

**Fruit Science****Modern Hi-Tech Strategies for Sustainable Guava Production and Higher Productivity**

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***Abstract: -***

*Guava (Psidium guajava L.) is an important tropical and subtropical fruit crop because of its high productivity, nutritional value, adaptability and relatively low cost of cultivation. However, conventional production is associated with irregular flowering, seasonal variation in fruit quality, pest problems and inefficient use of resources. Hi-tech practices such as high-density planting, meadow orcharding, canopy management, crop regulation, fertigation, drip irrigation, mulching, foliar nutrition and use of tolerant rootstocks can improve productivity and profitability. Their integrated adoption helps optimize plant population, canopy architecture, water and nutrient use, flowering and fruiting, resulting in better yield and fruit quality.*

**1. Introduction:**

Guava is one of the important commercial fruit crops of India and is well adapted to tropical and subtropical climates. It can grow under a wide range of soil conditions, including saline, alkaline and clayey soils. Because of its nutritional and nutraceutical value, it is often called the “Apple of the tropics” (Kumar and Mishra, 2012; Maji *et al.*, 2015). Guava naturally produces several flowering flushes. The major flowering seasons are Ambe Bahar, Mrig Bahar and Hastha Bahar, resulting in fruits during different seasons. Rainy-season fruits are generally poorer in quality and more susceptible to fruit-fly damage, whereas winter fruits are usually superior and obtain better market value (Mishra and Tiwari, 2000; Singh *et al.*, 2000). Therefore, modern production aims to increase productivity while regulating flowering and fruiting toward the most profitable season.

**2. High-Density Planting and Meadow Orchard**

High-density planting (HDP) increases

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the number of plants per unit area and can substantially improve production per hectare. Guava has been successfully grown under meadow orcharding at  $2 \times 1$  m spacing, accommodating about 5,000 plants  $\text{ha}^{-1}$ . Under proper canopy management, yields of 40–60 t  $\text{ha}^{-1}$  have been reported (Singh, 2008). Although yield per plant may decrease under HDP, total yield per hectare can increase because of the greater number of plants. However, HDP must be combined with regular topping, hedging, training and pruning to control tree size and maintain adequate light penetration. Moderate density can also be beneficial. A spacing of  $6 \times 4$  m, accommodating approximately 416 plants  $\text{ha}^{-1}$ , was reported to provide suitable canopy conditions without reducing fruit yield and quality (Bal and Dhaliwal, 2003).

### 3. Canopy Management and Pruning

Training and pruning are essential components of high-density guava production. Guava bears flowers on current-season shoots, so pruning encourages new shoots and helps regulate flowering. It also maintains the balance between vegetative and reproductive growth (Dhaliwal and Singh, 2004). Pruning during April–June increased flowering compared with pruning during February–March (Singh *et al.*, 2001). Kumar and Rattanpal (2010) reported that pruning half of the vegetative growth at  $6 \times 4$  m spacing

produced about 55.1 kg fruit  $\text{tree}^{-1}$ , equivalent to an estimated 54.4 t  $\text{ha}^{-1}$ . In meadow orchards, pruning about 50% of shoot length encourages lateral shoot production, while repeated pruning helps maintain the desired compact canopy (Singh, 2008).

### 4. Crop Regulation

Crop regulation is important because guava naturally flowers several times a year. The objective is to suppress undesirable crops and encourage flowering and fruiting during the preferred season. Winter production is generally desirable because of better fruit quality and market value (Boora *et al.*, 2016; Lal *et al.*, 2017).

#### Major crop-regulation methods include:

- ☞ **Withholding irrigation:** Temporary water stress induces a resting period followed by profuse flowering after irrigation is resumed.
- ☞ **Root exposure/root pruning:** Temporary exposure of roots reduces moisture availability and induces rest; the roots are subsequently covered and irrigated.
- ☞ **Shoot pruning:** Encourages new shoots that bear flowers and helps regulate the crop.
- ☞ **Deblossoming:** Removal of rainy-season flowers can increase the subsequent winter crop.

