Guava Rejuvenation

Central Institute for Subtropical Horticulture
Rehmankhera, Lucknow-227 107

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Gorakh Singh
Rajneesh Mishra
G.P. Singh

Central Institute for Subtropical Horticulture
Rehmankhera, Lucknow-227 107

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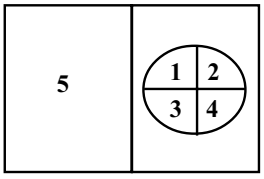

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Introduction

Guava is one of the most common fruits in India. It is quite hardy and prolific bearer. Guava fruits is often called poor man's apple, though the fruit is neither poor in its nutritive nor commercial value. It excels most other fruits in productivity, hardiness, adoptability and vitamin C content. Guava has got well-established local market in over 60 countries throughout the tropics and subtropics, including some of the Mediterranean areas. Presently, the productivity of guava is much below the productive potential, which understandably could be attributed to the significant prevalence of old and unproductive orchards with declining yield pattern. Manipulation of canopy size and shape by means of pruning and training for its containment and for better yield performance was not felt as a necessary orchard management technique for guava in earlier days. In guava, majority of the older plantations are of seedling origin of non-descript material and have poor genetic potentiality and have become senile. Such plantation can be improved through rejuvenation technique.

Economic importance

Guava is one of the richest natural sources of vitamin-C containing 2 to 5 times more vitamin-C than oranges and 10 times more than tomatoes bred for high vitamin-C content. Compared to other fruits, the whole guava is a moderately good source of calcium, a fair source of phosphorous and a good source of iron. Guava is consumed in different ways. The fruit is usually eaten raw, both green and ripe (when it becomes fragrant). It is also stewed and used in short cakes, puddings, sauce, ice cream, butter, marmalade, chutney and other products and pies. However, guava fruits are processed commercially into jelly, jam, cream, cheese, puree, juice, powder and nectar.

Area recommended for production

Today, it is grown practically in all the states of India and the best quality guava is produced in the Indo–Gangetic plains extending from west to east of Uttar Pradesh and Bihar. However, Allahabad district of Uttar Pradesh has the reputation of growing the best guava in the country. In India, guava is well adapted in almost all states, contributing 4 per cent of total production. Acreage of 0.25 million hectares with annual production of 1.75 million tones, show the encouraging potential of its commercial cultivation.

The major guava production belts in different states in India are as follows:

S. No.	Important belt of different states
1.	**Andhra Pradesh-** East Godavari, West Godavari, Guntur, Krishna, Anantapur, Medak, Khammam.
2.	**Bihar-**Bhagalpur, Muzaffarpur, Ranchi.
3.	**Gujarat-** Bhavnagar, Ahemdabad.
4.	**Karnataka-** Bangalore, Kolar, Shimoga, Dharwar.
5.	**Madhya Pradesh/ Chattishgarh-** Indour, Durg, Jabalpur, Rewa, Bilaspur, Raipur
6.	**Maharastra-** Satara, Beed, Pune, Ahmed Nagar, Aurangabad, Amaravati.
7.	**Orissa-** Cuttack, Bhubneshwar.
8.	**Tamil Nadu-** Madurai, Dinadigul, Salem.
9.	**Uttar Pradesh-** Allahabad, Farrukhabad, Kanpur, Unnao, Aligarh, Badaun, Varanasi, Fatehpur, Lucknow, Faizabad.
10.	**Rajasthan-** Udaipur, Ajmer, Chittorgarh, Sawai Madhopur, Kota, Bundi, Jaipur, Jhalwar, Khethari, Banshwara.

Production constraints

Over the years, productivity of guava crop continues to be low. There are various limiting factors related to production and productivity which is pertinent and gravest is the declining trends in bearing potential of senile orchards. Thickly shaded guava orchards are commonly seen in large tracks in different parts of country. These have brought down the average productivity. Boosting up the present productivity of 7 to11 tones per hectare is a challenging task for researchers as well as the extensionists. But what makes their task quite daunting is the declining production potential of old and crowded orchards existing in abundance (Fig. 1). It has been observed that after 15 to 20 years of age orchards generally begin to lose vigour and bearing potential and the dreaded disease of wilt accelerates their process.

