



# A Review: Vegetative Propagation of Mango (*Mangifera indica* L.) Through Grafting



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## Abstract

Mango can be propagated by both sexual and vegetative methods. Among different vegetative methods of propagation like veneer grafting, epicotyl grafting, and side grafting are being adopted in different parts of India. Factors like varieties, time of grafting, method, growing conditions, defoliation period of scion, age of the scion, leaf and node retention on rootstock etc. influenced the success and survivability of mango grafts. Rainy season grafting in mango shows best results of growth and survival percentage compared to other seasons of grafting. Inarching, veneer grafting, side and wedge grafting methods are most common, but the stone grafting method is easy, cheap and rapid method to produce high quality and quantity in comparatively less time and area. In comparison to different budding and grafting methods, softwood grafting gave maximum success. This method is broadly used in the states like Maharashtra, Karnataka and Kerala. Higher graft success was obtained during the months of July-August, September and October. The success of grafting depends on the season, age of rootstock and scion, preparation of scion before grafting, cultivars, height of grafting and media used in stone grafting methods. Epicotyl grafting technique plays a vital role in the success of graft union and the advantages is that the germinating seedlings are in juvenile condition and the cells have the potentiality of quick differentiation.

**Keywords:** Mango; Propagation; Grafting; Survival

## Introduction

*Mangifera indica* L. (Mango) is one of the most dominant fruit crops cultivated all over India belongs to family Anacardiaceae. It is national fruit of India and also called the king of fruits. All stages of fruit like immature, mature and ripe, used because of its excellent delicious taste and nutritive value. Young and unripe fruits is acidic in nature and used for culinary, preparing pickle, chutney and amchoor. The ripe fruits used widely and also used for preparing several products like, jams, squashes, jellies, custard powder, syrup, nectars, toffee, baby food etc.

Mango trees cultivated in both tropical and subtropical areas. Moderate rain falls, favours its growing from June to October and rainless dry weather from November onwards. Rains during pre-flowering and flowering period lead to delayed flowering and increase vegetative growth. Flowering season of mango trees is induced by temperature level of climatic condition. Mango is produced throughout the world specially in the countries like Philippines, Indonesia, Thailand, Burma, Malaya, Sri Lanka, Egypt, South-East Africa, Israel, Tropical Australia, USA (Hawaii and Florida). In India, mango is cultivated in almost all the states,

while UP, MP, Bihar and Andhra Pradesh are the leading states in area and production. Other states where mango cultivation exists include Orissa, West Bengal, Karnataka, Gujarat, Maharashtra, Madhya Pradesh, Tamil Nadu, Kerala and Punjab. Districts of Uttar Pradesh, like Lucknow and Amroha (City of Mango) are very famous in mango production and producing lots of varieties of mango.

The farmers generally use seed for mango propagation. Mango can be propagated by both sexual and asexual (vegetative) methods. Hartmann et al. [1] reported that varietal purity can't be maintained by growing plants from its seed. These plants take decade for fruiting and the canopy covers larger area. While the vegetative propagation is best because it retains the characteristics of the mother plant, and get flower and fruit earlier, to remain comparatively smaller with the benefit of more plants accommodation per unit area. It yields earlier and much higher economic returns. In India, the grafting techniques was practiced since ancient times. But different methods of propagation like veneer grafting, epicotyl grafting, and side

grafting are being adopted in different parts of India. However, stionic relationship is an important factor for successful graft production.

Singh et al. [2] concluded that success rate of veneer grafting in open conditions was higher in July to August. Therefore, it is very necessary to evaluate time on success of veneer grafting in mango. Bhan et al. [3] standardized the epicotyl grafting in mango at the Horticulture Research Station, Krishnanagar and they claimed about 75-80 % success by using germinating seed as a rootstock and semi-mature terminal shoot as a scion. In epicotyls grafting young seedlings are used as rootstock for grafting.

