

CANOPY MANAGEMENT

There are several operations involved in improving the yield and the quality of mango fruits. Among them, canopy management is one of the most important factors to sustain the yield and quality of fruits in mango. In many fruit crops, increase in production with enhanced fruit quality is achieved by managing canopies. Capturing and conversion of sunlight into the fruit biomass (dry matter content) is an important process in fruit production. In general, compact and small trees capture and convert sunlight into fruit production in a better way than the larger ones. The main controlling factors are the extent of incoming radiation and percentage radiation intercepted by tree canopies. It can be enhanced by proper canopy management practices. For commercial fruit cultivation, the natural form and shape of fruit trees are to be modified through the practice of pruning to achieve the targeted yield by scientific approach. This is because; it is not always wise to allow a plant to develop naturally, since unwanted portions may develop at the expense of those which are essential. Appropriate pruning practices keep the plant in such shape and condition as to yield fruits of desired quality. Canopy management depends on the nature and growth pattern of plant, number of plants per hectare and pruning techniques.

Principles of Canopy Management in mango

Canopy management is the manipulation of tree canopy to optimize the production of quality fruits. It encompasses both training and pruning which affect the quantity of sunlight intercepted by trees, as tree shape determines the exposure of leaf area to incoming radiation. An ideal training strategy centers around the arrangement of plant parts, especially, to develop a better plant architecture that optimizes the utilization of sunlight and promotes productivity. Light is critical for growth and development of trees and fruits. The green leaves harvest the sunlight to produce carbohydrates and sugars which are translocated to the sites where they are needed *viz.*, buds, flowers and fruits. Better light penetration into the tree canopy improves tree growth, productivity, yield and fruit quality. The density and orientation of planting also impact the light penetration in an orchard. Generally, in close planting, quicker shading becomes a problem. Initial build up of a strong and balanced framework of the tree is essential for further management. The canopy management should aim for,

1. Maximum utilization of light by regulating the growth

2. Avoidance of built – up microclimate congenial for diseases and pest infestation
3. Convenience in carrying out the cultural practices
4. Maximizing the productivity with quality fruit production
5. Economy in obtaining the required canopy architecture

The canopy management should broadly aim at

1. Formation of strong frame work having branches on all directions with near equidistance between branches.
2. Developing the canopy with centre opened so that it gets better exposure to sun light.
3. Controlling the stature/size of the plant to harness the maximum productivity.

CANOPY MANAGEMENT IN YOUNG TREES

The early stages of growth are most important for the initial shaping of the young tree. A well structured tree will be able to carry a heavy crop, facilitate spraying operations and ensure the fruit is exposed to plenty of light leading to a good blush on the fruit at maturity. Training the plant during juvenile phase is important to get a strong frame. To develop a strong trunk, the trees should be allowed to grow over 1 metre height initially. They are then cut back to a height of 0.6 to 0.7 m. The site of first cut is important for the development of a strong frame. Mangoes grow in flushes; each flush is delineated by a concentrated whorl of leaves on the stem. This is referred to as a “ring of buds”, as a bud capable of forming into a branch which is situated at the base of each leaf. If the cut is made above this “ring of buds” the resulting regrowth will be a feather duster effect of seven or more shoots developing. These would need to be thinned out to three or four if a good tree structure is to be attained.

However, cutting above the ring of buds may result in the formation of weak crotches, prone to breaking during storms and heavy bearing. Below the “ring of buds”, the leaves are more spaced out along the trunk. An inch below the ring of buds is the correct point to give a cut (Fig.1 and 2).

