

International Journal of Agriculture Extension and Social Development

Volume 8; Issue 11; November 2025; Page No. 152-155

Received: 03-08-2025
Accepted: 06-09-2025

Indexed Journal
Peer Reviewed Journal

Study the performance of different scion varieties graft on the alphonso rootstock of mango under nursery conditions in Tenkasi District

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DOI: <https://www.doi.org/10.33545/26180723.2025.v8.i12c.2738>

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Abstract

A field experiment was undertaken at ICAR – Krishi Vigyan Kendra (KVK), Tenkasi, during 2022–2023 to evaluate the performance of different mango (*Mangifera indica* L.) scion cultivars grafted onto the Alphonso rootstock under controlled nursery conditions. The study aimed to identify a superior scion variety that performs best in terms of graft success, survival rate, and early vegetative growth when grafted on the Alphonso rootstock. The experiment was conducted using a Completely Randomized Design (CRD) comprising six treatments with three replications. Softwood grafting was carried out towards the end of August using six commercially popular scion varieties—Banganapalli, Bangalora, Neelum, Sindhura, Mallika, and Imam Pasand. The results of the study revealed notable variation among the different scion combinations. The Imam Pasand scion grafts exhibited the earliest bud sprouting (11 days), closely followed by Banganapalli and Neelum. Imam Pasand grafts also recorded the highest grafting success (95.62%) and survival percentage (89.41%), along with superior scion growth (28.55 cm), scion girth (13.44 mm), and number of leaves (17.90). Root development traits, including primary root length (24.22 cm), root diameter (9.50 mm), and number of roots (38.42), were also highest in the Imam Pasand combination. Similarly, fresh and dry weights of both shoots and roots were greatest in Imam Pasand grafts, indicating excellent vegetative vigor and compatibility with the Alphonso rootstock. These findings suggest that Imam Pasand scion grafts are highly compatible with Alphonso rootstock and are best suited for commercial nursery propagation under Tenkasi conditions.

Keywords: Mango (*Mangifera indica*), Grafting, Rootstock, Scion, Vegetative growth

Introduction

Mango (*Mangifera indica* L.), a member of the family *Anacardiaceae*, is one of the most important and popular fruit crops of tropical and subtropical regions. It is widely recognized as the “King of Fruits” due to its attractive color, exquisite taste, unique flavor, and high nutritional composition. The fruit serves as both a delicacy for the elite and a vital source of nutrition for millions of people in developing countries during the summer months. The mango is believed to have originated in the Indo–Burma region, encompassing parts of India, Myanmar, and Malaysia. Over centuries, it has spread widely across tropical and subtropical zones and is now cultivated in more than 90 countries. In India, mango holds a prestigious position as a national fruit and a cultural symbol. It occupies approximately 2.52 million hectares, producing about 18.43 million metric tonnes annually (Anonymous, 2019). Major mango-producing states include Andhra Pradesh, Uttar Pradesh, Maharashtra, Karnataka, Tamil Nadu, and West Bengal. Among these, Andhra Pradesh ranks first in area (3.33 lakh ha) and second in total production (45.40 lakh tonnes).

In Tamil Nadu, mango cultivation is a major component of fruit-based horticulture, particularly in the districts of Krishnagiri, Dharmapuri, Salem, and Tenkasi. The crop is propagated primarily through vegetative means—chiefly wedge grafting, side grafting, and softwood grafting—as

these methods ensure true-to-type progeny and earlier fruiting compared with seed propagation. Among these, softwood grafting has gained prominence due to its high success rate and quicker establishment. Grafting is the process of uniting a scion (desired shoot portion) and rootstock (seedling providing the root system) so that they grow as a single composite plant. The success of grafting largely depends on the physiological compatibility between the rootstock and the scion. The rootstock influences several key plant traits, including tree vigor, adaptability to soil and climate, disease resistance, and even fruit quality and yield. Similarly, the scion determines the canopy structure, flowering behavior, and fruit characteristics.

Thus, identifying compatible scion–rootstock combinations is vital for establishing vigorous, long-lived, and productive trees. Since the Alphonso variety is widely used as a rootstock because of its adaptability and resistance to environmental stress, evaluating the grafting performance of elite scion cultivars on this rootstock becomes essential. The present study was therefore conducted to assess the graft success, survival, and growth performance of six commercially significant scion cultivars grafted onto Alphonso rootstock under the specific nursery conditions of Tenkasi district.

Materials and Methods Experimental Site and Design

The experiment was carried out at ICAR–Krishi Vigyan Kendra (KVK), Tenkasi, Tamil Nadu, during 2022–2023 under natural nursery conditions. The site experiences a tropical climate with moderate humidity, annual rainfall of around 900–1200 mm, and an average temperature ranging from 25 °C to 35 °C. The study followed a Completely Randomized Design (CRD) with six scion treatments replicated thrice.