Epicotyl grafting was successfully used as an efficient, economic and rapid method for the propagation of mango [3-4]. Side grafting, also known as Nakamura method, was formerly popular [5-6]. Mild weather condition in the absence of strong winds, intense heat and heavy rain is highly effective for this method [7], and success has also varied (50-100%) with different cultivars [8]. In India side grafting is generally practiced in humid, coastal areas.

### Season of Grafting

Singh & Shrivastava [8] reported that the best results (84% take) were obtained with inarching and soft wood grafting both in July. [9] reported that the best month for grafting were June, July and August, during which 100% take could be expected. [10] obtained in trials with the cv. Dashehari, softwood grafting on 20th August gave the highest grafting success (90%) compared with 67% in July and 70% in late September.

Khalil et al. [11] observed that the time of grafting was found best between May and September. [12] recorded 92% success of veneer grafting during the rainy season. Patil et al. [13] at Dharwad observed that when stone grafting in mango done during first week of July using 7 to 10-day old seedling as rootstock, Mulgoa gave 100 per cent successful graft while Alphonso, Pairi and Totapari, recorded 40.00, 53.33 and 53.33 per cent grafting success, respectively [14]. Observed that the highest average sprout length was recorded under June grafting and survival after 180 days was highest in August grafting.

Kumar et al. [15] conducted an experiment at Ranchi to study the effect of stone grafting in mango and observed the best growth and survival (79%) of grafted plants in the treatment with used scions, which had been defoliated for 8 days and stored for 3 days before grafting in the rainy season. Nayak & Sen [16] reported that the percentage of success was also greater 78.8% when it was done in July- August compared with 75% in January-March. However, overall rate of growth was greater in winter grafted plants. Jacob et al. [17] reported that the higher graft success (90%) was obtained during the months of July-August, September and October. Pandey and Singh at Varanasi observed the greatest sprouting of scion (76.33%) and subsequent survival (40.22%) of stone-grafted mango cv. Amrapali when

grafted on 16th August. Prasanth et al. [18] studied epicotyl grafting in mango and reported that grafting in the first fortnight of July resulted earliest sprouting (28.71 days), while grafting in the first fortnight of August recorded late sprouting (35.10 days) under North- Eastern dry zone of Karnataka.

Veneer grafting performed on 10th August was found to be the best technique in terms of sprouting percentage after one (89.62%) and six (82.30 %) month of grafting [19].

### Effect of Variety

Singh et al. [20] observed that the Dashehari gave significantly higher average sprouting success (65-90%), average number of leaves (8.27) and survival after 6 months (65.35%) than Langra in July. Radha et al. [21] reported that the height of the plants varied from 26.3 cm in Chandrakaran to 36.5 cm in Bangalora at 6 months. Karim [22] reported that the highest success was in Sindhu (80.12%) followed by Fazli and Hybrid-10 (73.05%) and (68.32%) respectively and the lowest was in Gopalbhog (55.25%). Bobade et al. [23] reported that the maximum values of growth parameters like height of sprout (6.02 cm), length of shoot (27.97 cm), length of secondary roots (23.73 cm) were also observed in grafts of variety Mallika and it was closely followed by grafts of variety Kesar. The maximum value of stionic ratio (0.93) was recorded in grafts of variety Pairi and it was at par with variety Amrapali (0.91).

Similar experiments have been carried out by different workers in different plant species on various parameters of grafting and success percentage with minimum time with respect to the various [24-37].

### Methods of Grafting

Singh and Srivastava [38] studied on softwood grafting in mango and recorded highest success (84%) in July. They also studied softwood grafting for two years from July to September and March to April. Better success was recorded in August (90%). Observed that grafting in the warm humid months of June and July gave the highest survival (72-78%). Singh & Suryanarayana [39] studied softwood grafting in mango from June to October in Andaman and obtained the higher grafting success (87%) during the month of August.