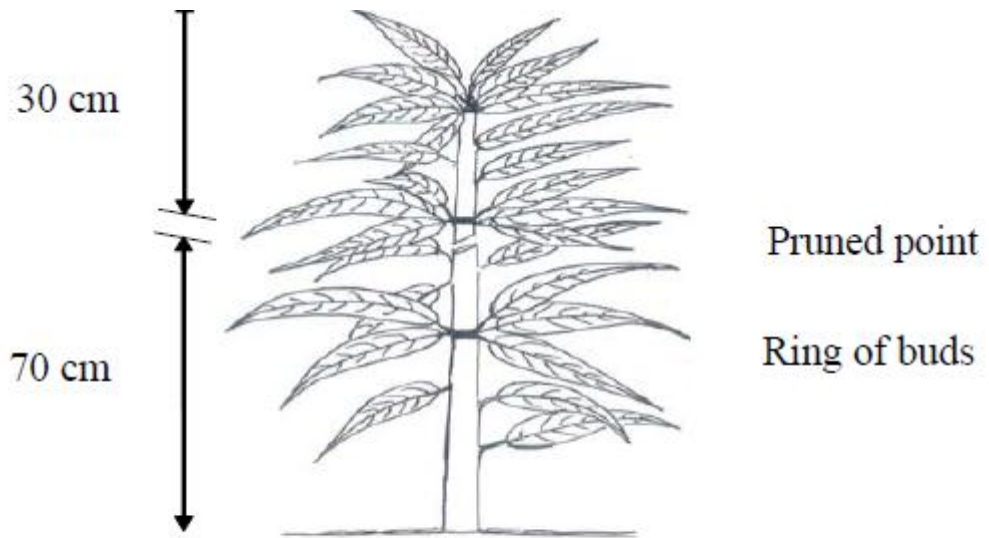


Fig .1. Young seedling of 1 M height with cut given below ring of buds

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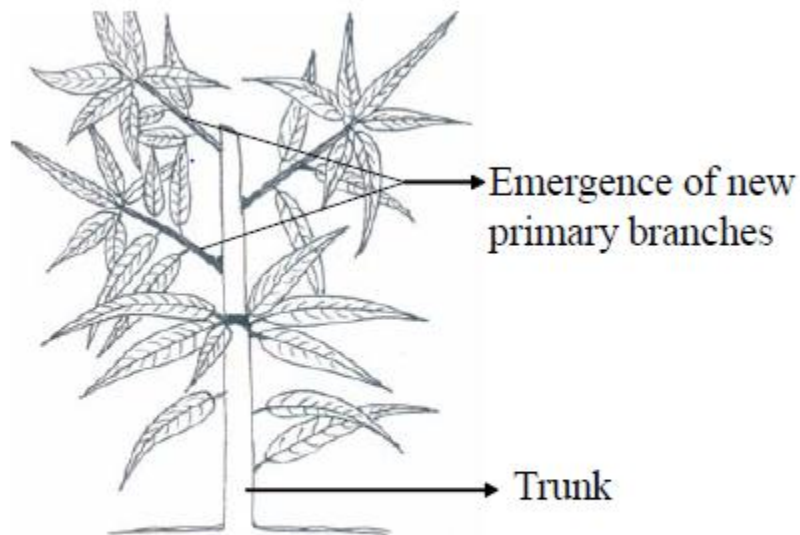


Fig .2. Emergence of new shoots below cut end

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It will ensure that the branches are well spaced out resulting in a strong frame for future development. After the initial cut, allow 3 or 4 shoots to grow into branches of over one metre long. These are then cut back to about 60-70 cm length, which will give a good strong branch for

supporting the growing tree. After this, the trees should start branching by themselves. Young trees can be pruned at any time of the year. The aim should be to develop a spreading tree rather than a tall tree. Downward and inward growing branches or branches that cross over each other should also be removed.

Stepwise operations

Allow the grafts to grow to a height of one metre from ground (single stem)



Head back the graft at 60-70 cm from the ground during October-November to induce primary branches (make a smooth cut with sharp secateur)



Heading back results in the formation of new primary branches (3-7) during March-April. Prune the excess branches and allow 3 to 4 in all the directions



Prune primary branches at 60-70 cm height to induce new secondary shoots (7-10 month after the first cut preferably during 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

CANOPY MANAGEMENT IN BEARING TREES

It may not be necessary to prune trees every year. Mango trees normally respond to pruning by sending out a vegetative flush, usually the heavier the pruning the more vigorous and numerous the flushes. Mango trees are terminal bearers, *i.e.*, they flower from the ends of the branches and will only flower on mature wood, *i.e.*, shoots that are six weeks or older. Hence, pruning affects the flowering and yield. It is therefore most important to ensure that the trees do not have enough vegetative flushes with poor yield. There are two periods when pruning can be taken up.