Raising of Rootstock

For raising rootstock seedlings, fully mature stones of the ‘Alphonso’ mango were collected from pulp-processing industries located in the Paiyur region of Krishnagiri district during May–June. The stones were washed thoroughly with clean water and treated with a fungicidal solution of carbendazim (10 g per 10 L of water) to prevent fungal infections. After surface drying, they were sown vertically in raised nursery beds at a spacing of 10 × 5 cm. Germination occurred within 2–3 weeks. The young seedlings were transplanted into secondary nursery beds once the first flush of leaves turned light brown and reached about one-fourth of their mature size. During transplanting, the taproots were trimmed to promote fibrous root development. Regular irrigation, partial shade, and protection from frost ensured healthy seedling growth. The seedlings attained the appropriate graftable stage by the end of August, approximately 90 days after sowing.

Grafting Procedure

Softwood grafting was adopted as the propagation method. Six scion cultivars—Banganapalli, Bangalora, Neelum, Sindhura, Mallika, and Imam Pasand—were selected for the experiment. Healthy, disease-free scion shoots aged 3–4 months were collected from mother trees and defoliated about 7–10 days before grafting. The rootstock seedlings were decapitated just above the active growing point, leaving 3–4 leaves intact. A 3–4 cm deep slit was made on the cut end of the rootstock. Correspondingly, the base of the scion was shaped into a wedge (approximately 7.5 cm long) to fit closely into the slit on the rootstock. The scion was then inserted and secured tightly using a thin polythene strip to prevent desiccation. The grafts were kept under partial shade and watered regularly. Any emerging shoots below the graft union were removed promptly to encourage scion growth.

Data Collection and Statistical Analysis

Observations were recorded for key parameters such as:

- Days to sprouting (time from grafting to bud emergence)
- Grafting success (%)
- Survival percentage (%)
- Scion length (cm)
- Number of leaves
- Scion girth (mm)
- Primary root length (cm)
- Fresh and dry weights of shoots and roots (g)

- Root diameter (mm)
- Number of roots

All data were statistically analyzed using the methods prescribed for Completely Randomized Design (CRD) to test treatment significance.

Results And Discussion

Days to Sprouting and Grafting Success

Significant variation was observed among the scion varieties in the number of days taken for sprouting and percentage of successful grafts. The earliest bud emergence was noted in Imam Pasand scion grafts (11 days), followed by Banganapalli (12 days) and Neelum (14 days). The variation in sprouting time among cultivars may be due to genotypic differences influencing the physiological and hormonal balance at the graft interface.

The grafting success rate was also highest in Imam Pasand (95.62%), followed by Neelum (89.36%) and Mallika (86.20%). This can be attributed to the greater compatibility between Imam Pasand scion and Alphonso rootstock, leading to faster callus formation and healing of the graft union. Similar observations were made by Bharatbhai *et al.* (2013) and Sukhjit Kaur *et al.* (2017), who reported that the degree of cambial alignment and hormonal balance significantly influences graft success in mango.

Survival Percentage of Grafts

The survival percentage differed markedly among the treatments. The highest survival rate (89.41%) was recorded in Imam Pasand, while Bangalora exhibited the lowest survival (72.04%). The superior survival performance of Imam Pasand may be attributed to the rapid establishment of graft union, greater leaf area, and enhanced root growth, which improved water and nutrient uptake. These physiological advantages resulted in vigorous vegetative growth and improved graft longevity.

Scion Girth and Vegetative Growth

Imam Pasand scion grafts recorded the maximum scion girth (13.44 mm), followed by Banganapalli (12.30 mm), while the least girth was observed in Mallika (11.47 mm). The increased scion girth in Imam Pasand could be linked to efficient vascular connection and higher photosynthetic activity, which ensured better carbohydrate translocation to the graft union. The conducive environmental conditions prevailing during the study period also favored faster healing and secondary growth of vascular tissues. Enhanced scion growth, higher leaf count, and vigorous root development observed in Imam Pasand grafts confirmed its superior compatibility with Alphonso rootstock. These findings are consistent with earlier studies in mango, which emphasized that scion–rootstock compatibility, environmental conditions, and proper grafting technique significantly influence the overall success and growth performance of grafted plants.

