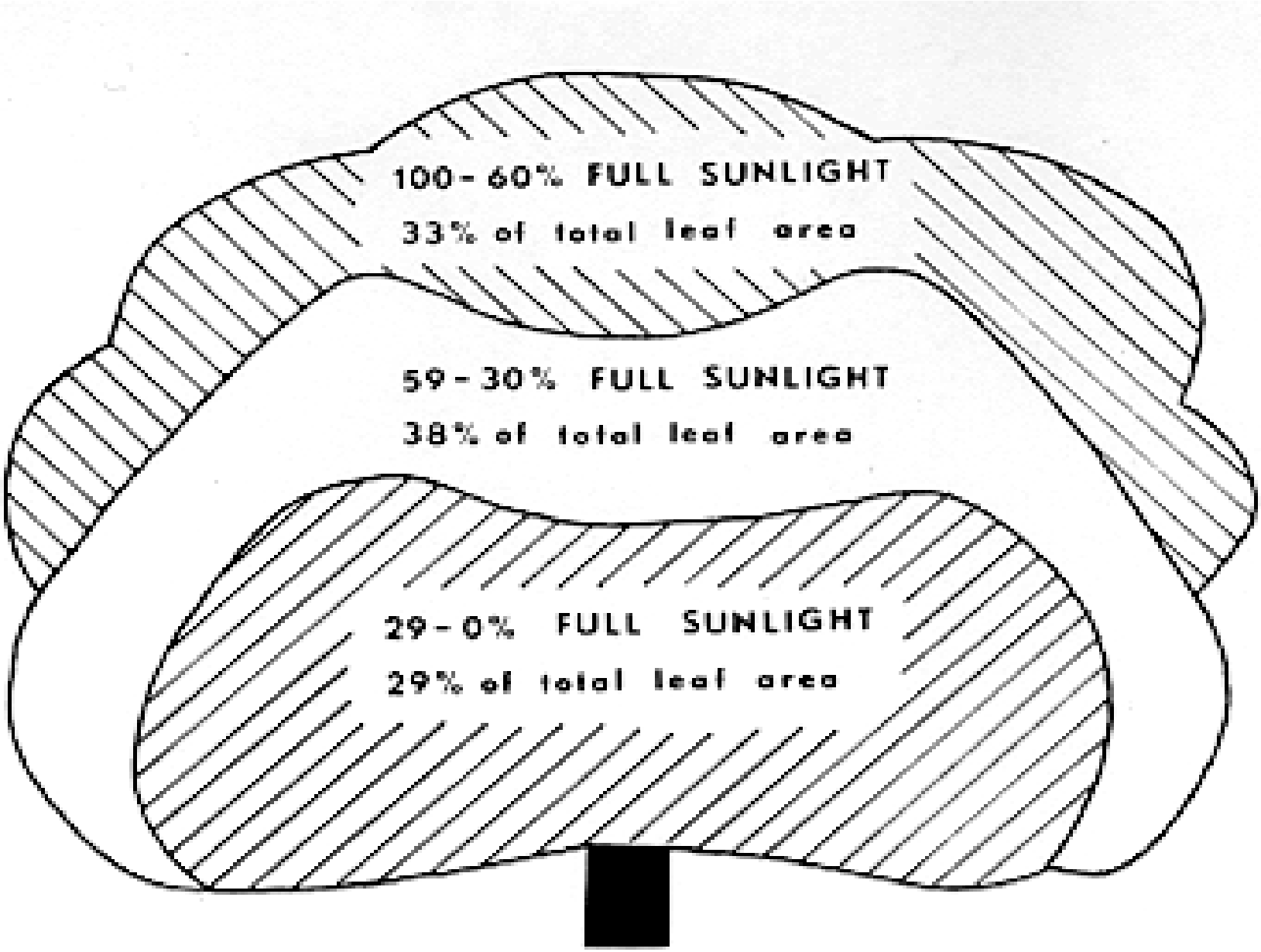
- Water shoots: These are extraordinary vigorous vegetative shoots which grow from the high points on the main branches in upright direction at the expense of main branches.
- Suckers: arise from adventitious buds on the roots or underground parts of the stem of the tree.

