



Spacing and Utilization of Land Area – Canopy Classification in Citrus

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Citrus trees (Rutaceae, $2n = 18$) have three to five growth flushes per year, depending on growing conditions. Each fresh growth flush is stacked on top of the previous one, resulting in a drift of young bearing wood to the canopy's periphery. This leads in larger trees with more shade inside the canopy over time, with the majority of the fruits emerging on the tops and outsides of trees. The majority of citrus fruits are born on leaves approximately 90 cm from the centre, where there is enough light for fruit bud production, while the inside area is mostly filled by supporting structures without fruits. Pruning should therefore be limited to that required for future canopy bearing surface development and for the conduct of efficient cultural and harvesting operations. Proper control of vegetative growth is essential for the maintenance of healthy, productive citrus orchards. Most orchards must be pruned at some time during their development to avoid problem associated with dead wood and overcrowded trees. When pruning should begin will depend to a large degree on the initial tree planting density. Poor light availability, loss of lower foliage and bearing wood, fruiting movement to upper tree canopy areas, and a decline in fruit output, size, and external quality are all consequences of overcrowding. As a result, good management necessitates pruning prior to the emergence of these adverse impacts. Variety, tree age, vitality, fruiting habits, growing circumstances, and production procedures all influence the response to pruning.

Canopy Management

Canopy management is the 'art' of fruit growing - it is much more than cutting off a few branches. Fruit trees produce fruit regardless of human intervention. Fruits house the seeds needed for trees to reproduce – when birds and animals eat the fruits, they distribute the seeds to start new growth.

However, for human consumption, it is important to manage fruit tree canopies to optimize the balance between vegetative growth and fruit production, and also to keep fruit picking manageable. An unmanaged canopy will grow all its fruit 25 – 30 feet in the air, which is difficult and just plain dangerous to get at!

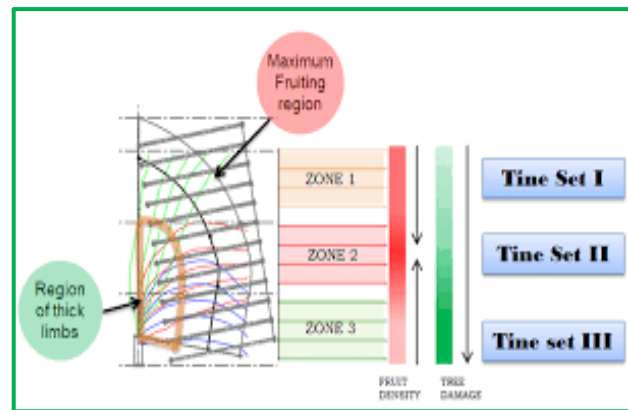
In the long run, managing a canopy will aid in the development of a sturdy tree that can carry heavy crop loads while also increasing fruit production and enhancing fruit quality. Fruit tree canopies can be managed in one of three ways:

1. **Pruning:** It is the process of removing limbs or branches from a tree. Most people think of canopy management as this, although it's simply one element of a bigger process.
2. **Training:** Rather than removing limbs, training involves positioning them in certain ways to manage growth. When at all possible, train rather than prune.
3. **Horticultural Practice:** Addition of nutrients, water *etc.* E.g. Rather than cutting limbs, cut back on water and nitrogen to stop excessive tree growth.

Utilization of Sunlight

It is impossible to overstate the importance of sunlight intercepted by the tree canopy in the production of high quantities of good quality fruit. Photosynthesis uses light to combine carbon dioxide from the air and water from the soil in the leaves to generate the basic foods that allow trees to survive, develop, and bear fruit. In congested orchards, light becomes a limiting factor, and trimming enhances light access. To increase sunlight penetration into the tree canopy, adjustments must be made. Sunlight not only affects blooming and fruit set, but it also improves the quality and colour of the fruit.

Carbohydrates are stored in the leaves, twigs, and branches of citrus trees, with just a small quantity reaching the root system. In the spring, just before the start of growth flush activity, the maximum amount of stored food is attained. Citrus trees' foliage serves as a vital food storage region, and excessive trimming forces the tree to focus on vegetative development rather than fruit production.



Intercropping for Space Utilization

As citrus trees take longer time to yield any profit to the grower, it is desirable to supplement one's income by growing some short-term crops particularly during the first four to five years. Judiciously selected and grown intercrops, besides providing additional income, suppress weed growth, reduce the evaporation of soil moisture and add considerable quantities of organic matter to soil. However, it must always be kept in mind that our major interest lies in the fruit-trees. Good growing conditions for the trees should be maintained at all times and the pests and diseases of both the crops must be kept under control. Short statured leguminous crops such as moong, mash, cowpea, gram, pea, groundnut, etc., can be grown as intercrop in citrus. In sweet orange orchards, guar-wheat can be taken during the first 5-6 years, with guar as green manure. Crops requiring more water than the citrus plants should be avoided, particularly berseem and potato. Tall growing crops which tend to overshadow the young plants and crops which tend to climb on trees should not be grown as intercrops.

Sufficient space should be left unsown around the young plants to make unrestricted growth. The fruit trees and intercrops should be provided with independent irrigation system and their fertilizer requirements should be met separately.

High Density Planting for Space Utilization

“High density planting technique is a modern method of fruit cultivation involving planting of fruit trees densely, allowing small or dwarf trees with modified canopy for better light interception and distribution and ease of mechanized field operation”. HDP and meadow orcharding gives higher yield as well as returns/unit area due to increasing the no. of trees/unit area. It is possible by regular pruning and use of bio regulators for maintaining the size and shape of the tree.

