JUST AGRICULTURE
multidisciplinary e-Newsletter

Canopy Management in Fruit Crops

Nanhe Lal Saroj[1], Karobi Handique[2], Sunil Ram[3], Ajay Patel[4] and Jahnabi Hazarika [5]

[1 & 4] Assistant Professor, Department of Agriculture Science, SRM University, Delhi-NCR, Sonepat, Haryana-131029

[3] Assistant Professor, Department of Foreign Language, SRM University, Delhi-NCR, Sonepat, Haryana-131029

[2] Assistant Professor, Faculty of Agricultural Sciences, Arunachal University of Studies, Namsai, Arunachal Pradesh-792103

[5]Young Professional, Department of Soil Science, College of Agriculture, Assam Agricultural University, Jorhat, Assam-785013

ARTICLE ID: 10

Introduction

Canopy management is one of the most important fruit plant management practices. This forms the basis of the precociousness and longevity of the fruit trees in an orchard. The strong scaffold system helps the trees to produce heavy crop loads of quality fruits without any major limb breakage, for example, patharnakh. Some trees bear regularly only if pruned every year, for example, peach and grapes. Regular annual priming is essential for the induction of a good amount of new growth, which will provide the tree with maximum fruit bearing area uniformly over the whole tree. Unpruned trees grow beyond limits provided for each tree in an orchard. The branches start intermingling with the branches of adjacent trees giving an impression of a jungle. The photosynthetic activity of the trees gets adversely affected leading to the poor yields of low-quality fruits. Orchards become economically unproductive. To keep the fruit trees within the area provided for their spread for the whole of their life, canopy management is of prime importance. Many factors go into the production of fruits. One factor is the optimum quantity of light. When the fruit tree absorbs the right amount of sunlight, it can produce high-quality fruit. It is therefore essential for a fruit farmer to pay attention to the tree canopies. And this is where canopy management plays a role.

Principles of Canopy Management

The aim is to induce trees to maintain a balance in between vegetative and fruiting wood, with uncrowded bearing wood situated conveniently within the relative shelter of the well-lit, adequately ventilated inner canopy.

1. Maximum utilization of light.

JUST AGRICULTURE
multidisciplinary e-Newsletter

2. Avoidance of built-up microclimate congenial for diseases and pest infestation.
3. Convenience in carrying out cultural practices.
4. Maximizing productivity with quality fruit production.
5. Economy in obtaining the required canopy architecture.
6. Induction of complexity in young trees.
7. Maintenance of complexity in bearing trees.
8. Reduction of the complexity of large, old trees declining due to the effects of age and/or shading.

Objectives of Canopy Management

1. To restore root/shoot ratio.
2. To obtain specific form of the plant.
3. To develop specific geometry within the plant and its overall topology.
4. To maintain an optimum balance between vegetative and reproductive parts.

Architecture of Canopy Management

Basic Method:

a) Training
b) Pruning

Training

It involves bending or tying branches to achieve a desired shape. In horticulture, training refers to the process of directing and controlling the growth of plants to achieve desirable shapes, sizes, and yield. This involves physical manipulation of the plant, including bending, tying, and pruning. The goal of training is to create a strong framework of branches that can support the weight of the fruit, and to ensure that the plant receives adequate sunlight and air circulation.

The training is done with the following objectives:

- To admit light up to the centre of the tree and provide sufficient movement of air across the plant.
- To increase photosynthetic activity by exposing leaves to the sun.
- To provide a strong scaffold system that could bear the heavy load of fruits, without limb breakage.

JUST AGRICULTURE
multidisciplinary e-Newsletter

- To growth of the tree so that various cultural operations such as spraying, hoeing irrigation and harvesting are performed at the lowest cost.
- To secure balanced distribution of fruit-bearing parts on the main limbs of the tree
- To protect the tree from wind damage

Training can be classified into several types, including:

1. **Central Leader System:** The central leader is allowed to grow uninterrupted. The secondaries grow on the central axis on all directions. The fruit tree grows in a natural way. The tree trunks become very strong due to the spread of many scaffolds and secondaries. The trees become tall and spread mostly unmanageable at maturity. This system is most suited to litchi and mango.
2. **Modified Leader System:** The central leader is allowed to grow to produce 3-4 side branches, then it is headed back at 75 cm height for low headed and at 90 cm for high headed plants. In the next year, the top bud sprouts to take the shape of the central leader, which is again headed back after getting 2-3 scaffolds at the last scaffold giving it an open centre. This can be done after 2-3 years of removal of the central leader that is why the system of training is called modified leader system of training. In all, there can be 5-7 scaffolds on which secondaries are made to develop by removing apical dominance of each scaffold periodically. Thus a tree takes the shape of an umbrella in spread and a cone in height. Modified leader system trees possess a strong durable framework like central leader system and openness of the open-centre system. Tress do not grow as tall as in central leader system, thus remain manageable for a long time. Orchard efficiency is never adversely affected due to overgrowth. There is no breakage of limbs due to the load of the fruits. This system is suited to pears, peaches, guava, mango, litchi and many more which can grow to form big trees.
3. **Open-centre System:** The plants are planted in the orchard and simultaneously headed back to 75 cm height. The well placed 4-5 side branches are allowed to develop on the main axis. The top growing axis is again cut and is not allowed to resprout and give side branches. The selected scaffolds are made to produce secondaries and tertiaries just like in modified leader system. Thus, the tree gives the appearance of the umbrella. The limbs can cause breakage on the small main axis due to over weight of fruit on few scaffolds in comparison to modified leader system. This system is preferred for those