Objectives of Pruning

- To control the size of the plant.
- To control the form (structural make up of the plant) which involves number, placement, relative size and angle of branches.
- Better quality fruits by better light distribution.
- To remove diseased, criss-crossed, dried and broken branches.
- To remove the non-productive parts in order to divert the energy into those parts that are capable of bearing fruits.
- Proper proportion of root- shoot ratio.
- To regulate the fruit crop.
- Longevity of the tree.
- Chances of insects-pests, diseases and winter injury are less.

Principle of Pruning

- **To admit more sunlight, remove unproductive branches which are producing few or no fruits and also to keep the plant in its proper vigour, vitality and to obtain optimum yields of good quality fruits.**


100 - 60% FULL SUNLIGHT
33% of total leaf area
59 - 30% FULL SUNLIGHT
38% of total leaf area
29 - 0% FULL SUNLIGHT
29% of total leaf area

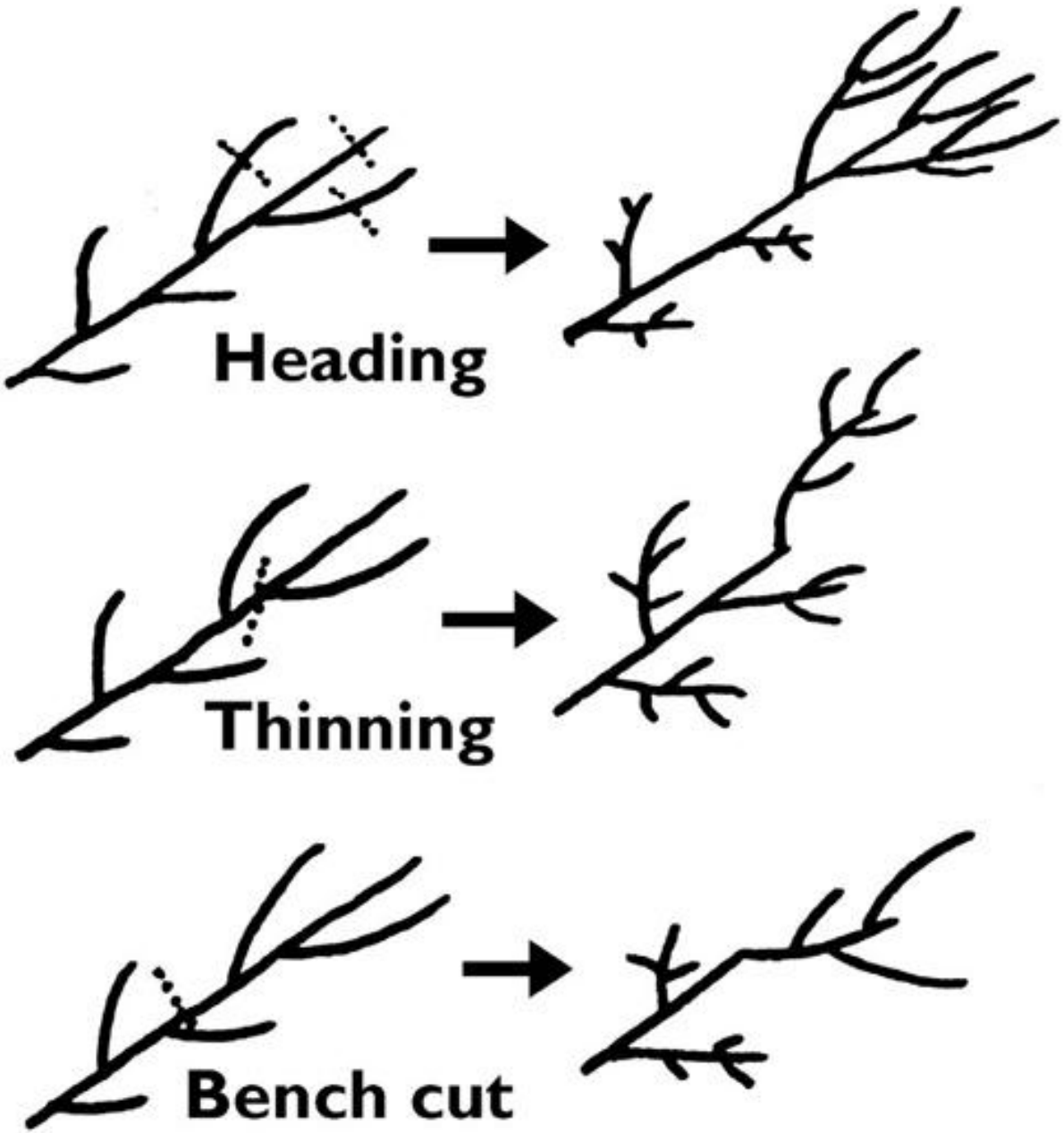
Types of Pruning

- Thinning out
- Heading Back
- Bulk Pruning
- Thin wood Pruning

- **Thinning out: When a shoot is entirely removed from the point of its origin and no re-growth is allowed to occur from the cut ends.**
  - **do not invigorate the tree**

