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BEST CANOPY MANAGEMENT IN FRUIT CROP PRODUCTION

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BEST CANOPY MANAGEMENT IN FRUIT CROP PRODUCTION

[Article ID: SIMM0068]

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ABSTRACT

Over the year, the strategies of fruit tree canopy management were developed for improving tree health, productivity, fruit quality and management efficiency of orchards in India as throughout the world. The strategy is to create, after planting, strong, balanced tree frameworks, and maintain it throughout the orchard's life. Canopy in a fruit tree refers to its physical composition comprising of the stem, branches, shoot and leaves also the number and size of the leaves, determining the density. Management of canopy architecture is one of the predominant technologies by which huge and unmanageable trees are properly managed to make them more productive. To optimize the utilization of light for increased yield of quality fruits, canopy management deserves greater attention by exploiting the various available techniques like training, pruning (dormant, summer and root pruning), branch orientation (bending), scoring, girdling, selection of proper rootstock, use of plant growth

regulators, appropriate use of fertilizer, deficit irrigation, use of genetically engineered plants with altered architectural characters would help in maintaining the ideal canopies of trees. In new plantations initial training and pruning is given to develop strong framework of the tree whereas in old plantation the aim of canopy management is to reduce tree height and make provision of solar radiation inside the canopy by thinning excessive biomass.

Keywords: Balanced tree frameworks, fruit quality, productivity, tree health

INTRODUCTION

Canopy in a fruit tree refers to its physical composition comprising of the stem, branches, shoot and leaves also the number and size of the leaves, determining the density. Indeed, canopy management is the manipulation of tree canopy to optimize its production potential with excellent quality fruits. Canopy management is one of the most important production factors confronting the burgeoning fruit industry in India. Small trees capture and convert sunlight into fruit production in a better way than larger ones. Fruit production involves the capturing and conversion of sunlight into the production of fruit biomass (dry matter content). The canopy management, particularly its components like tree training and pruning, affects the quantity of sunlight intercepted by trees, as tree shape determines the presentation of leaf area to incoming radiation. Fruit plants become tall and huge if they are not managed by proper training and pruning from the initial stage. For harvesting the sun, each plant must establish its optimum canopy spread at earliest of its life cycle. Management of canopy architecture is therefore one of the predominant



technologies by which huge and unmanageable trees are properly managed to make them more productive. It not only involves just pruning and tree training but also includes the regulation of flowering and fruit growth

BASIC COMPONENTS OF CANOPY MANAGEMENT:

- Training- Development of frame work to a plant
- Pruning-
 1. Thinning out: Removed entirely without leaving any stub
 2. Heading back: Branches and shoots are removed leaving its basal portion intact.

Objectives of training:

- Admits higher light and air to the center of the tree.
- Expose maximum leaf surface to the sun.
- To protect tree from sunburn and damage.
- Facilitates easy maintenance

Methods of training:

1. Open Centre:
 - Main stem is allowed to grow only to a certain height.
 - Leader stem is pruned and scaffold branches are encouraged.
 - Vase shaped system
2. Central Leader System:
 - Main stem extends from surface of soil to top of tree.
 - Closed Centre – Apple, Cherry, Pear, Pecan, Plum
3. Modified Leader System:
 - Intermediate between open centre and central leader
4. Bower System:
 - Also called as Pandal or pergola
 - Eg, grapes and cucurbitaceous vegetables
5. Telephone System:
 - Overhead trellis system

6. Head System:

- Followed in grapes
- Wines are allowed to grow as a single stem with the help of stakes.
- After 1.2m side shoots are allowed.

Objectives of pruning:

- Remove surplus branches
- Fruit colour will improve.
- To remove dead and diseased limbs.
- Improve fruiting wood and to regulate production of floral or buds.
- Maintain a balance between vegetative growth and fruiting

Methods of pruning:

1. Root Pruning:
 - Dwarf fruit trees
 - Circular trench 45cm away & roots are cut off every year.
 - Deccan Vidharba - induce flowering in oranges.
2. 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.
3. Notching:
 - Partial ringing above the dormant lateral bud.
 - Increases yield of fig trees in Pune.
 - Produce strong shoots in apple.
4. 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.



5. Pollarding:
 - Removing growing point in shade trees-silver oak.
6. Lopping:
 - Reduce canopy cover in shade trees.
7. Pinching:
 - Removal of terminal growing point.
 - Flower crops: carnation, chrysanthemum.
8. Disbudding:
 - Removal of unwanted flower bud – Cut flowers: rose, carnation, dahlia, chrysanthemum
9. Bending:
 - Decreases amount of auxin moving to tip
 - Increasing fruit production in guava.
10. Copping:
 - Complete removal of trunk
 - Eucalyptus, Cinchona
 - 30 - 35cm stumps are alone left.
 - Produce vigorous shoots in 6 months.