JUST AGRICULTURE
multidisciplinary e-Newsletter

fruit trees which have 10-15 years of life span example peaches and plums. This system is very suitable for exotic peaches in North Indian plains.

Pruning

Pruning involves removing parts of the plant, such as branches and leaves, to control the size and shape of the canopy. Pruning is the process of selectively removing certain parts of a plant, such as branches, buds, or roots, to improve plant growth, yield, or appearance. It is a common practice in horticulture and agriculture and is done for various reasons, including training plants to grow in a particular shape or size, increasing fruit production, improving plant health, and removing diseased or dead plant tissue.

The Pruning is done with the following objectives:

- To remove the apical dominance for encouraging branching.
- To remove unproductive over crowded branches.
- To remove diseased and dead wood branches.
- To encourage vegetative growth.
- To control the overall size of the fruit tree.
- To regulate fruiting for regular cropping.
- To give particular training.

Pruning can be classified into several types, including:

1. **Thinning out:** This involves selectively removing branches from a tree or plant to improve light penetration and air circulation. Thinning helps to reduce overcrowding, which can lead to competition for resources and a decrease in plant health.
2. **Heading back:** When only one-third to one-half terminal portions of the branches, having their basal portion intact, are removed. Such pruning encourages development of secondary branches, lateral bud growth and destroys apical dominance of twig, shoot or branch.
3. **Dehorning:** It consists of removal of all the wood after leaving 7-10 cm thick stub all over the tree. Such severe treatment should normally not be given except when it is the last resort to bring it into control.

Special pruning techniques:

Root pruning

- Dwarf fruit trees

JUST AGRICULTURE
multidisciplinary e-Newsletter

- Circular trench 45cm away & roots are cut off every year.
- Deccan Vidharba-induce flowering in oranges.

Ringing

- Complete removal of the bark from the branch or trunk
- Increase fruit bud formation.
- Interrupts the downward passage of carbohydrates
- Mango -force flowering over vegetative tree.
- Grape -promote fruit set and large size fruit.

Topping

- This involves cutting the top off of a tree or plant to control its size or to remove dead or damaged branches.
- Topping is not recommended for most plants, as it can lead to weak growth and a reduction in overall plant health.

Pinching

- This involves using your fingers to pinch off the tips of young shoots or buds to promote branching and denser growth.
- Pinching is often used on herbs and other plants that benefit from compact growth.

Notching

- Partial ringing above the dormant lateral bud.
- Increases yield of fig trees in Pune.
- Produce strong shoots in apple.

Smudging

- Smoking of trees
- Mango: Philippines to produce off season crop
- Done for a week –centre of the crown of tree
- India-mango trees induce early blossom.

Pollarding

- Removing growing point in shade trees-silver oak.

Lopping

- Reduce canopy cover in shade trees.

JUST AGRICULTURE
multidisciplinary e-Newsletter

Pinching

- Removal of terminal growing point.
- Flower crops: carnation, chrysanthemum.

Disbudding

- Removal of unwanted flower bud
- Cut flowers:rose, carnation, dahlia, chrysanthemum

Bending

- Bend to a 45–60-degree angle
- Increase lateral branching
- Decrease terminal growth
- Decreases amount of auxin moving to tip
- Increasing fruit production in guava.

Coppicing

- Complete removal of trunk: Eucalyptus, Cinchona
- 30 -35cm stumps are alone left.
- Produce vigorous shoots in 6 months

When pruning, it is important to use clean, sharp tools to make precise cuts and to avoid damaging the plant. Different plants require different pruning techniques and timing, so it is important to research and understand the specific needs of each plant species before pruning. Over-pruning or incorrect pruning techniques can harm the plant and reduce its overall health and productivity.