Fig 1. Old and crowded guava orchard

The essentiality of developing and deploying appropriate technology to manage such senile orchards in order to attain the competitive edge in commercial production and to meet the quality standards of the conscious consumers led to initiation of research efforts in this area by the Central Institute for Subtropical Horticulture, Lucknow. A technology to rejuvenate and restore the production potential of old, un-productive and wilt affected

orchards has been developed, which employs pruning of branches at different periodicity and at different severities. The technology also helps in maintaining the manageable tree height with open architecture and canopy of healthy shoots with outwardly growth facilitating penetration and utilization of light. Crowding and encroachment of guava trees with subsequent inefficient light utilization, is an obvious problem with older orchards, if trees are not well managed. The internal bearing capacity of guava trees also decreases with time, due to overshadowing of internal bearing wood.

Technology for rejuvenating senile orchards

The rejuvenation technology involved the heading back of exhausted trees (showing marked decline in annual production) to the extent of 1.0 to 1.5 meter height above the ground level (Fig. 2) during May-June or December-February with the objective of facilitating production of new shoots from below the cut-point and allow the development of fresh canopy of healthy shoots (Fig. 3).

Fig 2. Heading back of branches of guava trees

Fig 3. Newly emerged shoots on beheaded branches of the trees

The newly emerging shoots are allowed to grow up to a length of about 40 to 50 cm, which could be attained in 4 to 5 months of rejuvenation pruning (Fig. 4).

Fig 4. Tree growth after 4 months of heading back

These shoots are further pruned out to about 50 per cent of its total length (Fig. 5) for emergence of

Fig 5. Trees showing shoot pruning (first cut) after 4 months of heading back

multiple shoots below the pruning point. This was mainly done to modify the tree structure and maintain canopy size (Fig. 6).

Fig 6. A portion of branch showing second pruning for better canopy development

Profusely emerging shoots in the inner canopy are also pruned out to promote branching. The multiple shoots developed as a result of second pruning are capable of producing flower buds (Fig. 7). The farmers keen to take rainy crop can allow the shoots to bear buds and fruits.

Fig. 7. A portion of branch showing flowers as a result of second pruning

However, as the winter crop has more marketing edge and value due to quality, taste and fruits being free of pest incidence, it is desired to promote fruit load in winter season. Hence, to check the onset of rainy crop, shoot pruning (50%) is also done again in May (Fig. 8).

Fig 8. A portion of branch showing better fruiting

Emergence of new shoots is facilitated. These new shoots emerging after May pruning are found to have

high flowering and fruiting potential for winter crop. This procedure of sequential and periodic pruning is continued every year for proper shaping of tree canopy (Fig. 9 & 10) and to ensure enhanced production of quality fruits during winter season.

Fig 9. Better tree canopies after management of shoots

The cost of rejuvenation technologies and the yield loss in the first year are compensated with sale of wood procured from pruned trees as well as the enhanced income in raising intercrop in rejuvenated orchards.

Growth and yield

Pruning at definite periodicity as standardized above rejuvenated the trees with attainment of healthy and vigorous canopy and development of short tree architecture conducive for canopy management, plant protection measures, cultural practices and harvesting operations. Grower should follow the management practices prudently for survival of trees and successful utilization of technique.

An enhancement of about 20-30 per cent in yield is recorded from these trees of cultivars Allahabad Safeda and Sardar as against un-pruned trees after the first year of rejuvenation pruning.

Fig 10. Aerial view of rejuvenated orchard

Yield enhancement in range of 70-90 per cent over the un-pruned trees is recorded after second year of pruning as with topping and hedging, vegetative to reproductive balance begins to stabilize (Fig. 11).

