

Sustainable technique of high density and meadow orcharding for guava

High density planting (HDP) is a modern method of fruit cultivation involving planting of fruit trees densely, allowing smaller dwarf trees with modified canopy for better light interception and distribution, and ease of mechanized field operation. HDP and meadow orcharding gives higher yield as well as returns per unit area by increasing number of trees per unit area. High density and meadow orcharding enhances production and quality of fruits. It is possible to maintain the size and shape of the tree by regular pruning and use of bioregulators.

GUAVA is an important fruit crop in tropical and subtropical regions due to hardy nature of the tree and prolific bearing even in marginal lands. Guava contains maximum vitamin C content per 100 g of pulp next to amla. It contains antioxidants and can control systolic blood pressure. It is a good source of roughage that helps relieve constipation. Guava contributes 4% of the total fruit production which is around 18.23 million tonnes from 182 thousand ha. The productivity is around 9.9 MT ha. The traditional system has often posed problems in attaining desired levels of productivity due to large tree canopy. Hence, there is a need to improve the existing production system, besides increasing its productivity. Currently, there is a worldwide trend to plant fruit trees at higher density and meadow orcharding to control tree size and maintain desired architecture for better light interception and ease pruning, pest control and harvesting. The high density and meadow orcharding enhances production and quality of fruits.

Soil

Guava trees are very hardy and thrive in all type of soil conditions from alluvial to lateritic. It can be grown on deep, friable and well-drained soil. Soil with pH of 6.5 to 8.5 is ideal.

Climate

Guava can be successfully grown in tropical and sub tropical climatic conditions. In areas having a distinct winter season, the yield and the quality also improved. It can grow from sea level to altitude of about 5000 ft (1,515 meter). It grows best when the annual rainfall is below 40 inches (1,016 millimeter) and restricted between June and September.

Commercial and improved varieties

Allahabad Safeda and Sardar (L-49) form the mainstay of Indian guava industry owing to their high yield, quality and wide market acceptability.

Some other improved guava varieties viz. Shweta, Pant Prabhat, Dhareedar, Arka Mridula, Arka Amulya, Punjab Pink, Safed Jam, Kohir Safeda, Hisar Safeda and Allahabad Surkha have been released by ICAR Institutes /SAUs in different states for commercial cultivation.

Seed propagation

Guava propagated from seeds germinates in about three weeks. Freshly extracted seeds of fully matured fruits should be used for this purpose. Seedlings can be raised in nursery or in polyethylene bag. Seed viability declines very quickly after extraction from fruits. Considering the hard coat of the seeds it is necessary to pour boiling water on the seeds and allowing it soak in water for two weeks prior to sowing or treating them with strong sulphuric acid for five minutes facilitates their germination.



Vegetative propagation

Air-Layering

Air-Layering is the commercial method in practice for propagation of guava. The most ideal time for air-layering in guava is between April and June in the warm and humid climate when the average temperature varies between 29.3 and 30.5°C and relative humidity between

69 and 80%. A shoot from previous years growth of 1 cm in diameter is selected for air-layering. A ring of bark about 3 cm long is removed. This area is covered with wet sphagnum moss and tied with polyethylene film. The rooting takes place in about 30-40 days.

Veneer grafting-budding, Forkert budding are some of the other methods of propagating guava.



Planting

Planting can be done any time during the year provided irrigation facilities are available. However, planting in December-January should be avoided as frost may cause severe damage. The pits of about 75×75×75 cm or 50×50×50 cm or 40×40×40 cm are dug as per layout plant. After 7 to 10 days, each pit is filled with soil mixed with 10 to 15 kg organic manure and 500 g of single superphosphate. Standard spacing for guava is 6×6 m, which accommodates 277 plants/ha. Dance spacing 3.0 m (row to row) × 1.5 m (plant to plant) accommodating 2222 plants/ha, spacing 3.0 m (row to row) × 3.0 m (plant to plant) accommodating 1111 plants/ha and 6.0 m (row to row) × 3.0 m (plant to plant) accommodating 555 plants/ha. It is important to shape the tree planting.

Spacing of the plants in the system depends on fertility of the soil, availability of water, intensity of sunlight and wind exposure.

