

Canopy Manipulation in Cashew: A Review

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FIGURE 1: Cashew Flower: Source (wikimedia.org)

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SUMMARY

Cashew has concurred the highest status in global market because of its countable nutritive status. The productive performance of cashew is greatly influenced by how best its canopy is manipulated for harnessing maximum benefits in terms of yield. Pruning of dead wood and crisscross branches can alone increase the yield by 30-40 per cent. The dwarf rootstocks also play a role in manipulating the canopy in cashew, wherein, canopy containment and yield were influenced by rootstocks. The canopy manipulation increases cashew productivity two-to three-fold and considered as superlative solution for food security.

INTRODUCTION

Cashew (*Anacardium occidentale* L.) belongs to the family Anacardiaceae and is a native of Brazil. Cashew, an important horticultural crop, is also gaining importance as an important rainfed tree crop both in traditional and nontraditional regions of the country. The Portuguese introduced it to India along the west coast during the 16th century to control soil erosion. The tree has a long productive life, perhaps up to 50 years; however, in poor conditions the economic life of tree would be reduced. The main product of cashew is nut containing a kernel. Cashew fruit also known as cashew apple and cashew nutshell liquid are the other products. The nut when processed gives the kernel, which is the economic product because of its taste and nutritional value. The cashew apple has various uses; it can be eaten as fresh fruit, or processed into juice and other products like jam, jelly, cider, pickles, etc. Feni, popular liquor is produced from cashew apple in the state of Goa. Cashew nut shell liquid oil is a by-product obtained during the processing of raw cashew nuts from the spent shells of the nuts and is used in friction linings, paints, varnishes and other industrial applications.

The production of cashew in India 7.43 lakh tonnes from an area of 11.05 lakh ha with productivity of 672.4 kg / ha. Whereas the requirement is 17 lakh tonnes per year. Thus there is shortfall of more than 50% in raw cashew nut production and hence India imports raw nuts from African countries. There is also threat for the import because now a days African countries also thinking

of processing cashew. The productivity is low particularly in Karnataka, Goa, Tamil Nadu, Andhra Pradesh and Odisha. The main factors for low productivity in these states are the large plantations under seedling origin and poor management practices. Pruning and training practices to shape the canopies and to rejuvenate the growth enabling the plantations to remain ever productive has arisen enough hopes in enhancing the cashew nut production in the country.

Pruning

Pruning is the judicious removal of plant parts viz., shoot, root, leaves, flowers, panicles or fruits to improve the efficiency and performance and to force the plants to behave in a way it are desired.

Principles of pruning

Pruning in any plant or species is based on certain principles. In cashew also plants can be pruned with various objectives. The broader principles of pruning in any species are follows:

- Overcoming the apical dominance.
- Changing the phases of growth.
- Maintaining the balance between root and shoot system.
- Relating to environmental conditions.

Besides these, varieties of cashew, growing conditions, spacing, cultivation practices adopted, type of canopy shape to be developed and incidence of pest and diseases are also to be considered while pruning the cashew plants.

Training is a method of directing the

plant growth in a desired direction, to form a definite canopy shape and contains the canopy size by employing pruning techniques.

Objectives of pruning and training

Any plant that needs to be pruned and trained should be with certain specific objectives. Some of the specific requirements of pruning and training in cashew are as follows:

- Development of stronger framework of branches.
- Exposing canopy area for tapping maximum solar energy.
- Distribution of fruiting branches throughout the canopy and securing the balance in canopy.
- Facilitation for easy farm operations such as manuring, inter cultivation, spraying harvest and picking of nuts.
- Accommodation of higher number of plants per unit area for productivity enhancement.
- Prevention of damage from wild fire, cyclones or strong winds.
- Advancement or delaying of flowering and fruiting.
- Overcoming pest and disease problems.

Types of training

In cashew, though it was suggested that modified leader system or open centre of training system be adopted when wider

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spacing is followed, other canopy shapes may also be adopted depending on the spacing provided.

Modified leader system of training

At present cashew grafts after planting are forced to grow with a clear single stem up to a height of 45 - 75 cm by removing side sprouts. Branching is allowed later in different directions with de-topping of the central leader to a height of 3-4 m. Regular annual trimming of branches and removal of crises cross branches is to be resorted to maintain canopy in definite size and shape. Finally, the canopy is maintained in a semi globular shape.