A. First pruning after harvest

First pruning should be done immediately after harvest and should be completed by the end of June/July. It includes:

i. Skirting. Removal of low hanging branches is known as skirting. It facilitates the operations such as fertilizer application and controlling of weed.

ii. Opening up. Removal of branches inside the tree which cross over or clutter up the centre of the tree restricting the penetration of sprays. One or two uprightly growing branches from center of tree are to be removed to reduce tree height significantly and to increase the availability of light inside the canopy for better photosynthesis. During removal of branches, first cut should be given on the lower side of branch, so that a smooth cut is possible which avoids bark splitting. In bearing mango trees, not more than 25 per cent biomass should be removed at a time; otherwise it results in excessive vegetative growth with reduced flowering shoots.

iii. Hygiene. It involves the removal of any diseased or dead branches in the tree, which could be a source of infection. However, it is need based and recommended for those trees found to have yield decline

B. Second pruning – pre flowering

Second pruning may be taken up in the middle of December and, if the timing is right, it is to be followed by a floral flush rather than a vegetative flush. Second pruning should be completed in a short period not exceeding one to two weeks.

i. Skirting: Low hanging branches which could cause fruit to drag on the ground are to be removed.

ii. Opening up: Twigs and disorderly branches inside the tree are to be removed to have a open canopy. This not only facilitates spray penetration for better insect and disease control but also allows light into the tree, improving fruit colour.

iii. Tip pruning: It is a useful practice where the trees have had a vegetative flush just prior to flowering. The young flushes are cut back to mature wood; the resulting flush may result into a floral one. Tip pruning will also reduce tree size (Plate.3).

iv. Hygiene: It is essential to reduce the source of flower and fruit infection. Any diseased or dead branches should be removed before flowering.

CANOPY MANAGEMENT THROUGH CHEMICALS IN BEARING TREES

Mango responds well for growth retardant treatments. Among the several chemicals, paclobutrazol has pronounced effect on flowering in mango. Pruning the flowered/vegetative shoots 10 cm above the node during June-July (immediately after harvest) followed by soil drenching with paclobutrazol 1 gm *a.i* per sq.m during August -September enhanced flowering, fruit set and quality of fruit in Banganapalli mango under irrigated condition in the regular season. Similarly, pruning 10 cm of terminal shoots after emergence of new growth (floral or vegetative growth) during December-January followed by application of paclobutrazol at 0.75 gm *a.i*. per tree of 9 year old during March-April resulted in good off-season crop in cv Neelum. Here also, trees subjected to this treatment should be under irrigation.

REJUVENATING OLD TREES

Old trees often produce fruits and difficult to harvest due to their size. Moreover, old trees harbour pest and diseases and it is difficult to reach the whole tree while spraying to control them. It is possible to cut these trees back to a more manageable size, but depending on the severity of the pruning one may lose two to three crops. Rejuvenation improves production, fruit size and quality once trees recover. But, rejuvenation of mango trees under rainfed condition is not recommended since the tree may not recover after pruning. There are four model approaches to take up rejuvenation in mango.

Model 1

In this model, the tall central trunks are cut back to about 3-4 m height from the ground. The actual site to cut back to should be at a point where there are side branches. A chain saw is necessary for the job to make a smooth cut. Here, one half of the tree is cut back and the remaining trunks and leaves will help protect the stump from sunburn. The freshly exposed trunks and branches to the sun should be painted with white water-based paint diluted three or

four times. This is to prevent sunburn, which could attract borer on to the damaged bark. In a short time, numerous shoots will develop; select the most vigorous of these, spaced evenly around the stump and if possible at differing heights. Remove all the unwanted shoots. This process should be repeated as often as necessary until the selected shoots begin to dominate and take over. Then the rest of the tree can be cut back and the operations may be repeated. By this method, half the yield will be realized throughout the process till it regains the vigour.

Model 2

Old, unthrifty trees can often be rejuvenated by a moderate to severe pruning. This is in the form of skeletonizing the tree, *i.e.* cutting back the branches of the tree till only the basic frame is left. Moderate skeletonising would entail cutting back the large branches to healthy wood, while at the same time maintaining the basic structure of the tree. Particularly large unthrifty trees would benefit from a more severe skeletonising, where all the main branches are cut back to the main trunk only leaving about a metre or so of branch. The whole trunk and remaining branches should be painted with diluted paint to prevent sunburn and borer attack. In both these cases there will be a proliferation of sucker growth. These should be treated as mentioned previously.