- **Heading back: When the terminal portion of branch/shoot is removed and it encourages lateral growth from the remaining shoot.**
  - **In other words, if a portion of a shoot is removed and the growth can develop from the remaining portion.**

- **Heading back promotes the growth of lower buds as well as several terminal buds below the cut.**
- **When lateral branches are headed into one year old wood, the area near the cut is invigorated.**
- **The headed branch is much stronger and rigid, resulting in lateral secondary branching.**


Heading
Thinning
Bench cut

- **Thin wood pruning: refers to the removal of slow growing, weak, under hanging branches or shoots which are either not fruiting or producing fruits of low quality.**

- **Bench Cut - removes vigorous, upright shoots back to side branches that are relatively flat and outward growing.**
  - **used to open up the center of the tree and spread the branches outward.**
  - ***This is a major cut and should only be used when necessary.***

Season of Pruning

- **Dormant Pruning**
- **Summer Pruning**

Dormant pruning

- Most often done during the winter- commonly referred to as dormant pruning.
- Dormant pruning is an invigorating process.
- Heavy dormant pruning also promotes excessive vegetative vigor,
- Timing of dormant pruning is critical. Pruning should begin as late in the winter as possible to avoid winter injury.

Why Dormant Pruning ?

- Visible Branching Patterns(branches can be seen easily at this time).
- Other orchard operations are less pressing
- Less danger of pulling bark away from around pruning wounds
- Pruning goes well with cool weather.
- Increased growth response
- Has less dwarfing effect on the trees than summer pruning.
- Improved Equipment Access
- Fungus diseases are dormant too, so there's less danger of transmission
- Tree is just about to start the active growth that promotes wound-healing

Summer Pruning

- Done during summers- referred to as summer pruning.
- Its severity is much less, less common, more specific and selective.
- Eliminates an energy or food producing portion of the tree and results in reduced tree growth.
- For most purposes, summer pruning should be limited to removing the upright and vigorous current season's growth; only thinning cuts should be used.
- To minimize the potential for winter injury, summer pruning should not be done after the end of July.

Advantages of Summer Pruning

- Better illumination of leaves and fruits
- Improved assimilation in centre of trees
- Better fruit colour, fruit quality and storage.
- Slower total growth of trees
- Less wood production
- Less total pruning effort and improved work efficiency
- Possibility of reducing crown volume of tree, better utilization of space, more tree per acre
- Less danger of winter injury

Training Systems

- **Central Leader**
- **Open- Centre**
- **Modified Leader**

Central Leader System

- **Main trunk extends from the soil surface to the total height of the tree**
- **Several side branches grow at different heights in various directions.**
- **Advantages:**
  - **Such trees are structurally best suited to bear crop load and to resist the damage from strong winds.**
- **Disadvantages:**
  - **Trees under this system grow too tall and are less spreading.**
  - **Tree management (spraying, pruning, thinning and harvesting) is difficult.**
  - **Shading effect on interior canopy (the lower branches of such trees may be so much in shade that the fruit may not be able to develop proper colour).**

Open Centre System

- Main trunk is allowed to grow upto 1.0 m by cutting within a year of planting.
- 3-5 lateral branches are allowed to develop from short main stem.
- Widely used fro peaches and is good for mechanical harvesting.
- Advantages:
  - The trees so trained allow maximum sunshine to reach their branches.
  - Better clouration of fruits on the interior side of the tree.
  - Trees are more fruitful and low spreading tree greatly facilitate operations like spraying, pruning, thinning and harvesting.
- Disadvantages:
  - Such trees are structurally weak, and their limbs are more likely to break with crop load and strong winds.
  - This system does not only need severe pruning to start with but also constant effort to maintain its form through drastic pruning treatment.