Results revealed that veneer grafting was the best while forkert budding was the most suitable method in terms of bud break, survival, sprout length, leaf emergence and final success [40-41]. Sabeky [42] reported that the highest percentage of grafting success (67.2%) was obtained with grafting on 4 April. Side and softwood grafting produced higher success rates 65.8 and 63.7%, respectively than shield budding (47.5%), after 90 days. Jana [43] reported that the maximum leaf number was observed in Tommy Atkins and Amrapalli. In recent times, many detached methods of grafting have been successfully used as an efficient economic and rapid method of propagation of mango [16,44-46].

## Scion Characteristics

Prasad et al. [47] studied certain aspects of veneer grafting in mango (*Mangifera indica* L.) cv. Banganapally in Tirupati they recorded that the Precured scions gave higher success (78.96%) than non-precured scions (52.75%). Success was highest (71.08%) with 100 days old scions and lowest (62.67%) with 120 days old scions. The mean graft survival after potting was 75.39% with precured scions and 52.28% with non-precured scions that high mortality often occurs when material grafted in the nursery is lifted and potted after grafting.

Kumar et al. [48] reported that the high success in veneer and cleft grafting (>85%) of mango. Alam et al. [49] reported that the minimum success (10.0%) was recorded in BARI Aam-3 grafted onto 5 and 30 days old seedlings. The tallest shoots (25.07 and 24.73 cm consecutively) were produced by Langra grafted on 15 and 20 days old seedlings. Maximum final success (76.67%) was recorded in 10.0 cm long scions followed by 7.5 cm long ones (70.00%) in variety Langra.

Majumder et al. [50] reported that the Grafting experiment on splice and wedge methods was carried out between August and November and, up to 80% success was achieved with splice grafting but survival was poor. Singh & Srivastava [51] conducted several trials on factors affecting success in veneer grafting in mango. They stated that the best results were obtained from 6 months old scions, grafted on 2 years old rootstocks in July/August. The bud sticks were defoliated and kept in moss wrapped with polythene for 3-5 days before grafting. Among the several tying materials polythene strips gave the best results.

Vegetative propagation of mango was described by Iqbal [52] in Fiji. He pointed out that cleft and side wedge grafting by using 5-6 mm large scion of the same diameter on the rootstock, were the most successful way of getting mango grafts. He also observed that grafting under 50% shade was more successful (50-95% success) than grafting in exposed condition.

## Root Stock Attributes

Geetha et al. [53] observed that the Grafting success was highest (96.67%) in Muvandan and Chandrakaran grafted with cv. Neelam during June and survival was highest (76.67%) in Puliyan grafted with cv. Banganapally during August. The grafted seedlings at 18 to 24 months of age were planted out in January. The results showed that rootstock Carabao survived all temperatures in both grafting combinations [54]. Islam et al. [45] reported that scions of mango cultivars Amrapali and Gopalbhog grafted on two-year-old rootstocks on 16 May gave the highest survival rates (56.82 and 52.98%). The survival and growth of scion and rootstock were evaluated at 120 days after grafting. Rootstock growth was most pronounced (44.57 cm) with grafting on 15 April. Among the cultivars, higher survival (66.13%) was recorded for Amrapali.

The maximum number of sprouted grafts, maximum sprouting percentage, minimum days for leaf emergence,

maximum number of leaves per graft, girth (above the union), minimum mortality (%) and maximum survival (%) of grafts when grafts were made on 6 cm height of rootstock. Consequently, maximum growth in terms of height and girth (below the union) were recorded in grafts made on 10 cm height of rootstock of mango cv. Kesar [55]. Among the growing media used in the study the soil +sawdust was found to be the best growing mixture in respect of sprouting, survival and overall performance of stone grafts over other growing mixtures [56].

## Conclusion

All the above investigation shows that cleft grafting method is better than the other vegetative propagation method for mango development. So, increasing the production of mango fruit grafting is one of the easy processes for developing the mango plant as soon as possible.

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