Fig. 11. Fruiting on rejuvenated guava tree

Fruit load with better quality also shifted significantly towards the interior of the canopy. New growth and inducement of bearer shoots are stimulated in the inner canopy in the same way the hedging and topping encourages new growth on the outside of the canopy. Upright branches generally remain vegetative and vigorous. Horizontal branches generally are more fruitful. A good combination of these two is necessary for fruiting in subsequent seasons. Therefore, horizontal growth of branches should be promoted rather upright growth to facilitate maximum bud growth. Tiller like growth of undesirable shoots and branches need to be uprooted for judicious use of nutrition and development of productive canopy.

Fruit yield and quality

Treatment	Fruit yield after rejuvenation (kg/tree)			Fruit quality		
	1st year	2nd year	3rd year	Weight (g)	TSS (^{0}Brix)	Total Sugar (%)
Rejuvenated	40.0	82.0	138.0	230.0	13.0	11.16
Unrejuvenated	28.0	41.0	56.0	119.0	9.0	7.97

Manipulation of vegetative growth and fruiting pattern after rejuvenation of trees

One of the critical characteristics of guava is that flowers are borne on newly emerging lateral shoots, irrespective of time of year. Consequently, the occurrence of bloom and fruiting in the course of the year may be erratic or seasonal, depending on how the environment affects shoot growth. This characteristic allows the tree to be manipulated to crop when desired in a favourable climate. Pruning is the main methods to force the axillary bud to shoot. Presumably, the flowers are already differentiated before the side shoots emerge,

implying that the lateral buds should not be forced to break before differentiation has been completed. Shoot growth is indeterminate under good growing conditions long vigorous shoots dominate, which suppress the emergence of flowering side shoots. Canopy design and shape influence light interception and higher monetary returns can be assured to guava growers.

One year after rejuvenation of guava trees, regular shoot pruning has been found efficient method for controlling tree size and better production in the rejuvenated orchards. In this method, mature shoots are cut back to 50 % in May-June for emergence of new shoots below the cut end (Fig. 12). After the appearance of flowers on new shoots, which developed from previous cut, semi-hard wood portion of these shoots is pruned out in September for induction of new shoots below the cut end (Fig. 13).

Fig. 12. Pruning for the initiation of new shoots, capable of producing flower buds

Fig. 13. Re-pruning of new shoots when the fruits are 2-3 cm in diameter for initiation of new shoot

These shoots are repruned when the fruits attained 2-3 cm diameter (Fig. 14) in December. The new shoots, which resulted from the third cut, are found to be efficient in fruit production in the following season (Fig. 15).

Fig. 14. New shoots that emerge as a result of repruning of new shoots, are also efficient in fruit production

Fig. 15. A portion of branch showing several fruits bearing shoot as a result of pruning

The crop yield is harvested during December – January, April – May and August – September, respectively (Fig. 16). No fruit is harvested in April-May under control trees. Studies indicate that overlapping of fruit growth developed as a result of pruning, makes it possible to harvest 3 crops in a year. With proper management of new shoots and flower initiation, the young shoots can be forced again to flower and fruit in the next season. The success of this technique depends upon the proper management of shoots through precise and timely pruning.

Fig. 16. Response of topping and hedging on growth and fruiting

Rejuvenating wilt-affected guava trees

Wilt is a pernicious disease and a curse to guava industry. It causes enormous loss to guava plantation every year. Browning characteristically identifies its incidence and wilting of leaves from tip, discolouration of stem, bark splitting followed by complete

Fig 17. Wilting plant showing bark splitting

mortality of branches and then whole tree (Fig. 17). An alternative period of heading back during December-February was also standardized, wherein the orchards particularly those infested with wilt disease were headed back during the stated period. Experiments at CISH showed encouraging results in regaining healthy canopy as well as crop bearing potential in wilt affected trees by way of severe pruning and intensive cultural and nutrient management.