Modified Leader System

- This training system is most acceptable for commercial fruit cultivation.
- This system combines the best qualities of the central leader and open centre systems.
- A leader develops on the young tree until it reaches the height of 2-3 m and then the growth is restricted.
- Laterals are selected to ascent in a spiral fashion up the central trunk and are cut until the proper number and distribution of branches have been obtained.
- Advantages:
  - The branches are well distributed, allowing plenty of sunshine to reach the interior of the tree.
  - The trees is structurally strong and not prone to limb breakage.
  - Owing to limited height of trees, spraying, pruning and harvesting may be done easily.

- **Some fruit trees bear on current season's shoots while others do so on the past season's growth.**
- **Bearing may also be on spurs and/or shoots.**
- **Mango, grape and most temperate fruits have flower buds formed much earlier to appearance of their flowers, but citrus fruits have flower buds differentiated just a little before flowering.**
- **Some fruits have simple flower buds while others have mixed buds—which upon unfolding give flowers as well as leaves.**
- **The pruning practice should be synchronized with the flowering habit of the species and sometimes even the variety.**
- **Evidently, one should be aware of the characteristics of the plant material in hand otherwise there are chances of rendering the trees less productive and sometimes out right barren through indiscriminate pruning.**

Systems of Training Dwarf Trees

1. Spindle Bush: modification of the dwarf pyramid or as intermediate between a vertical cordon and a bush form.

- Differs from the dwarf pyramid in that it has no specific arrangement of scaffold branches and from the vertical cordon in that the fruit is borne on short branches rather than directly on the main stem or trunk.
- Most important feature of this system is the tying down of lateral shoots in a horizontal position with little or no summer pruning.
- Trained with or without support posts with a central leader straight and with many small fruiting branches.
- These branches are bent out and down by spreaders to develop wide crotches and to induce early fruiting.
- Tree spread is controlled by cutting back the shoots to ½ to ¾ of their length or back to weak laterals.

Systems of Training Dwarf Trees

2. Dwarf Pyramids: consists of a tree with a central stem about 2.5 m tall from which short branches radiate in successive tiers so that a pyramidal shape is build up.

- **Fruiting spurs are developed on the short branches.**
- **Summer pruning forms an essential part of success with dwarf pyramids.**

Systems of Training Dwarf Trees

3. Cordons: are single stemmed trees.

This form is seldom found in commercial fruit production and has been replaced by dwarf pyramids.

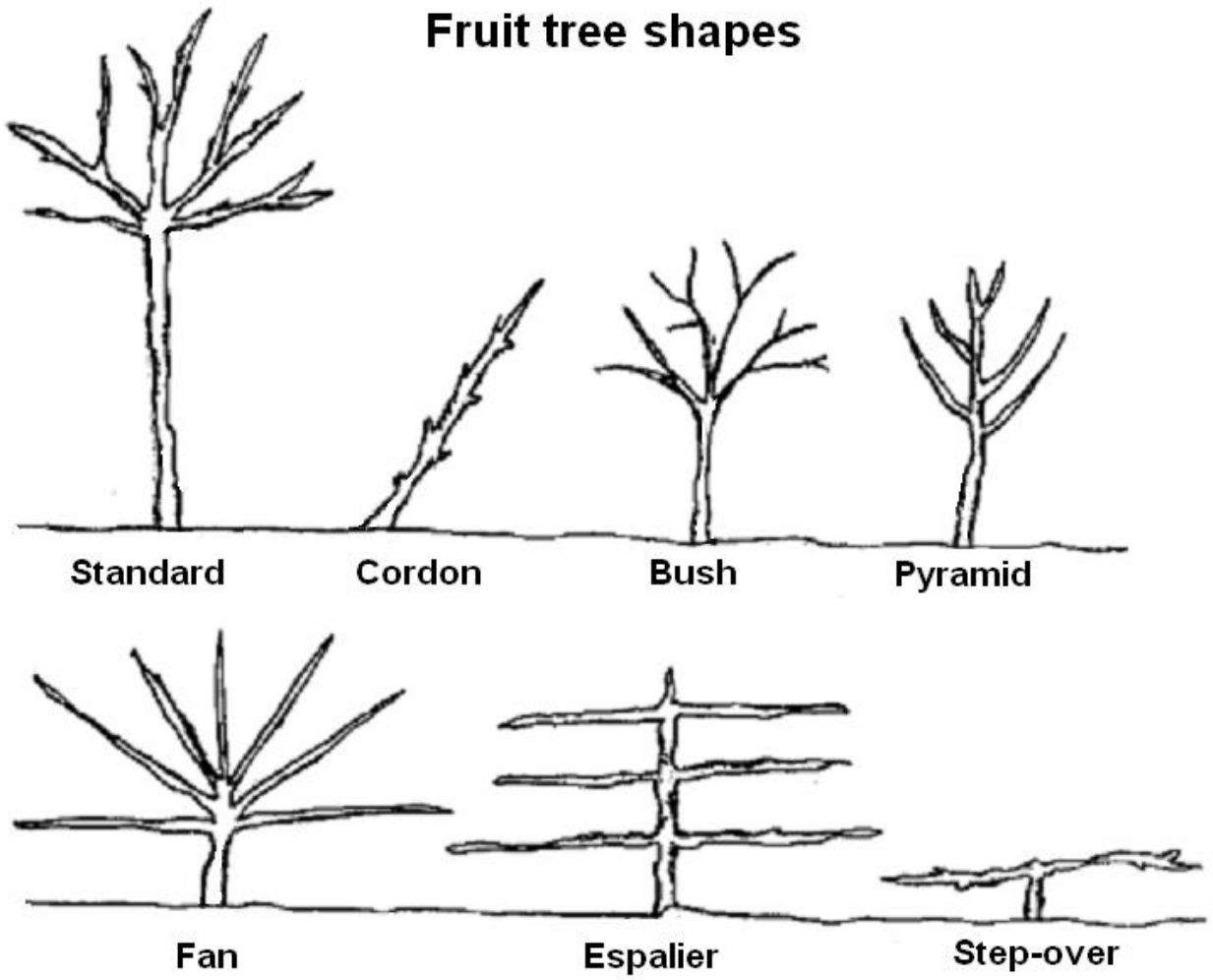
Cordons are vertical, oblique or horizontal