Model 3

In old and dense mango orchards, light interception and photosynthetic potentials of trees is reduced resulting poor yield. The branches existing on main trunk are considered as **first order branches**, the branches existing on first order branch are called **second order branches**, the branches existing on second order branch are called **third order branches**, similarly fourth and fifth order. At IIHR, Bangalore, pruning third order branches 30cm from point of origin recorded the maximum yield in Alphonso (86.3 kg/tree). Trial conducted at CISH revealed that pruning second order branches recorded maximum pooled fruit yield of twelve years after pruning (57.99 kg/tree) of Dashehari.(Fig.3).

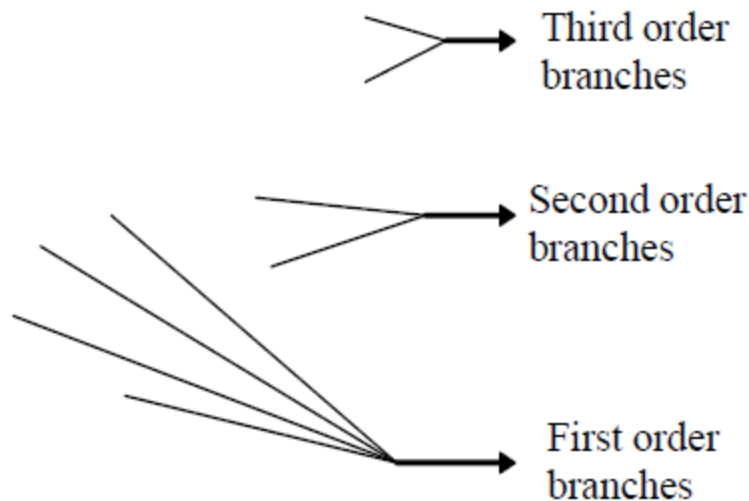


Fig.3. Pruning from third order branches retaining 30 cm from the origin

Model 4

Central Institute of Subtropical Horticulture (CISH), Lucknow had conducted a trial to rejuvenate 40-50 years old mango trees in the farmers field. In this process, main branches were pruned at a height of 5 M from the ground level during December. About 3-4 diverging branches were kept for developing healthy umbrella-shaped canopy and rests were removed from the base (Fig.4 & 5). Pruned surfaces were smeared with copper oxychloride paste immediately after pruning to check the microbial infection. Pruned trees were kept under intensive care and management. Cultural practices like nutrition, irrigation, hoeing, weeding *etc.*, were done properly. Profuse shoots emerged from prune branches from April onwards. Only 8-10 outward growing well spaced healthy shoots were retained per branch and the rest were removed. Plant-protection measures were seriously adopted especially against stem-borer, leaf cutting weevil and anthracnose. Because pruned trees came into flowering and fruiting after 2 years of pruning, growers ended up with loss by missing crops for 2 year, hence, technology was refined to undertake the pruning work in alternate rows in the orchards. With alternate row pruning, availability of light to unpruned trees in two adjacent rows was greatly improved and their

fruiting increased by 2-3 times. Thus, enhanced production from unpruned trees compensated the loss to some extent.