In this system, the central leader is de-topped depending on space allotted in orchard. Less spaced plants can be de-topped to a lesser height so as to have higher leaf area exposed to sunlight. Thus developed canopy needs annual maintenance by minimum trimming of the over growth after harvesting of the fruits. This kind of canopy helps in reducing the dead wood development and water shoot development. The system is well suited for plants spaced at wider spacing. The height of the plants in modified leader system of training is regulated as per the space provided. The height of canopy, for the plants spaced at 5m x 5m for example may be contained at 2.5 m. Similarly, in the plantations of 8m x 8m spacing, the plants are to be de-topped at 4m height.

Open centre system

In this system of training, the plant is allowed to grow up to a height of 30 to 50 cm from ground with a clear single stem and there after the terminal growing tip is pinched off to force lateral branching. The lateral branches are allowed to grow in all the directions to form an open centre vase shape. The shape needs to be maintained by minimum trimming and removal of overcrowding of branches. The canopy needs to be opened every year for forcing the light penetration to interior part of the canopy.

In this system, the light penetrates deep into interior parts of canopy and hence dead wood development is very less. Added to this there is scope for flowering both in inner and outer surfaces of canopy as there is increased surface area for flowering and fruiting. In cashew, this system is also well suited for wider spaced plants in an orchard.

Central leader system

The plants are allowed to grow tall without pruning the central stem in this system of training. Only lateral branching is forced in different directions. In the initial years of orchard establishment of widely spaced orchards (8m x 8m and above) this system is good as it gets sufficient sunlight to grow and flower. In closer planted orchards in later years, lower branches get

shaded due to overcrowding of branches and drying of the branches and dead wood development begins. Therefore, the system is advisable to only widely spaced plants in an orchard. It also requires annual maintenance by pruning and trimming. However, there is always difficulty for forcing all the plants of an orchard to develop central system because at times, the central growth stops and only side branches grow.

Rejuvenation of senile trees

Redevelopment of canopy is possible by heading back or by limb pruning of existing senile trees, which have exhausted canopies and erratic growth resulting in reduced yield. Heading back if done at 1.0 - 1.5 m height of the trees, new flushes emerge from dormant buds on remaining trunk and develop into a vigorous new canopy. The new vigorous canopy develops into a productive growth within 6-10 months depending on the variety and hence it should be attempted immediately after the harvest of the crop yield (May to June) so as to get normal yield in ensuing fruiting season. It was noticed that cashew stem and root borer (*Plocaederus ferrugineus*) problem is worsened with the beheading of the trees. The shot hole borer also starts feeding on the cut trees. Therefore, sufficient precautions are to be taken up before taking up limb pruning in cashew.

Steps be considered while rejuvenating old trees

- Prior survey of the plot to see the suitability of the plants for rejuvenation to be done. If several plants in the plot carry the cashew stem and root borer damage the rejuvenation may not be possible.
- If a few plants have damage in the initial stage, remove the cashew stem and root borer grub and treat the plants with insecticide before taking up pruning.
- Prior to beheading swab the trunk with chlorpyrifos (0.2%) to prevent the damage and 2-3 times after beheading at regular intervals of a month until new canopy develops. Regular checking for prevention of cashew stem and root borer damage is required.
- Smear pruned ends of branches with 10 per cent Bordeaux paste to prevent the gummosis and entry of pathogen. Best season for heading back of the old trees is May - June i.e, immediately after the harvest of the crop.
- The new flushes come out from the dormant buds on the trunk. These sprouts need to be protected from insect pests (mostly sucking pests and leaf

beetles and caterpillars) in the initial stages by applying suitable insecticides such as monocrotophos (0.05%) and lambda-cyhalothrin (0.003%).

- Good phytosanitary measures should be adopted to manage the rejuvenated trees.
- Limb pruned trees should be maintained further by pruning or trimming as and when required in subsequent years. It may be noted that yield of limb pruned trees was much better than freshly planted trees.
- If plants are properly protected the canopy redevelopment can help in enhancing the nut yield to its full potential after 2-3 years.

Top working

Generally, old cashew plantations are of seedling origin and would have become senile. Such plantations can be rejuvenated by top working on flushes arising from beheaded trees. Trees rejuvenated by top working start flushing and fruiting in the next season with vigorous canopy growth.

Requirement for top working

- Trees should be young enough (15-20 years) to produce new flushes; preferably trees should have smooth brown colored bark.
- Trees should not have the infestation of cashew stem and root borer.
- Trees should be healthy with well-developed branches and root system.

Method of top working

Top working involves

- a) Beheading of trees
- b) Grafting of new flushes on beheaded trees with a desired scion variety.

a) Beheading of trees

- Convenient and suitable time for beheading of trees is immediately after the harvest of the crop i.e., period during April - June depending on fruiting period of the tree (early, mid and late season of cashew types).
- After selection of trees for beheading, cut the limbs for reducing weight of crown and finally retain the stump at 1.0 - 1.5 m height with primary branches. While pruning limbs, care should be taken so that the bark should not have splinter damaged on retained stump.
- Cut wounds should be treated with 10 percent Bordeaux paste soon after pruning to prevent gummosis and the invasion of pathogens if any.

