



## Influence of Grating Time on Success of Soft Wood Grafting in Mango under Coastal Andhra Pradesh

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### Article History

Received on 06<sup>th</sup> August, 2025

Received in revised form on 05<sup>th</sup> November, 2025

Accepted in final form on 17<sup>th</sup> November, 2025

Published on 28<sup>th</sup> November, 2025

### Abstract

The experiment was conducted during August, 2023 to March, 2024 at Mango Research Station, Dr. YSR Horticultural University, Nuzvid, Andhra Pradesh, India to study the effect of grafting time on success of soft wood grafting in mango. The experiment consisted of 2 factors i.e grafting time and varieties with 3 replications and laid out in a two factorial Randomized Block Design (FRBD). The results indicated that among the treatments, bud break (14.2 days) was observed early on 10<sup>th</sup> September (17.5 days) while grafting done in 10<sup>th</sup> October took more days for bud break (18.8 days). However, graft success and survivability percentage was found highest (86.3 and 70.8% respectively) in October grating. Among the varieties, percentage of graft success and survivability were significantly highest (>80% and >60% respectively) in all varieties except Royal Special which recorded 77.9% of graft success and 59.9% of survivability. The interaction effects showed that graft success per cent was found significantly highest in Totapuri grafted on 10<sup>th</sup> October (91.7%) which was on par with Chinnarasam grafted on 10<sup>th</sup> August (88.7%), 10<sup>th</sup> October (86%) and Baneshan grafted on 10<sup>th</sup> October (88.3%). Graft survivability percentage was significantly highest in Chinnarasam (74.7%). Baneshan (73%) and Totapuri (70.7%) grafted on 10<sup>th</sup> October. The findings of this experiment clearly indicated that soft wood grafting done in the month of October was effective for graft success and survivability under coastal Andhra Pradesh.

**Keywords:** Soft wood grafting, time of grafting, mango

### 1. Introduction

Mango (*Mangifera indica* L.) is national fruit of India and also called as “king of fruits” due to its excellent delicious taste and nutritive value (Liu et al., 2013). Almost all parts of the mango tree have different uses hence, the tree is adored as a sacred (Reddy, 2001, Parmar et al., 2012). India has diverse varieties and each with its own distinct flavour, aroma and texture (Anila and Radha, 2006, Dalvi et al., 2010).

Mango is suitable for grown in tropical and subtropical regions (Makhmale et al., 2016, Kulkarni et al. 2023). It generally does well within temperature range of 24–27°C but also can tolerate temperature as high as 48°C. The water requirement depends on age of plants, soil and climate conditions, growth and developmental stages etc. (Malik and Mitra, 2001, Reddy et al., 2001, Gawankar et al., 2010, Dhake et al., 2011; Hada and Singh, 2017). Mango fruits are rich source of vitamins A and C, carbohydrates, fatty acids, minerals, dietary fiber, polyphenols, carotenoids, organic acids and pigments. The energy value of mango fruit pulp varies from 60–190 Kcal.

Unripe fruits are acidic in nature and used for culinary, preparing pickle, chutney and amchur while the ripe fruits are used for table purpose and also for preparing several value-added products like jam, squashes, Ready to Serve (RTS) beverages, syrup, nectars, toffee, etc. (Rajendrakumar et al., 2001, Singh and Saxena, 2008). Ripe mangoes can play an important role in balancing human diet by providing about 64–86 calories of energy per 100 g (Rathore et al., 2007). Successful orchard establishment hinges on the availability of high-quality and healthy planting material, as it is fundamental to achieving optimal growth and productivity in fruit crops (Shiv Kumar et al., 2025; Ambrish et al., 2025).

India is the leading country for mango production in the world which occupies 24 mha with production of 21.79 mt (Anonymous, 2023). In Andhra Pradesh mango is cultivated in 4.31 lha with production of 49.85 lmt (Anonymous, 2023). Mango plants raised by seed (sexual method) leads to enormous variability and they may not true-to-type because of its cross pollinated and heterozygous nature (Roshan et al., 2022). It becomes highly necessary to preserve and maintain



the desirable characters of each variety by propagation through vegetative methods (Banyal et al., 2021). Therefore, vegetative methods are adopted to get true-to-type plants and also for early bearing. Veneer grafting technique is common method using to produce planting material in mango. However, veneer grafting fails to produce erect and stout plants of uniform canopy, which is one of the most important prerequisites for successful modern mango cultivation (Ram and Pathak, 2006). The success of grafting depends on numerous factors like temperature, relative humidity, light, soil moisture, aeration, age of rootstock, method and time of grafting, growing media and skill of grafter (Prasanth et al., 2006; Singh et al., 2012; Deepak et al., 2019). Hence, present investigation was carried out to know the correct time of grafting on success of softwood grafting in different mango varieties.