🔪 **Chemical flower thinning:** NAA, NAD, 2,4-D and ethephon have been investigated for crop regulation (Das *et al.*, 2007; Maji *et al.*, 2015; More *et al.*, 2016).

The appropriate method depends on cultivar, climate, soil, irrigation availability and market demand.

### 5. Shoot Bending and Fruit Thinning

Shoot bending breaks apical dominance and activates dormant buds, encouraging lateral growth and flowering. It can improve fruit set and contribute to off-season production (Sarkar *et al.*, 2005).

Fruit thinning reduces excessive crop load and can improve fruit retention and quality. Mamun *et al.* (2012) reported that 50% fruit thinning combined with shoot bending produced high yields in guava, with up to 23.15 kg plant<sup>-1</sup> recorded in one cultivar.

### 6. Fertigation and Irrigation Management

Fertigation supplies water and nutrients together through irrigation and allows nutrients to be applied according to crop demand. It improves nutrient-use efficiency and can reduce fertilizer losses (Kumar *et al.*, 2007). Fertigation has produced higher yields than conventional soil fertilizer application in guava. Jeyabal *et al.* (2000) reported that fertigation with 75% of the recommended N and K produced 12.3% higher yield than soil application of 100% recommended N and K,

indicating potential fertilizer savings. Under meadow orcharding, irrigation and fertigation must be carefully scheduled. Ramnivas *et al.* (2012) reported a maximum benefit:cost ratio of 2.91 with 75% irrigation and 75% water-soluble fertilizer. Drip irrigation at 100% ET<sub>c</sub> has also been associated with higher guava yield than lower irrigation levels (Sharma *et al.*, 2013).

### 7. Mulching and Foliar Nutrition

Mulching conserves soil moisture and can improve fruit production. Materials such as paddy straw, dry leaves, sawdust and plastic mulch can be used. In one study, black polythene mulch resulted in 47.05 kg fruit plant<sup>-1</sup> and the highest number of fruits per plant (Das *et al.*, 2010). Foliar application of nutrients can supplement soil fertilization. A combination of urea, K<sub>2</sub>SO<sub>4</sub>, ZnSO<sub>4</sub> and borax applied at flowering and after fruit set was reported to improve vegetative growth, nutritional status, yield and fruit quality (Khamis *et al.*, 2007).

### 8. Tolerant Rootstocks

Salinity and sodicity can restrict guava production. Evaluation of guava germplasm under saline-sodic conditions identified Mirzapur Seedling, Cheeni guava and Karela as promising materials for use as rootstocks under saline conditions (Santhi *et al.*, 2019). Their physiological and biochemical characteristics indicated better tolerance to

salinity-related stress. The use of tolerant rootstocks can therefore help extend guava cultivation to problem soils while maintaining productivity.

## 9. Integrated Hi-Tech Production

The major technologies should be adopted together rather than independently. A successful modern guava orchard should combine: High-density planting → canopy management → crop regulation → drip irrigation → fertigation → mulching → foliar nutrition → suitable rootstock.

Increasing plant population alone does not guarantee higher productivity. The canopy must be maintained according to the available space, while water and nutrients must be supplied according to plant demand. Crop regulation should be used to synchronize production with favourable market conditions.

## 10. Conclusion

Hi-tech guava production focuses on maximizing productivity per unit area while improving fruit quality and resource-use efficiency. High-density planting and meadow orcharding increase plant population and production potential, while training and pruning maintain suitable canopy architecture. Crop regulation, deblossoming, shoot bending and fruit thinning help regulate flowering, fruiting and crop load. Drip irrigation and fertigation improve water and nutrient efficiency, while mulching and foliar nutrition

further support plant growth and fruit production. The use of salinity-tolerant rootstocks can improve production under problem soils. Therefore, the integrated application of these practices provides a practical approach for achieving higher yield, better fruit quality, efficient input use and improved profitability in guava cultivation.