Table 1: Effect of different scion grafts on days to sprout, success, survival, scion girth, scion growth, number of leaves, primary root length and number of roots

Scion variety	Days to sprout	Success (%) (60 days)	Survival (%) (180 days)	Scion girth (mm)	Scion growth/length (cm)	Number of leaves	Primary root length(cm)	Number of secondary root
T1	12	86.51	81.71	12.3	25.84	13.47	21.05	33.85
T 2	15	75.39	72.04	11.55	22.51	10.12	16.55	23.66
T 3	14	89.36	83.12	12.76	27.33	14.49	22.11	32.62
T 4	20	84.53	73	11.56	23.48	12.66	17.99	29.46
T 5	13	86.2	83.93	11.47	25.14	15.18	20.74	31.4
T 6	11	95.62	89.4	13.43	28.55	17.89	24.21	38.41
CV		1.89	1.77	5.9	4.61	5.92	6.49	5.45
CD (5%)	-	2.92	2.53	1.27	2.09	1.47	2.36	3.06

Height of Grafted Plant

The height of the grafted plant is an important growth indicator reflecting the overall compatibility between scion and rootstock. Among the different scion varieties studied, Imam Pasand recorded the maximum graft height of 38.41 cm, followed by Banganapalli and Neelum, whereas the minimum height (23.66 cm) was observed in Bangalora. The superior plant height observed in Imam Pasand may be attributed to its enhanced vegetative vigor and efficient physiological activity at the graft union, resulting in better uptake and utilization of nutrients. Growth parameters such as the number of leaves and leaf area play a significant role in determining plant height, as a larger photosynthetic surface produces more carbohydrates essential for elongation and biomass accumulation. A greater number of leaves increase the photosynthetic rate, thereby enhancing carbohydrate synthesis and promoting rapid vertical growth of the grafted plant.

These results are consistent with the findings of Bobade *et al.* (2018) ^[1] and Bose *et al.* (2019) ^[2], who also reported that increased leaf production and improved photosynthetic efficiency contribute to greater plant height in grafted mango varieties.

Number of Leaves per Graft

The number of leaves per graft is a key determinant of the photosynthetic potential and overall vigor of grafted plants. In the present study, the Imam Pasand scion recorded the highest mean leaf count of 17.89 leaves per graft, followed by Banganapalli and Mallika, while Bangalora showed the lowest number of leaves. The higher leaf count observed in Imam Pasand grafts may be due to vigorous seedling growth and greater accumulation of photosynthates, which facilitate improved nutrient uptake and translocation. This, in turn, promotes the formation of new leaves and supports sustained shoot growth. Increased leaf area and chlorophyll content also enhance the rate of photosynthesis, enabling the grafted plant to accumulate more carbohydrates, which are vital for continuous growth and development. Comparable findings were reported by Jana (2007) ^[3] and Ram *et al.* (2012) ^[4] in mango, where they observed that scion varieties exhibiting greater photosynthetic efficiency and nutrient assimilation produced a significantly higher number of leaves per graft.

Root Studies

Root characteristics play a fundamental role in determining the establishment, stability, and growth performance of

grafted plants. The results of the present study revealed that the Imam Pasand variety exhibited the maximum root length, greater tap-root diameter, and a higher number of secondary roots compared with other scion combinations.

The increased root length in Imam Pasand grafts may be attributed to rapid healing of the graft union and higher leaf area, which ensures efficient carbohydrate synthesis and translocation toward the root zone. These carbohydrates act as an energy source for root elongation and lateral root development. The enhanced tap-root length and greater number of secondary roots likely improved the plant's capacity for water and nutrient absorption, supporting better vegetative growth above ground.

The superior root development observed in Imam Pasand could also be a result of strong physiological and genetic compatibility between the scion and Alphonso rootstock. Such compatibility promotes active cambial connections, leading to improved translocation of nutrients and water from roots to shoots. Consequently, grafts of Imam Pasand demonstrated greater root mass and overall vigor compared with other treatments.

Conclusion

The findings of the present investigation clearly demonstrate that the choice of scion variety significantly influences the success and growth performance of grafted mango plants. Among the six scion cultivars evaluated, Imam Pasand grafted onto Alphonso rootstock through softwood grafting at the end of August exhibited superior performance across all parameters—earlier sprouting, higher graft success and survival rates, greater scion girth, increased plant height, higher leaf number, and well-developed root systems.

The results indicate that Imam Pasand, followed by Banganapalli and Mallika, are the most promising scion varieties for large-scale propagation through softwood grafting under nursery conditions in Tenkasi district. The superior vegetative vigor, compatibility, and root development recorded in these varieties make them ideal candidates for commercial mango multiplication programs.

Acknowledgement

The authors gratefully acknowledge the support and facilities provided by the Director, ICAR–Agricultural Technology Application Research Institute (ATARI), Hyderabad, and the staff of ICAR–Krishi Vigyan Kendra, Tenkasi, for their guidance, technical assistance, and encouragement during the successful completion of this study.

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