Canopy management

Untrained or unpruned guava trees become huge and unmanageable after a couple years of growth. Trees are pruned to increase the yield of quality fruits by eliminating crowded and criss-cross branches. Pruning begins at an early stage of plant growth to develop single trunk trees with well spaced scaffold branches to form the farmework. Apical growth is to be controlled within the first year of planting for better canopy architecture. Trees are topped to a uniform height of 60-70 cm from the ground level two-three months after planting to induce the emergence of new growth below the cut point. As a result, new shoots emerge. Three to four equally spaced shoots are retained around the stem to form the main scaffold limbs of the tree. These shoots are allowed to grow for 4-5 months after topping until they attain a length of about 40-50 cm. The selected shoots are further pruned to 50% of their length for inducing multiple shoots from the buds below the cut end. Newly emerged shoots are allowed to grow up to 40-50 cm and are pruned again for the emergence of new shoots. This is mainly done to obtain the desired shape. The pruning operations continue during the second year after planting. After two years, the short branches within the tree canopy from a compact and strong structure. All the plants are confined to a hedge shape of 2 m interrow width and 2-5 m height for which pruning is performed in January-February and May-June every year.

Fertilization

The amount of fertilizers to be applied in high density/meadow orchard of guava depends on the age of tree, condition of plant and type of soil. For proper growth and higher yield, following fertilizer doses should be applied.

Table 1. For spacing of 3 x 1.5 m (2222 plants/ha); 3 x 3 m (1111 plants/ha) and 6 x 3 m (555 plants/ha)

Year	Urea (g/plant)		S Sp (g/plant)	MOP (g/plant)
	June	September	September	June
1 st	182	78	375	100
2 nd	364	156	750	200
3 rd	546	234	1125	300
4 th	728	312	1500	400
5 th & above	910	390	1875	500

Table 2. For spacing 2 x 1 m (5000 plants/ha)

Year	Urea (g/plant)		SSp (g/plant)	MOP (g/plant)
	June	September	September	June
1 st	90	40	185	50
2 nd	180	110	370	100
3 rd	270	115	555	150
4 th	360	150	740	200
5 th & above	450	190	900	250

Irrigation

Newly planted plants should be watered at the time of planting every second day during the first week and afterwards once or twice a week during the initial months. During long dry periods, newly planted young guava (first year) should be watered twice a week. Once the rainy season sets in, irrigation is done as per the requirement. For the plants of 2 years or above, irrigation becomes beneficial for growth and fruiting during prolonged dry periods. Irrigation is required at intervals of 7-10 days in summers and at 25 days in winters.

Weed control

Weeds should be kept under control throughout the year because fruit harvesting is done throughout the year, for the easy mobility of labour. For this purpose, spray Gramoxone @ 6ml/litre of water during March, July and September. To control perennial weeds in March, spray may be done with Round up (Glyphosate) @ 10 ml/litre. Spray of these weedicides should be carried out on a calm day to avoid the damage to guava foliage.

Insect pests

Fruit fly

Fruit fly, the serious threat to guava production particularly during rainy season, lays eggs singly in ripened fruits just below the epicarp which eventually results in appearance of minute depression with dark punctures. Maggots after hatching feed on pulp and make fruit unfit for consumption. They pupate in soil and takes about 12 to 18 days to complete its life cycle during July-August (main season).

Management

- Spraying of protein hydrolysate and Malathion (0.1-0.25%+0-0.5%) on host trees for killing of adult flies.
- Hanging of wooden block traps soaked in ethanol, Methyl eugenol and Malathion (6:4:1) for 72 hours on trees @ 10 traps/ha during fruiting period.

Bark eating caterpillar

The pest feeds on the bark of main trunk stem and branches. Infestation is associated with the presence of irregular tunnels and patches covered with silken thread entangled with excreta and chewed particles on shoots, branches, stems and main trunk. Shelter holes are common at the joints of shoots and branches. In case of severe infestation, young infested shoots get dry and die above the point of girdling, giving die back like symptoms.

Management

- Killing of caterpillars mechanically by inserting iron spoke in shelter holes at early stage of infestation followed by inserting cotton wool soaked in Dichlorvos (0.25-0.5%) in the borer hole and plugging with the wet soil.
- Application of conidial suspension of naturalis-L (0-40%) in the borer hole is also effective.

Pomegranate butterfly

The insect attacks both rainy and winter season crops.

Its incidence is at peak in the months of August (rainy season crop) and November-December (winter season crop). The violet brown female butterfly lays shiny white eggs singly on calyx of flowers and fruits. The larva bores the fruit and feed on the flesh and seeds, making the fruit hollow from inside.

Management

- Carbaryl (0-2%) or Ethopropox (0.05%) spray at the beginning of fruiting season and before ripening of fruits.

Stem borer

The female eggs are laid in the bark by making an inverted U shaped punctures on the branches and main trunks. Grubs initially feed on the bark and later on enter into the wood making zig-zag and single long tunnels. Its life cycle is annual.