Other Method:

Use of suitable rootstock and interlock**.**

Some important dwarfing rootstocks of fruit crops

1. **Apple:** M27, M9, EMLA 26.
2. **Pear:** Quince C
3. **Peach:** Siberian C, St. Julien X, P. besseyi and Rubira.
4. **Plum:** St. Julien A, St. Julien K, Pixy.
5. **Cherry:** Giesela series, Stockton Morello, Oppenheim, Charger.
6. **Mango:** Olour, Vellaikolumban
7. **Citrus:** Trifoliate Orange, Flying Dragon

JUST AGRICULTURE
multidisciplinary e-Newsletter

8. **Guava:** Pusa Srijan
9. **Cashew nut:** Anacardium pumilum
10. **Grape Fruit:** Flying dragon

Canopy management in horticulture crops:

Stepwise Operations:

Mango

- Grafts to grow to a height of 1m from the ground
- Head back the graft at 60-70 cm from the ground during October-November to induce primary branches
- Formation of new primary branches (3-7) during March-April.
- Prune primary branches at 60-70 cm height to induce new secondary shoots (October-November)
- Thin the excessive secondary shoots retaining 2-3 shoots per primary branch
- Tertiary branches (2 to 3) can be obtained by pruning the secondary branches at 60-70 cm height

Guava

- Trees are topped to a uniform height of 60-70 cm from the ground level, 2-3 months after planting to induce the emergence of new growth below the cut points.
- Pruning is performed in January and May-June every year

Pomegranate

- Pruning of the terminal portion of a branch lowers down the total flower production.
- Pruning does not affect sex ratio and fruit quality.
- Pruning affects the production of total fruits, and marketable and unmarketable fruits significantly
- Fruit size and yield of higher-grade fruits are more with high-intensity pruning.

Grapes

- The canopy is often managed on a trellis by training, pruning and leaf removal

Sapota

- Regulation of vegetative growth to improve productivity and quality of fruits central
- leader system

JUST AGRICULTURE
multidisciplinary e-Newsletter

Acid lime

- Acid lime plants may be trained to modified central leader system, with a smooth trunk up to 75-100cm height from the ground level and 4-5 well-spaced and well-spread branches, as scaffolding branches
- Lightly pruned young trees make more development of roots and shoots, producing fruits earlier

Banana

- In most banana growing regions, solar radiation is abundant and productivity of banana largely depends upon the efficient utilization of this resource. In multistorey cropping system, banana is grown to harness maximum light, land and nutrient availability. Light interception, soil fertility, climatic conditions, soil moisture etc. are important points to be considered for laying out of high-density plantation.
- Pruning of surplus leaves is a common operation in banana cultivation. Leaf pruning improves light penetration and reduces disease spreading through old and senescent leaves. The micro climate, especially availability of light and heat is improved by removal of leave. For optimum crop production, minimum of 12 leaves are required to be retained.

Jackfruit

- Training in jackfruit in early stage to build strong framework and to avoid weak crotches is necessary. Plants of jackfruit should be trained on single stem. Apical growth needs to be controlled within first year of planting for better canopy architecture.
- Plants are topped (headed back) to a uniform height of 70-80 cm from the ground level, 3-4 months after planting to induce the emergence of new growth.
- Three to four well-spaced limbs are retained around the main stem to form the scaffold limbs of the plant.
- Additional unwanted shoots are removed from time to time to give the plant desired shape

Conclusion

Dwarfing-canopy and rootstocks are suitable for a variety of fruit crop production techniques, particularly high-density plantings. Some tropical, subtropical, and temperate fruit

JUST AGRICULTURE
multidisciplinary e-Newsletter

species, primarily dwarfing-rootstocks, are available for this purpose, allowing for fruit production in both covered and open fields. Dwarfing in fruit crops can be achieved through various approaches like use of dwarfing rootstock, root pruning, training, use of growth retardants, control of nutrient elements etc. Paclobutrazol are most effective and widely used growth retardant. Dwarfing rootstock plays important role in controlling tree size and induce precocious bearing in fruit plants. Pruning practices like tip pruning, pinching, removal of apical buds, heading back, etc. control the tree size. Ringing and girdling control the tree size by restricting the flow of carbohydrates and auxins to the roots. Recently genetic engineering has widened the gene pool which can be manipulated to induce dwarfism and harvest maximum benefits in horticultural crops.

References

Karan Kumar and Sharma (2020). Canopy Management in Fruit Crops. Dr. Y.S. Parmar U.H.F., Nauni, Solan (HP) *Just Agriculture* ***Vol.1***, Article *Id: 046.*

Mahala, K., Bhateshwar, M. C. and Solanki, S. K. (2022). Advances In Canopy Management in Fruit Crops. Recent Innovative Approaches in Agricultural Science, 155.

Practical Manual on Canopy Management in Fruit Crops-Dr. Gorakh Singh (2010). Department of Agriculture & Cooperation, Ministry of Agriculture, Govt. of India, New Delhi-110001