## References

1. Bal, J.S. and Dhaliwal, G.S. (2003). High density planting studies in guava. *Haryana Journal of Horticultural Sciences*, 32: 19–22.
2. Boora, R.S., Dhaliwal, H.S. and Arora, N.K. (2016). Crop regulation in guava – A review. *Agricultural Reviews*, 37(1): 1–9.
3. Das, B., Nath, V., Jana, B.R., Kumar, S. and Dey, P. (2007). Evaluation of crop regulation in guava grown under rainfed plateau conditions of eastern India. *Indian Journal of Horticulture*, 64(3): 294–299.
4. Das, B.C., Maji, S. and Mulieh, R. (2010). Response of soil covers on guava cv. L-49. *Journal of Crop and Weed*, 6(2): 10–14.
5. Dhaliwal, G.S. and Singh, R. (2004). Effect of different pruning levels on vegetative growth, flowering and fruiting in Sardar guava. *Haryana*

- Journal of Horticultural Sciences*, 33(3–4): 175–177.
6. Jeyabal, A., et al. (2000). Effect of fertigation on crop productivity and nutrient-use efficiency.
  7. Khamis, M.A., Bakry, K. and Moty, S.A. (2007). Improving growth and productivity of guava trees. *Minia Journal of Agricultural Research and Development*, 27(1): 51–70.
  8. Kumar, R. and Mishra, D.S. (2012). Guava: A health capsule. *Indian Farmer's Digest*, 45(8): 30–32.
  9. Kumar, Y. and Rattanpal, H.S. (2010). Effect of pruning in guava planted at different spacing under Punjab conditions. *Indian Journal of Horticulture*, 67(Special Issue): 115–119.
  10. Lal, N., Sahu, N., Marboh, E.S., Gupta, A.K. and Patel, R.K. (2017). A review on crop regulation in fruit crops. *International Journal of Current Microbiology and Applied Sciences*, 6(7): 4032–4043.
  11. Maji, S., Das, B.C. and Sarkar, S.K. (2015). Efficiency of some chemicals on crop regulation of Sardar guava. *Scientia Horticulturae*, 188: 66–70.
  12. Mamun, A.A., Rahman, H. and Rahim, M.A. (2012). Effect of shoot bending and fruit thinning on productivity of guava. *Journal of Environmental Science & Natural Resources*, 5(2): 167–172.
  13. Mishra, D.S. and Tiwari, J.P. (2000). Guava: A potential fruit of subtropical India. *Swarna Sedyam*, 3(9): 47–49.
  14. Ramnivas, R., Kaushik, A., Sarolia, K., Pareek, S. and Singh, V. (2012). Effect of irrigation and fertigation scheduling on growth and yield of guava under meadow orcharding. *African Journal of Agricultural Research*, 7(47): 6350–6356.
  15. Sarkar, A., Ghosh, B., Kundu, S. and Sukul, P. (2005). Effect of shoot pruning and bending on yield and fruit quality in guava cv. L-49. *Environment and Ecology*, 23(3): 621–623.
  16. Santhi, V.P., Parthiban, S., Vijayalakshmi, K., Auxilia, J. and Masilamani, P. (2020). A review on recent advances in enhancing the productivity of guava (*Psidium guajava* L.) through hi-tech practices. *International Journal of Current Microbiology and Applied Sciences*, 9(8): 1922–1934. DOI: 10.20546/ijcmas.2020.908.220.
  17. Sharma, S., Patra, S.K. and Ray, R. (2011). Effect of drip fertigation on

growth and yield of guava cv. Khaja.

*Environment and Ecology*, 29: 34–38.

18. Sharma, S., Patra, S.K., Roy, G.B. and Bera, S. (2013). Influence of drip irrigation and nitrogen fertigation on yield and water productivity of guava. *The Bioscan*, 8(3): 783–786.
19. Singh, G. (2008). *High Density and Meadow Orchard in Guava*. Technical Bulletin, Central Institute for Subtropical Horticulture, Lucknow.