Under experimental trial, wilt affected trees were headed back from 1.0 to 1.5 m above the ground level during December to February. The topping height i.e. the point of heading back is generally decided on the basis of extent of disease infection and its severity as well as the tree architecture. Pruning is undertaken from 5 cm below the infection point. It is identified

through presence of green wood and healthy pith. Profuse emergence of shoots was observed on the wilt affected trees and they were allowed to grow. After five months of growth, i.e. May-June, the shoots were subjected to pruning to 50 per cent of their length for initiation of new shoots to bear floral buds for winter season crop (Fig. 18, 19, 20, 21).

Fig 18. Developing canopy after rejuvenation of wilting plant

Fig 19. Developing canopy on wilted trees as a result of rejuvenation in the farmer's field

Fig 20. Flowering on wilted trees as a result of heading back followed by shoot management

Fig 21. At farmer's field

With this technique not only new canopy was restored but also yield of 30 to 35 kg/tree was obtained.

Microbial analysis of soil

Initial results of investigations about load of causal pathogen of wilt i.e. *Fusarium oxysporum* and *Fusarium solani* in the rhizosphere of the wilt affected trees subjected to pruning for rejuvenation and wilt affected control trees have been found to be encouraging. Microbial analysis

of soil samples showed comparatively lower load of *fusarium* in the rhizosphere of the pruned trees. Observing the encouraging results of the technique in rejuvenating the senile orchards, demonstration trials were planned to study the on-farm performance in different farming situations.

Technology demonstration in farmers' field

Twenty three demonstrations trials were laid out in the predominant and traditional belts of guava located in Allahabad region. About 1470 guava trees including 750 wilt affected trees were subjected to pruning for their rejuvenation in different locations of Allahabad and Kausambi districts of Uttar Pradesh (Fig. 22). All the trees responded well to pruning and developed new canopy of healthy shoots except for 20 trees which were severely affected with wilt disease. With subsequent pruning in May a good harvest of quality fruits was secured. As the technology helped in securing yields in range of 20 to 25 kg/ tree in different demonstration plots after first year of rejuvenation, the farmers rated the technology effective in managing the senile orchards and regaining their production potential.

Fig. 22. Demonstration trial in farm's field

With the encouraging results at farmers' fields the rejuvenation technology for guava standardized by CISH sought the attention of farmers as well as the government agencies engaged in promotion of guava. An extensive programme for rejuvenation of senile orchards has been launched under National Horticulture Mission (NHM 2005) in Uttar Pradesh and state departments of Punjab, Haryana, Madhya Pradesh, Bihar and Maharashtra have shown keen interest for technological collaboration and interventions in their respective areas.

Cultural practices in rejuvenated orchards

Inter cultivation

Regular inter cultural practices are essential for proper upkeep of the pruned guava orchards. It improves physical condition of soil, ensures aeration by breaking soil surface crust and removes those weeds which compete for soil moisture and nutrition. In order to manage the orchard soil, two time ploughing is necessary in a year. One ploughing should be done during June and second ploughing during December. The first ploughing helps in checking run-off losses and facilitates maximum intake of water into the soil. The second ploughing checks the weed growth and induces vegetative shoots.

Orchard floor management

Besides rejuvenating the trees, this technology also offers opportunities for employment and income generation through raising intercrops in the floor space of the pruned orchards. Intercropping is intended to maximize land and space use efficiency to generate supplemental income, particularly during the phase of canopy development in pruned orchards. After rejuvenating the guava orchards, tree takes about 2-3 years to develop canopy and cover the area. However, great care should be taken in selecting the right type of intercrops at the centre, between and within rows of pruned guava trees. Vegetables and leguminous crops can easily be taken upto three year's after rejuvenation. The crops like cowpea, bean, cabbage, cauliflower, chillies, okra and partial shade- loving plants (ginger, turmeric and elephant- foot yam), as intercrop in the orchard provide sustainable return from the initial stage of canopy development (Fig. 23).