Management

- U shaped markings and eggs should be destroyed with warp knife during September-October.
- Injection of 5 ml Dichlorvos (%) in case of severe infestation.

Diseases of Guava

Anthraxnose

The plants begin to die backwards from top of the branch. Twigs petiole and young leaves are also attacked resulting into leaf fall virtually leaving the twigs dried and naked. Fruit and leaf infection are generally seen in rainy season crop. Pin head spots are first seen on unripe fruits, which gradually enlarge. The infected areas on unripe fruits become corky and hardy, and often develop cracks in case of severe infection.

Management

- Sprays of Bordeaux mixture (3:3:50) or Copper oxy chloride @ 0.3 per cent at 7-10 day intervals.
- Monthly spraying of Difolatan (0.3%) and Dithane Z-78 (0.2%).
- For post harvest treatment, dip the fruits in 500 ppm tetracycline solution for 20 minutes.

Canker

The appearance of canker on green fruits is evidenced in the form of minute, brown or rust coloured, unbroken, circular, necrotic areas, which later open the epidermis in a cruminate manner. The canker remains confined to a shallow area and does not penetrate deep into the flesh of the fruit. In severe cases, large number of cankerous spots develops. Small rusty brown angular spots also appear on the leaves.

Management

- Three to four sprays of 1% Bordeaux mixture or lime sulphur at 15 days interval.

Phytophthora fruit rot

Disease appears at the stylar end of fallen fruits or the ones touching the ground and covered with foliage or

Guava yield obtained under different densities (t/ha)

Density	3 rd year	4 th year	5 th year	6 th year	7 th year
1.5 x 3 m	25	40	50	55	56
3 x 3 m	20	25	30	40	39
6 x 6 m	5	13	15	20	28

Yield under meadow orchard system (t/ha)

Density	1 st year	2 nd year	3 rd year	4 th year	5 th year
2 x 1 m	15	25	45	55	60

stored in the form of whitish cottony growth which spreads very fast as the fruit ripens and covers the entire surface within 3-4 days during humid weather. Fruit skin below the whitish cottony growth become a little soft, turns light brown to dark brown and emits unpleasant smell. The diseased fruits generally retain their normal shape unless they are invaded by saprophytes which cause rotting. Immature fruits if infected, shrink, turn dirty brown to dark brown remain hard texture, either remain intact as mummified fruit or drop.

Management

- Spraying of Diathane Z-78 (0.2%) or Aureofungin (10 ppm) are found effective in controlling the disease.

Stylar end rot

The first symptom is the discolouration in the region lying just below and adjoining the persistent calyx which gradually increases in size, turn dark brown and becomes soft. Affected region becomes pulpy and light brown in colour in contrast to the bright white colour of the healthy ones. At an advanced stage fruit shrinking occurs and concentric wrinkles develop on the skin. Finally, the entire fruit is affected and covered with pycnidia.

Management

- Spray of Copper oxychloride (0.3%) at 15 days interval.
- Two sprays of Carbendazim (0.1%) at 15 days interval in such a way that last spray falls 12-15 days prior to harvest.

Wilt

Yellow discolouration and curling of leaves of terminal branches appear initially. Later on plants show yellow to red discoloration of leaves. Subsequently, there is pre-mature shedding of leaves. Fruits of all the affected branches remain under developed, hard and stony. Later

the entire plant defoliates and eventually dies.

Management

- Proper orchard sanitation and severe pruning of affected parts.
- Incorporation of FYM mixed with *Aspergillus niger* strain AN17 @ 5.0 kg/pit.

Production

The production of guava in high density planting (1.5×3m) is 25 t/ha in the third year. The yield goes up to 45 t/ha in the fifth and 57 t/ha in the seventh year of growth. In the density of 6.0×6.0 m, the yield is 6.5 t/ha hence the meadow orchard system is more beneficial than any other system. In this system, the production starts in the first year itself giving an average yield of 15 t/ha which doubles in the next year. The 3 and 5 year yield is approximately 42 and 65 t/ha respectively. This clearly shows the meadow orchard system is better than other planting systems.

India is the largest producer of guava in the world but the productivity is very less as compared to developed countries because of the absence of improved production and protection technologies. HDP and meadow orcharding gives higher yield as well a returns/unit area due to increasing the number of trees/unit area. It is possible by regular pruning and use of bioregulators for maintaining the size and shape of the tree. Guava planted at spacing 2-5 m×2-5 m and 3 m×6 m under HDP and 2 m×1 m under meadow gives higher production as well as more income in Allahabad Safeda and L-49. Thus, it is clear that farmers should have to adopt this technology for improving its productivity.

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