## 2. Materials and Methods

The experiment was conducted during August, 2023 to March, 2024 at Mango Research Station, Dr. YSR Horticultural University, Nuzvid, Andhra Pradesh, India. The experimental site was geographically situated at 16° 46' 48" N latitude and 80° 50' 59" E longitude. The experiment was laid out in completely Randomized Design with two Factorial concept (FRBD) with three replications. There were twelve treatment combinations involve two factors among these first factor contains three levels of grafting time viz., 10<sup>th</sup> August (T<sub>1</sub>), 10<sup>th</sup> September (T<sub>2</sub>) and 10<sup>th</sup> October (T<sub>3</sub>). The second factor contains four varieties viz. Baneshan (V<sub>1</sub>), Chinnarasam (V<sub>2</sub>), Totapuri (V<sub>3</sub>) and Royal Special (V<sub>4</sub>). Thirty grafts were prepared in each treatment per replication. For rootstock purpose the stones are removed from the pulp and they were immediately planted in the polythene bags of 12x10 inch and 300-gauge thickness containing potting mixture of soil, FYM and coco peat in the ratio of 2:1:1. Soft wood grafting was done on two months old root stock. The terminal, vigorous, healthy, 2–3-month-old shoots were selected for scion and leaves were defoliated 7-10 days before for grafting. The scion sticks were collected from mother trees in the morning time on the day of grafting. Immediately after separation of the scion sticks from the mother tree, they were wrapped in moist cloth and carried in polythene covers to the site of grafting.

Grafting was performed on the same day of separation. Thirty plants were selected from each treatment and data was recorded for different growth characters, viz. days to bud break, success and survival percentage, shoot length of scion, number of leaves, scion girth and stock girth. The data was recorded at 120 days after grafting and data were analyzed as per method suggested by Panse and Sukhatme (1985).

## 3. Results and Discussion

The results presented in Table 1 indicated that significant differences were found for all the characters studied. Among the different grafting times, grafting done in 10<sup>th</sup> August has recorded least number of days for bud break (14.2 days) followed by 10<sup>th</sup> September (17.5 days) while grafting done in 10<sup>th</sup> October took more days for bud break (18.8 days). The earliest bud breaking in 10<sup>th</sup> August might be due to higher meristamatic activity and also because of the favourable weather conditions prevailing during that period due to which early sprouting occurs. These findings are in agreed with the findings of Khushi et al. (2019). Percentage of graft success and survivability were found significantly highest (86.33% and 70.8% respectively) in October grafting while grafting done in 10<sup>th</sup> September recorded lowest percentage of graft success (76.7%) and survivability (58.7%). The maximum success percentage might be due to presence of sufficient carbohydrate and other food material in the scion and rootstock and the accumulated food material is mobilized for new growth which in turns high meristamatic activity in scion. It might also be due to abundance humidity in atmosphere during October resulted in more callusing at graft union as compared to 10<sup>th</sup> September. These results were comparable with findings of Biswajit et al., 2019; Amar et al., 2025 in mango. The higher success of grafting during this time may attributed to the congenial weather conditions like temperature, light, sunshine rate and relative humidity prevailed during these dates, which resulted in increased cell activity leading to better callusing at union of stock and scion (Deepak et al., 2019) in mango.