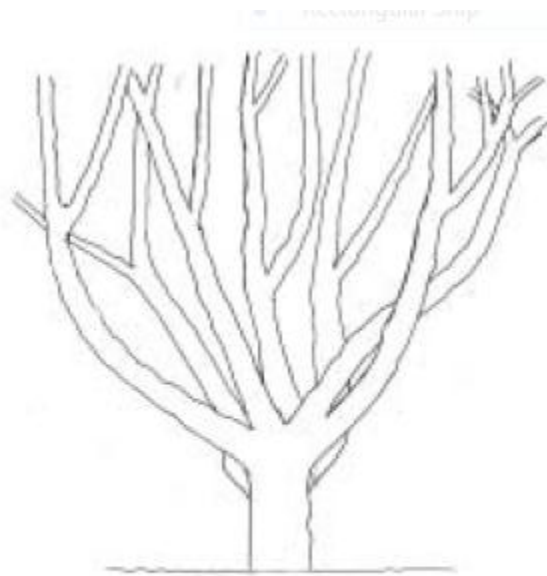


Fig.4. Before pruning

Canopy management in Guava

For managing the canopies of the trees under high density planting approaches like pruning and use of growth retardants singly or in combinations may be exploited. But under high density planting system, light and other microclimatic conditions are important aspects which directly or indirectly affect the vegetative growth, yield and quality of guava fruits. In case of temperate fruits like apple, pear and peach extensive study have been made but little work has been done on tropical and sub-tropical fruit crops. As guava tree respond well to canopy modification with respect to vegetative and reproductive growth therefore, modification of canopy through pruning and use of certain growth regulators in high density orchards may be steps to enhance the production efficiency. Guava has a higher proportion of 'shade' to 'sun' leaves and their leaves are found photosynthetically inactive under deeper shade and act as unproductive sink. Therefore, vegetative growth, fruit yield and quality are functions of light interception and translocation of light energy into chemical energy. Quality fruit is function of absorption of light and light is directly proportional to the yield of fruit trees interception was more in guava

trees planted, at wider spacing and decrease significantly with the depth of the canopies irrespective of the planting densities. It is observed that fruit yield and quality of guava fruits decreased with poor light interception at higher planting densities. Therefore, management of canopy under high density planting as must for proper light penetration. Narrow spacing (6×2 m) in guava increased the production per unit area and fruits had significantly higher values for total soluble solids, vitamin C, sugars and lower values of acidity. Increased yield of guava per unit area by increasing the plant population has also been reported. Now, pruning has emerged as a commercial and alternative method for regulating the crop in guava. Thus, the pruning may be helpful in reducing the tree size and improving the fruit quality as well. This gives an opportunity to increase the number of trees per unit area and subsequently the higher yield. Untrained or Untrained guava trees become huge and unmanageable even after 3-4 years of planting. The bearing area is reduced and the interior of the plant becomes entirely devoid of fruiting. Trees are pruned to increase the yield of quality fruits by removing the crowded and criss-crossed branches. Training and pruning begins at an early stage of plant growth to develop single trunk trees with well spaced scaffold branches to form the strong frame work. Apical growth is to be controlled within the first year of planting for better canopy architecture. Trees are topped to a uniform height of 60-75 cm from the ground. As a result, new shoots emerge. About 3 to 4 equally spaced shoots are retained around the stem to form the main scaffold limbs of the tree. These shoots are retained the stem to from the topping until they attain a length of about 40-50 cm. The selected shoots are further pruned to 50 per cent of their length for inducing multiple shoots form the buds below the cut ends and again emerged new shoots. This is mainly done to obtain the desired shape. The pruning operation continues maximize fruiting during the second year after density planting. After two years, the short branches within the canopy produce a compact and strong structure. All the plants are confined to a hedge and May-June of every year. Pruning in canopy management of Guava Tree pruning is an annual practice on Guava farms in India and is carried out to:

- Manage plant canopy and better plant architecture.
- Direct or control plant growth, to obtain the desired tree canopy.
- Encourage flower and fruit production to maximize production of high-quality fruit per unit area.

- Facilitate harvesting and to utilize the bearing area of the tree efficiently and obtain the desired leaf : fruit ratio.
- Optimize sunlight utilization and air movement in the tree. It is essential for obtaining optimal yield and high fruit quality. Dense canopies of plants results inadequate air movement promote fungal and insect pests within the tree.
- Effect rejuvenation by removing dead or excessive wood or shoots.
- Allow spraying and cultural practices to be applied more effectively.
- Extent the production period. Guava fruit bears on current season's growth and respond very well to pruning. The production season of Guavas can be controlled by the time of pruning. If pruning is done later in the season, fruit will also be harvested later.

Pruning usually involves there basic techniques: thinning, heading back and pinching or tipping, Thinning involves the removal of entire branches at the point of origin. By thinning, the plant is reduced without obviously altering its size or form. Heading back is the process of pruning to shorten branches. Heading back is usually used to induce production of flowers and fruit and to limit tree size. Pinching involves the removal of the growth tip of the stem. This action will stimulate the growth of side branches. Plant growth substances play a vital role in development of auxiliary shoots. These different techniques are usually combined to obtain the desired tree structure. Limited sunlight penetration will adversely affect yield and fruit quality once the tree starts bearing.