Fig 23. Chilies as intercrop in the rejuvenated orchard

Water management

The chief economic consideration, which encourages growers to go for guava cultivation is that, this tree does not suffer much, if it is not watered during hot months. But adequate moisture is required soon after heading back of branches for proper initiation and development of shoot growth. Care of pruned trees requires watering them regularly during the dry season. Due to lack of moisture stress in the pruned

trees, the emergences of new shoots as well as rejuvenation process are severely affected. Therefore, it is necessary to ensure irrigation in the rejuvenated trees which is required at regular intervals for initiation of shoots below the cut portion. To promote the proper development of tree canopies and fruiting twigs, irrigation required at the interval of every 7 to 10 days in summer and about 15 to 20 days interval in winter, in addition to the period of rainfall during the monsoon season.

Surface mulching in rejuvenated orchards

Mulching at the base of pruned trees is done by using black polythene sheets (100 micron or 400 gauge) or heavy mulching with organic material, such as, straw, dried grass, banana leaves surrounding the main trunk.

Mulching with organic materials should be applied thick enough (12 to 15 cm) to prevent weed growth yet permit rain water penetration to the root area. Black polyethylene sheets prevent soil surface evaporation and tend to produce water under the sheets through condensation, supporting tree growth besides affording weed control. There is a considerable reduction in water application in polythene mulched orchards as compared to unmulched orchards. Reduction in water could lead economized the inputs and leading to enhance production per unit area (Fig. 24-25).

Fig. 24. Polythene mulching in rejuvenated orchards

Fig 25. Better fruiting under polythene mulched tree after rejuvenation

Integrated nutrient management

Integrated nutrient management in guava refers to maintenance of soil fertility and plant nutrient supply to an optimum level for sustaining the desired crop productivity in rejuvenated orchards through optimization of the benefits from all possible sources in an integrated

manner. Therefore, it is holistic approach where we first know what exactly is required by plants for optimum level of production, in what different forms these nutrients can be applied in soil, at what different timings is best possible method, and how best these forms can be integrated to obtain higher productivity with efficiency of economically acceptable limits in environment friendly way. In the rejuvenated guava trees, integrated nutrient and water management assumes much more significance. These two inputs are essentially required to be managed in a manner, which provides maximum output. The amount of fertilizer to be applied, depends on the age of the tree, condition of tree and type of soil. For proper growth and profitable yield, fertilizer should be in the required optimum dosages. The results on the effect of manures and fertilizer on the yield and growth have clearly shown that guava is very responsive to the application of inorganic fertilizers alongwith organic manures. Soil type, nutrient status and leaf analysis can give better indication for requirement of nutrients. Since, leaf is the principal site of metabolic activity in the plant and changes occurring in this leaf metabolic activity are reflected in the plant performance, emphasis is now being given to adopt leaf analysis as a tool to assess the nutrient needs of guava plants. Critical limits of N,P,K, Ca and Mg have been worked out, which are 1.4-1.96, 0.20-0.40, 1.31-1.70, 0.67-0.83 and 0.25-0.68 per cent, respectively.

In the rejuvenated orchards, first application of FYM @ 50kg/plant alongwith 5kg neem cake/plant is made at the time of heading back of branches. Six month after heading back, manure and fertilizers may be given as FYM 50kg, 3kg neem cake + urea 1300g + single super phosphate 1875g and 500g muriate of potash per plant per year. This mixture is to be applied in two split doses preferably in June and September. Fifty per cent of urea and entire dose of muriate of potash to be applied in June and the rest dose of urea and entire dose of single super phosphate are applied in the month of September. Fertilizers are applied in a ring which covers an area of 30cm away from the trunk and covering the periphery of the tree. Soil should be dug to depth of 8-10cm and the fertilizers should be properly mixed in the soil. Deep digging should be avoided, as most of the nutrient absorbing roots are located close to the surface.

Micronutrient deficiencies

Deficiencies of zinc and boron have become widespread in different guava growing areas.

Zinc

As a result of zinc deficiency, the leaves become small and form a cluster.