Grafting done in 10<sup>th</sup> October recorded significantly maximum plant height (69.5 cm), rootstock girth (8.5 mm), scion girth (6.2 mm) and long shoot length (10.1 cm) while 10<sup>th</sup> August grafted plants recorded minimum plant height (63.9 cm), rootstock

Table 1: effect of grafting time on graft success and growth parameters of mango

Grafting time	Days to bud break	% of graft success	% graft survivability	Plant ht (cm)	No. of leaves	Root stock girth (mm)	Scion girth (mm)	Shoot length (cm)
10 <sup>th</sup> August	14.2	79.7	60.9	63.9	16.0	7.9	4.8	8.3
10 <sup>th</sup> September	17.5	76.7	58.7	67.9	14.8	8.5	5.9	9.9
10 <sup>th</sup> October	18.8	86.3	70.8	69.5	16.3	8.5	6.2	10.1
SEm±	0.36	1.73	1.2	0.7	0.73	0.23	0.2	0.43
CD (p=0.05)	1.1	5.1	3.56	2.0	2.2	0.7	0.6	1.3
CV%	11.6	5.3	6.6	3.5	NS	10.2	12.1	15.7



girth (7.9 mm), Scion girth (4.8 mm) and short shoot length (8.3 cm). This might be due to favorable climatic condition, which accelerated early bud break and thus secondary effect on maximum increased stionic height. However, number of leaves was not influenced by grafting time as it showed non-significant results. These results clearly indicated that grafting in 10<sup>th</sup> October followed by 10<sup>th</sup> September is suitable for increasing the plant growth characters and graft success and survivability in mango. These results were in line with findings of Dewangan et al. (2023) in cashew.

Among the different varieties of the present study (Table 2) Royal Special (15.2 days) and Baneshan (15.6 days) varieties were found early while Chinnarasam was found late (18.9 days) for bud break after grafting. This variation in time

required for bud breaking might be due to varietal characters of mango (Khushi et al., 2019). Percentage of graft success and survivability were significantly highest (>80% and >60%, respectively) in all varieties except Royal Special which recorded 77.9% of graft success and 59.9% of survivability. This difference in success might be due to the prevalence of varied climatic conditions at the time of grafting operation and response of varieties. The highest success was also probably due to availability of dormant scion with swollen bud in bulging condition at that time. Maximum plant height (68.6 cm) was recorded in Totapuri which was on par with Royal Special (68.2 cm) and Baneshan (68 cm). Similarly, number of leaves was also found significantly more in Royal special (17.3) and Baneshan (16.1) while less number (14.7) was recorded in Chinnarasam and Totapuri.

Table 2: performance of mango varieties on success of soft wood grafting

Varieties	Days to bud break	% of graft success	% graft survivability	Plant height (cm)	No. of leaves	Root stock girth (mm)	Scion girth (mm)	Shoot length (cm)
Baneshan	15.6	83.1	65.0	68.0	16.1	7.9	5.4	10.3
Chinnarasam	18.9	81.6	66.7	63.6	14.7	8.5	5.9	9.3
Totapuri	17.6	81.0	62.3	68.6	14.7	8.5	5.7	9.2
Royal special	15.2	77.9	59.9	68.2	17.3	8.1	5.7	8.9
SEm±	0.43	1.4	1.37	0.77	0.83	0.27	0.22	0.48
CD ( $p=0.05$ )	1.3	4.2	4.1	2.3	2.5	NS	NS	NS
CV %	12.9	5.3	6.6	3.5	16.4	10.2	12.1	15.7

The interaction effect of grafting time and varieties (Table 3) showed that Baneshan variety grafted on 10<sup>th</sup> August took minimum days (12.0) for bud break which was on par with Chinnarasam variety grafted on 10<sup>th</sup> October (14.0) while Chinnarasam grafted on 10<sup>th</sup> September took maximum days (25.7) for bud break. However, the graft success per cent was found significantly highest in Totapuri grafted on 10<sup>th</sup> October (91.7%) which was on par with Chinnarasam grafted on 10<sup>th</sup> August (88.7%), 10<sup>th</sup> October (86%) and Baneshan grafted on 10<sup>th</sup> October (88.3%). Graft survivability percentage was significantly highest in Chinnarasam (74.7%). Baneshan (73%) and Totapuri (70.7%) grafted on 10<sup>th</sup> October. This variation might be due to the supply of photosynthesis and other growth factors that were necessary to influence cambial activity and subsequent grafting success. These findings were in agreement with Khushi et al. (2019).