Vertical cordons: trees are trained erect and grown to a height of 10-12 feet with the first fruiting wood developed at about 30 cm. from the ground

Oblique cordons: are trained at the 45^0 angle.

4. Palmettes: refers to the shape of a palm leaf, an open fan or an open hand with spread fingers.

- **Formed by developing lateral scaffold branches from the trunk beginning at 30 cm from the surface of the ground.**
- **These laterals are in pairs and are equally balanced in opposite directions. Other scaffolds are in turn vigorously developed but are kept about 30 cm apart.**
- **Four groups: Horizontal, Oblique, Candelabra, Fan Palmette**


Fruit tree shapes
Standard
Cordon
Bush
Pyramid
Fan
Espalier
Step-over

5. Espaliers: similar to kniffin system of training grapes.

- The trellis is 5 feet high with either 2 wires at 3 feet and 5 feet OR 4 wires at 2,3,4,and 5 feet.

6. Hedgerow Plantation:

- **Adapted to mechanical cultivation.**
- **Distance within the rows - close and between the rows - wide to accommodate machinery and management.**
- **Adapted to compact trees, staked free standing on trellised growing north to south.**
- **Trees planted fairly close 4 feet in rows, 12 feet apart and grown as small bushy trees that develop into a continuous or hedgerow habit.**
- **Hedgerow plantation can also be developed without support using semi dwarf or semi-standard rootstocks with trees 10-15 feet apart in rows 20-30 feet apart.**
- **Trees are kept 10 feet in height.**

7. Meadow or Bed Orchards:

- **In this system, trees are planted at ultra high densities of 30,000 to 100,000 tree per hectare.**
- **Trees spaced 30 x 45 cm apart with sprinkler head through which hormones, fertilizers, herbicides, pesticides and water may be applied.**
- **Cropping is taken every other year upto 20 t/acre but cropping every year may be possible by judicious pruning and management.**
- **It offers complete mechanization of both pruning and harvesting coupled with chemical control of weeds.**

Limitations: - High cost of establishment

- Orchard become uneconomical before standard orchards.

- Annual production is sacrificed because of removal of fruiting buds in alternate years.

8. Tatura Trellis system in Peaches:

- **One of the highest yielding systems.**
- **System appears to be V shaped.**
- **Trees are planted about 6 x 1 m apart (1668 trees/ha).**
- **Bearing starts in the second year.**
- **Main framework consists of Y shaped leaders which are tied with the wires.**