Intervenial chlorosis, sparsely distributed foliage, reduction in leaf size and leatheryness of leaves, reduced plant growth, die back of branches, reduction in number of flowers and cracking of fruits are the other characteristics symptoms expressed by the trees. The deficient trees do not flower normally and also get barened with no flush. Extreme reduction in yield with poor fruit quality are also observed. It is a serious problem in waterlogged and saline areas.

Management

1. Soil application of zinc sulphate @ 800g/tree, 10 to 15 days before flowering (in winter as well as in rainy season flowering) should be done.
2. Two pre-blossom sprays of 0.3 to 0.5 per cent zinc sulphate at 15 days interval should be done.

Boron

Its deficiency in guava results in internal necrosis and affected portion becomes hard. Fruit size is reduced and leaves start falling. Cracking of fruits are seen in extreme cases.

Management

1. Pre-flowering spray of 0.3 to 0.4 % boric acid should be done.
2. Spray of borax @ 0.5% (dissolved in hot water) during July and August are beneficial for fruit quality.

Management of pests and diseases

Fruit fly, fruit borer and bark eating caterpillars are major insect pests, whereas guava wilt, fruit rot and die back are the important diseases.

Pest Management

Fruit fly (*Bactrocera dorsalis* Hendel): The fruit fly is the most destructive insect in production of guava, particularly during rainy season. When the fly remains uncontrolled, the amount of marketable fruit is drastically reduced. Damage occurs as the larvae hatch out from eggs oviposited beneath the surface of ripening fruit and begin to feed on the flesh. Affected fruits turn progressively soft and mushy as the larvae begin feeding, until the fruits become 'waterlogged and the juice begin to drip on handling.

Control measure

1. The traps are very useful tool in monitoring and control of population of fruit fly. Hanging of bottle traps containing 200 ml of water emulsion of methyl euginol (0.1%) + malathion (0.1%) during fruiting season (April-July) is very effective for control of fruit fly. Ten traps per hectare in orchard give satisfactory control. Traps can be fixed during morning time.
2. Collection and destruction of infested and fallen fruits along with maggots useful in reducing

the pest population. Ploughing tree basin also helps in checking the pest population as the pupae are destroyed by being exposed to unfavourable temperature and also becomes the prey for predators.

3. Adult fruit flies can be controlled by bait spraying of carbaryl (0.2%) + 0.4% protein hydrolysate or molasses at pre-oviposition time.

Bark eating caterpillar (*Indarbela* spp.): It is another serious pest of guava found all over the India. The old, shady and neglected orchards are more prone to the attack of this pest. The caterpillars bore into trunk, main stem and thick branches of guava trees and remain inside the holes during the day. The caterpillars come out in night to feed on the bark and make silken galleries inside.

Control measure

1. Kill the caterpillars mechanically by inserting the iron spoke in shelter holes made by these borers at early stages of infestation.
2. In case of severe infestation, remove the webs and insert the swab of cotton wool soaked in 0.05 per cent dichlorvos or inject water emulsion of 0.05 per cent monocrotophos or 0.05 per cent chlorpyriphos and plug the holes with mud.

Guava fruit borer (*Virachola isocrates*): The guava fruit-borer has been found in northern region of the country. The caterpillars bore the raw fruits of all sizes and eat the pulp of the fruits. The infested fruits usually dry up.

Control measure

1. Collect the infested fruits with borer and destroy them to check the carry over of the pest.
2. The adults may be managed by spraying of carbaryl (0.1%) or fenthoate (0.05%) or phosalone (0.01%) at the beginning of fruiting season and before ripening of fruits.
3. Spraying of carbaryl (0.2%) at the early stage of crop has been found effective in reducing the pest population.

Disease Management

Fruit canker

The fruit canker is widely prevalent in India. It produces numerous circular to raised dark coloured corky cankerous growths on fruits. Infected fruits are deformed and give a chickenpox appearance. Infected fruits do not ripe and are not palatable.