The results from table 4 indicating that Totapuri, Royal Special and Baneshan performed better for plant height which was ranged from 63.4 cm to 72.0 cm when grafted on 10<sup>th</sup> October followed by 10<sup>th</sup> September. However, Chinnarasam grafted on these dates showed minimum plant height. All varieties grafted on 10<sup>th</sup> August showed minimum plant height ranged from 63.7 cm to 64.8 cm. Number of leaves was found highest in Baneshan (18.3) grafted on 10<sup>th</sup> September but this was on par with all varieties in all dates except Totapuri grafted

Table 3: Interaction effect of grafting time and varieties on success of soft wood grafting

Time of grafting	Varieties	Days to bud break	% of graft success	% graft survivability
10 <sup>th</sup> August	Baneshan	12.0	74.7	61.0
	Chinnarasam	17.0	88.7	66.3
	Totapuri	19.7	80.7	59.7
	Royal special	8.0	74.7	56.7
10 <sup>th</sup> September	Baneshan	14.3	86.3	61.0
	Chinnarasam	25.7	70.0	59.0
	Totapuri	14.7	70.7	56.7
	Royal special	15.3	79.7	58.0
10 <sup>th</sup> October	Baneshan	20.3	88.3	73.0
	Chinnarasam	14.0	86.0	74.7
	Totapuri	18.3	91.7	70.7
	Royal special	22.3	79.3	65.0
SEm±		0.73	2.43	2.37
CD ( $p=0.05$ )		2.2	7.3	7.1
CV %		12.9	5.3	6.6



Table 4: Interaction effect of grafting time and varieties on growth parameters of mango

Time of grafting	Varieties	Plant height (cm)	No. of leaves	Root stock girth (mm)	Scion girth (mm)	Shoot length (cm)
10 <sup>th</sup> August	Baneshan	63.7	14.0	7.8	4.7	9.4
	Chinnarasam	63.7	15.7	8.3	4.6	7.9
	Totapuri	64.8	16.7	7.6	4.7	7.5
	Royal Special	63.7	17.7	7.8	5.2	8.2
10 <sup>th</sup> September	Baneshan	68.2	18.3	8.0	5.4	10.8
	Chinnarasam	63.8	13.0	8.4	6.2	9.7
	Totapuri	69.6	11.3	8.7	6.1	10.3
	Royal Special	69.9	16.7	8.8	5.9	8.9
10 <sup>th</sup> October	Baneshan	72.0	16.0	8.0	5.9	10.8
	Chinnarasam	63.4	15.3	9.0	6.8	10.2
	Totapuri	71.4	16.0	9.1	6.1	10.0
	Royal Special	71.1	17.7	7.8	5.9	9.6
SEm±		1.33	1.47	0.47	0.40	0.83
CD ( $p=0.05$ )		4.0	4.4	1.4	1.2	2.5
CV %		3.5	16.4	10.2	12.1	15.7

on 10<sup>th</sup> September which was recorded minimum number of leaves (11.3). Though, root stock girth was found significantly highest in Totapuri grafted on 10<sup>th</sup> October (9.1 mm) but it was on par with all varieties on all dates except Totapuri grafted on 10<sup>th</sup> August which was recorded minimum (7.6 mm). All varieties grafted on 10<sup>th</sup> September and 10<sup>th</sup> October showed highest scion girth with maximum in Chinnarasam grafted on 10<sup>th</sup> October (6.8 mm) except Baneshan on 10<sup>th</sup> September (5.4 mm) while the varieties grafted on 10<sup>th</sup> August recorded lowest values with minimum in Chinnarasam (4.6 mm). The varieties grafted on both September and October recorded highest shoot length with maximum values of 10.8 cm in Baneshan. Lowest values for shoot length were recorded in Totapuri grafted on 10<sup>th</sup> August (7.5 cm). However, Baneshan grafted on 10<sup>th</sup> August also recorded highest value (9.4 cm) on par with other dates. These results indicated that the variation in increased plant height might be due to cumulative effect of time of grafting operation and varieties. Priyanka et al. (2023) also reported that this might be due to its ability to build up more of the photosynthates and its subsequent partitioning thereby resulting into development of greater framework of grafted plant in tamarind. Similar findings were reported by Dhopat et al. (2025) in jackfruit.

#### 4. Conclusion

The varieties viz., Baneshan, Chinnarasam, Totapuri and Royal Special were performed well in October grafting for graft success and survivability percentage. Hence, soft wood grafting could be effective when it was done in the month of October for all commercial varieties of mango under coastal

Andhra Pradesh where the weather was ideal for soft wood grafting.

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