Basic Principles of Canopy Management:

- Quality fruit production and maximum fruit productivity
- Economy in obtaining the required canopy architecture
- Maintenance of optimum microclimate – RH, Temperature etc.
- Reduction of pest and disease incidence.
- Convenience in carrying out the cultural practices.
- Tree utilization of maximum sunlight

CANOPY MANAGEMENT OF FRUIT CROPS:

Canopy is physical composition comprising of stem, branches, shoots and leaves and canopy density is determined by the number and size of the leaves, architecture of stem, branches and shoots. The canopy management components like training and pruning which affect the sunlight intercepted by trees and fruit production involves the capturing and conversion of

sunlight into production of fruit biomass or dry matter content. Canopy management of the fruit tree deals with the development and maintenance of their structure in relation to the size and shape for the maximum productivity and quality. The basic concept in canopy management of a perennial tree is to make the best use of the land, the climatic factors for an increased productivity in a three-dimensional approach. Tree vigour, light, temperature and humidity play a vital role in the production and quality of the fruits. The size, shape and volume of canopy are affected by climate, planting density, rootstock, method of propagation, training, pruning, regularity of bearing, soil type, nutrition, irrigation, intercrop, growth regulators used, diseases, pests, environmental pollution etc. The crux of the canopy management lies in the fact, as to how best we manipulate the tree vigour and use the available sunlight and temperature to increase the productivity and quantity and minimize the adverse effects of weather parameters. In the canopy management, major emphasis is usually required to reduce the excessive canopy shading and increase the air circulation in the fruiting region.

IMPORTANCE OF LIGHT INTENSITY IN CANOPY MANAGEMENT:

- Important factor in production of fruit has a role in flower induction as well as in fruit development through carbohydrate synthesis.
- High light interception and distribution in the tree canopy increased assimilates in the shoots is a pre-requisite for flowering in mango and other fruits generally, high yield of quality fruits.
- Light interception is influenced by plant density, canopy shape, canopy leaf area index and can be raised by increasing the



density of foliage in the canopy, the height of the tree and number of tress per hectare.

- Light intensity decreases, within the tree canopy as the outer portion shades the inner canopy.
- Light exposure influences flower bud differentiation, fruit set, fruit colour and quality.
- Light was found to perform a triggering action in the process of fruit bud differentiation in grapes.
- Failure of the flowering in mango trees with dense canopies (Buronkar and Gunjate, 1991) and opening of the canopies through pruning (Madhavarao and Shanmugavelu, 1976), (Rameswar, 1989) support indirectly the role of light in fruits bud formation in mango.
- However, the light dependence for the flower bud formation is not the same in different varieties. While, White Riesling variety of the grape requires less light intensity, Thompson Seedless requires less light for the fruit bud formation. Hogher light intensities of more than 3,600 ft candles and temperature above 35oC are favourable for the bud fruitfulness in Thompson Seedless grape.
- The light utilized by the plants for the photosynthesis corresponds to 400 to 700 nm of the electro-magnetic radiation from the sun.
- Kriedmann and Smart 1971 reported that the photosynthesis in grapes rapidly increases upto the light intensity of 5,000 ft (200 watts/m²).

IDEAL CANOPY ARCHITECTURE:

An ideal training strategy centers around the arrangement of plant parts to develop a better plant architecture. This plant architecture optimizes the utilization of

sunlight and promotes productivity. Ideal canopy architecture should fulfil as many as possible principles involved in canopy management. i.e., the canopy size should be dwarf, spreading and open in mango and guava. In order to obtain more yields per unit area of the land, it is desirable to have the required surface area per canopy volume by increasing the canopy height. But due to inconvenience in carrying out the cultural operations including harvest, the canopy height should be at manageable level.

ISSUES IN CANOPY MANAGEMENT:

An understanding of the reasons behind the difficulties in canopy management (Australian Extension avocado handbook, Newitt and Vock, 2001)

- The avocado is a rainforest species, which has evolved to compete for light in that situation. Growth is rapid and, if left unchecked, the tree may reach 15 to 20 m tall and 12 to 15 m in diameter within 15 to 20 years. Good spray penetration of the canopy and coverage often is more difficult to obtain and they also pose a higher risk of injury to pickers.”
- The combination of terminal flowering and the long cropping cycle in the avocado present a unique problem for canopy management. As fruit form on the perimeter of the tree and are carried for considerable time (in some cases, over 12 months from fruit set to final harvest), there are few opportunities for pruning that do not risk damage to fruit.”
- One option for reducing tree size that has been used successfully in other tree crops is dwarfing rootstocks. However, no dwarfing rootstocks suitable for commercial avocado orchards have yet been found.



- When establishing an orchard, land is generally the highest value input and growers need to maximize the return per hectare in as short a time as possible. The standard approach is to plant trees at a higher-than-normal density (up to 400 trees per hectare). Densities of up to 2000 trees/ha are being tried in California, but these are not considered suitable for Australian conditions. When planted at higher densities, trees will soon grow into each other unless canopy management is practiced. Once the side canopies meet, light penetration into the orchard is significantly reduced and, as a result, the fruiting surface migrates to the tops of trees. This reduces fruit yield, size and quality, makes pest and disease control more difficult and increases the costs of harvesting. Poor light penetration also reduces growth of the inter-row grasses, increasing the risk of soil erosion between the tree rows.
- Avocado branches are highly susceptible to sunburn. Heavy pruning exposes large limbs to the sun, and these limbs need to be protected by applying whitewash or a white plastic paint (not mineral-based paint).
- One of the most effective ways to minimize canopy growth is to maximize fruit load because a tree carrying a heavy crop has fewer resources to put into vegetative growth. Careful management of nitrogen is the key to maintaining a good balance between fruit production and vegetative growth.”

Lack of canopy management leads to:

- Larger height and stature
- Higher cost of management
- Low photosynthetic efficiency
- Low productivity
- High pest and disease incidence

CONCLUSION:

Canopy management is therefore, an essential tree management operation starts from the first year of plant establishment and enables the plant to produce/yield high quality and quantity by providing proper framework and more fruiting / yielding area.

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