I. Preparation of 1 percent Bordeaux mixture

Dissolve 1 kg of copper sulphate crystals in 50 liters of water. In another vessel containing 50 litres of water, prepare milk of lime with 1 kg of quick lime. Pour the copper sulphate solution into the milk of lime slowly, stirring the mixture continuously. Test the mixture before use by dipping a polished knife in it. If the blade shows a reddish color, add more lime until the blade is not stained when dipped again. Always use plastic buckets for preparing Bordeaux mixture

ii. Preparation of 10 percent Bordeaux paste

For preparing 10 percent Bordeaux paste, dissolve 1 kg of copper sulphate crystals in 5 liters of water and 1 kg of quick lime in 5 liters of water and prepare the paste.

Top working and grafting

- Hundreds of new flushes may sprout from the dormant buds on the remaining stumps. About 15-20 new flushes of 45-60 days are to be selected in different branches of the trunk for grafting.
- The sprouts should be grafted adopting the softwood grafting technique with scion sticks of high yielding or required elite type of varieties.
- The ideal season of grafting is June - August and depending on the growth of flushes. The non-grafted shoots be removed gradually in a phased manner. The shoots arising from the base of the grafted shoot be pruned off immediately.
- Finally, only about 10-15 successful grafts are retained and remaining needs to be thinned out. This can be judged depending on size and canopy development capacity of the plant. The gradual thinning and removal of unwanted flushes is to be continued until normal canopy establishes.
- The top worked trees can start yielding from 2nd year of grafting onwards.

Tools used for pruning

Training and pruning done through manual method is cumbersome in cashew. There are tools available to make the operation simple and easy.

Secateur

Used to prune lateral shoots and small twigs of 1.5 to 3 cm diameter.

Pruning saw:

Used to prune small woody branches of 5 to 10 cm diameter.

Pole tree pruner and pruning shear

Used to prune 10 to 20 cm diameter upto its reachable height.

Chain saw

Power or fuel operated chain saw is used to prune woody shoots of any size.

Telescopic power tree pruner

Used to prune woody branches of smaller size upto its reachable height.

Pest management in the rejuvenated trees

The trees which have been top worked need to be checked for any symptoms of cashew stem and root borer pest incidence right from the first week after top working at 15 days intervals. Normally, the fork regions and the cut ends (if uncovered) will have the pest entry and exudation of the fine frass material in small quantity. These spots of the bark should be chiseled cautiously so as not to make more damage onto the bark of the top worked trees. The tunnel made by the grubs, which bore into the bark, can be traced out by the freshness of frass. The young grubs remaining inside need to be removed and killed. In case, the frass comes out from the root zone the soil at that spot need to be dug out and the infested root needs to be checked for the grubs which are normally found in the underside (ventral) portion of the roots.

The direction in which the grub has moved in both the stem and root can be made out by the freshness of frass where in the older frass is dark brown and the fresh frass will have reddish colour. In case the grubs are not removed when they are young they damage the bark severely and later enter into the hard wood during which time the frass comprises of whitish fibrous powder. The grubs have to be killed under these situations using a pliable wire or gear wire as the tunnels will be zigzag in nature. A slushy sound is heard as soon as the grubs get poked with the wire and the body fluid oozes out of the tunnel.

The chiseled surface needs to be treated using either carbaryl suspension (1.0%) or chlorpyrifos solution (0.2%). Repeated infestation of treated top worked trees is not uncommon. Hence constant vigil of these trees and those immediately next to it is of utmost importance during the months of July to November when the symptoms of infestation like frass and yellowing of the shoots is noticed. In certain cases where water logging occurs at the collar region the bark starts rotting at the collar region and the tree likely be attacked severely by the shot hole borers. In such cases, there is an immediate need for treating such trees by swabbing and drenching with 0.2% monocrotophos (approximately 2-4 it's per tree) as such trees will lead to spread of infestation to the neighboring trees in a short time.

CONCLUSION

Cashew has concurred the highest status in global market because of its

countable nutritive status. Low productivity reflected with high cost makes cashew nuts not available for middle and lower class of people. The improved productivity will increase the per caput consumption and best solution to overcome malnutrition. To optimize fruit production and productivity, thoughtful canopy manipulation is one of the most important subjects to sustain the yield and quality of fruits. The above techniques are found suitable to increase cashew productivity two-to three-fold and considered as super lative solution for food security.

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