Control measure

1. The disease can be effectively managed by 3 to 4 sprays of 1 per cent Bordeaux mixture or lime sulphur at 15 days interval.

Anthracnose

High humidity and frequent rains favour the spread and intensity of disease attack. It occurs mostly on fruits during rainy season. Most characteristic symptoms include the appearance of small spots of the size of pinhead, which are first observed on unripe fully grown fruits during rainy season. They are dark brown to black in colour, sunken, circular and bear numerous minute black pinhead growth in the centre of the lesions. In favourable weather, several spots coalesce to form bigger lesions. The diseased portions are comparatively harder than the healthy tissues. Ripe fruits become soft. Unopened flowers and buds are also attacked and they are shed.

Control measure

1. Pruning of diseased twigs and destruction of fallen leaves and fruits are also helpful in managing the disease.
2. Mancozeb (Dithane M-45, 0.2%) or thiophanate (Topsin M, 0.1%) or carbendazim (Bavistin, 0.1%) or Copper oxychloride (3g/litre of water) on mature fruits reduce the infection.

Stylar end rot

Severe infestation occurs during rainy season which reduces the quality of fruits. The symptoms start as a circular, water-soaked lesions at the stylar end and later on they become reddish brown in colour.

Control measure

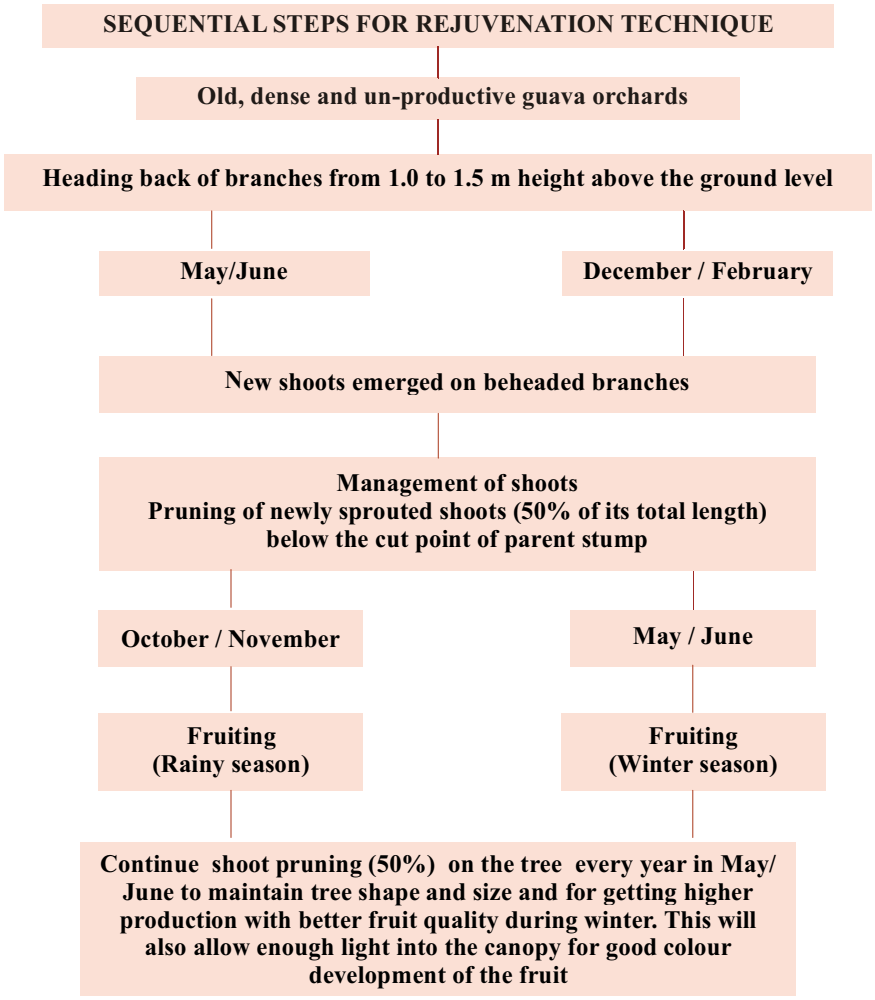
1. The disease can be managed effectively by spraying of carbendazim (Bavistin, 0.1%) or thiophanate (Topsin M, 0.1%) at 15 days interval during fruit maturity stage. However, no spraying is done before 15 days of harvesting.