Components of HDP and Meadow Orchardring

1. Dwarf scion varieties
2. Dwarf rootstock varieties
3. Training and pruning
4. Suitable crop management practices

5. Use of bio-regulators
6. Planting Density
7. Planting Geometry
8. Mechanization

Rootstock Raising

Citrus varieties are usually not propagated on their own roots. Usually citrus plants are raised by budding scion varieties on the suitable rootstock. The rootstocks impart certain desirable characters e.g. improved fruit quality, higher productivity, adaptability to agro-climatic conditions, resistance to diseases, pests, *etc.* In Punjab, rough lemon (Jatti Khatti) is the most commonly used rootstock for most of citrus varieties. Its seeds are extracted in August-September. For Blood Red sweet orange, Cleopatra should be used as rootstock. Its seed ripens in January and should be sown in the first week of February. Pectinifera is recommended rootstock for Mosambi variety of sweet orange and its seed should be sown during August-September. Daisy and W. Murcott mandarins should be propagated on Carrizo rootstock.

Dwarfing Rootstocks

1. Trifoliolate Orange
2. Troyer Citrange for growing Kinnow in HDP by spacing the plants at 1.8m x 1.8 m.
3. Flying Dragon – Ultra dwarf rootstock.



Cleopatra



Trifoliolate Orange



Troyer Citrange

Crop Regulation or Bahar Treatment

Mandarin flowers three times a year in South and Central India: in February (Ambe bahar), June (Mrig bahar), and October (Haste bahar), with Mrig bahar being the most popular. Flower regulation is accomplished by restricting water for a month or two prior to flowering, until the plants have withered and lost some of their leaves. They are then manured and irrigated, resulting in abundant flowering.

Basic Pruning Methods

The two most common pruning cuts are heading back and thinning out, and they serve slightly conflicting purposes. Heading back destroys apical dominance and stimulates lateral bud bursts by removing the terminal section of a shoot or branch. Internal wood may become less productive and finally die as the particular tree grows in size. Thinning out entails the removal of entire branches from laterals or the main trunk, which is accomplished with hand-held equipment. It promotes the surviving terminals to grow longer, resulting in a larger, more open tree. This form of pruning is sometimes done to let more light into the tree.

Training Systems Followed in Different Citrus Group

- ✚ Sweet orange and mandarin: Single stem system.
- ✚ Acid lime: Modified central leader system.
- ✚ Lemon: Open centre system.
- ✚ Grape fruit: No training.

Canopy Management in Different Citrus Species

1. Grapefruit

The grapefruit plants are spreading in nature. The formation of upright branches is negligible. The foliage is quite dense. The only precautions need to be taken are to check or thin out the dense foliage, to the extent sufficient for letting the light and air to the interior parts of the plant.

2. Lemon

- Lemon trees have a more willowy or weeping tree structure than that of most orange and mandarin trees.
- The branches and limbs are more easily broken by strong winds when the crop load is heavy.
- Overall lemon tree branches are longer, thinner and more flexible than those of orange trees. Pruning should aim to shorten these branches.
- Pruning should be done to encourage fruit development on the insides of trees where it is more protected from wind.
- Lemons also have a tendency to produce strong, vigorous upright water shoots that are usually thorny. These are normally unproductive and should be removed as early as possible.

3. Lime

- Acid lime plants may be trained to modified central leader system, with a smooth trunk upto 75 to 100 cm height from the ground level and 4 to 5 well spread branches, as scaffolding branches.
- All sprouts appearing on the trunk upto a height of 75 to 100 cm should be removed. Similarly on grown up trees, the water suckers appearing on main trunk and scaffolding branches should be removed promptly.
- Once a young plant is trained to a desired shape, it requires very little pruning. Light pruning may be given during later years.
- Light pruned young trees make more development of roots and shoots, producing fruits earlier than those pruned heavily. Pruning of bearing trees though differs with variety, chiefly consists of removal of dead, dried, diseased, broken and criss cross branches, whose existence is detrimental to the health of trees. Removal of water suckers is also essential.
- Pruning may be done just after harvesting. Soon after pruning, the cut ends may be smeared with Bordeaux paste or Blitox.

4. Mandarin

- The trees at planting time are headed back more severely to a height of 70 to 80 cm from the ground level.
- Usually, 3 to 5 well spread laterals are selected as the future scaffold limbs.
- Further, these shoots are again pruned for initiation of new shoots below the cut points.
- These shoots are more prone to flowering and fruiting.
- In bearing, mandarins are considered to be over bearers and also alternate bearers to some extent.
- Pruning and cutting back of one year old shoot to half length or to full length is recommended for obtaining proper yield of high quality fruits. The pruning, therefore, is done to keep balance between fruiting and vegetative growth.

- The pruning of some of the shoots certainly removes a part of fruiting area and helps to maintain regular cropping. The dried up branches found in the lower part of the plant is also removed.
- 5. Sweet Orange**
- Sweet orange trees are trained to single stem system and any shoot emerging from the portion below the bud union is nipped off regularly. The first year growth beyond height of 0.7 metre to 1 metre is headed back to develop side shoots.
 - Only 4 to 6 branches having wide angle with the main trunk are allowed to grow upto 2.5 to 3 metre. Thereafter, no training is required. Training of plants is completed in 3 years so that plants attain a mechanically strong canopy. The pruning in pre-bearing trees is done at any time avoiding the peak winter.

Conclusion

The alteration of tree canopies to enhance the production of high-quality fruits is known as canopy management. Because tree shape controls the presentation of leaf area to incoming radiation, canopy management, particularly its components such as tree training and pruning, has an impact on the amount of sunlight intercepted by trees. The arrangement of plant parts, in particular, is an appropriate training approach for developing a superior plant architecture that maximizes the use of sunlight and boosts productivity. Citrus farmers are the best people to analyze their plants' performance and plan and implement canopy management operations based on that information.