Fruit rot

The symptoms appear on mature green fruits as a water-soaked lesion that develops very rapidly to affect entire fruits. This is very serious during rainy season and spoils nearly 20-25 per cent of the fruits before harvesting.

Control measure

1. Remove diseased fruits from the orchard and destroy them so that fruit flies and other insects cannot land on the fungal mass to pick up spores for reinfection.
2. Pre-harvest spraying of carbendazim or thiophanate (Bavistin or Topsin M, 0.5%) 15 - 20 days before harvesting effectively manages this disease.



Management practices to be followed prudently by grower in the trees pruned for rejuvenation

1. Apply cow dung or copperoxychloride on the cut portion.
2. Make basin around the tree for regular watering and application of FYM and fertilizer application.
3. Apply 50 kg of FYM per plant and recommended dose of fertilizers.
4. Apply the paste of copper and lime on the larger limbs as well as trunk to prevent sun burn injury.
5. Insure irrigation soon after

rejuvenation for shoot sprouting and proper development of tree canopies.

6. Pull out the caterpillar (trunk borer) mechanically by inserting iron spoke in the shelter holes.
7. Remove the webs and insert the swab of cotton soaked in monocrotophos and plug the holes with mud.
8. Use black colour polythene for mulching (100 micron = 400 gauge) soon after rejuvenation

Cost of Rejuvenation Technology

(Standard spacing for guava is 6m×6m, accommodating 277 plants/ha)

Area (1 ha)	Activities	Total cost (Rs.)
A. Labour Cost		16,620.00
Heading back of branches from 1 to 1.5 m height above the ground level +removal of all the cut materials from the orchard +pasting of cow dung or copperoxychloride on cut portion + pulling out the caterpillar, removing the webs and inserting the swab of cotton soaked in monocrotophos and plugging the holes with mud + painting of exposed wood with copper and lime + making basin around the tree + hoeing and weeding of basin + application of FYM@50kg/basin/plant and mixing them thoroughly with soil (@ Rs. 60/- per plant)		
B. Input cost		
	i) Insecticide	2,000.00
	ii) FYM	10,000.00
	iii) Fertilizers	2000.00
C. Total variable cost		
Miscellaneous charges (@ 10% of variable cost)		3,062.00
Interest on variable cost (@ 8% of variable cost)		2,450.00
Total cost		**36,132.00**

The cost of rejuvenation technologies and yield loss in the first year are compensated with sale of wood (cut material) and also enhanced income from raising intercrop in rejuvenated orchard.

Income generated during the process of rejuvenation technology

1. Sale of wood (cut material) – The cost of cut materials depends upon the size of trees. In general, the total cost of woods ranging from Rs. 30,000 to Rs. 35,000 per hectare was obtained in different locations of Allahabad and Kaushambi districts of Uttar Pradesh.
2. In the first year, farmers also gained income from raising intercrops in rejuvenated orchards and it has been observed that nearly Rs. 15,000 to Rs. 25,000 could be gained from raising cucurbits and chillies.
3. Fruiting starts after first year of rejuvenation and obtained yield in the range of 30 to 35kg per tree.

Management practices to be followed after rejuvenation

A. Pasting of cowdung on cut portion

B. Mechanical control of trunk borer (pulling out the caterpillar by inserting iron spoke in the holes on the trunk)

C. Plugging the holes with mud

D. Pasting base of the trunk with copper oxichlorite

E. Application of FYM in tree basin

F. Mulching with black polythene sheet

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