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Effect of different grafting time on success of softwood grafting in mango cv. Langra under Chhattisgarh plain zone

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Abstract

The present investigation entitled "Effect of different grafting time on success of softwood grafting in mango cv. Langra under Chhattisgarh plain zone" was carried out during the year 2023-24 in the shade net of Horticultural Research Farm in Pt. K.L.S. College of Horticulture and Research Station Rajnandgaon, Chhattisgarh. The experiment was laid out in Completely Randomized Design (CRD) with 8 treatments and three replications. The treatment consists of (T₁) 15th August, (T₂) 30th August, (T₃) 15th September, (T₄) 30th September, (T₅) 15th October, (T₆) 30th October, (T₇) 15th November and (T₈) 30th November. The results showed that the treatment T₃ (15th September) performed on 15th September (T₃) recorded minimum number of days taken to bud sprouting (11.08 days), minimum number of days required for first leaf opening (14.17 days), maximum number of sprouts per graft (8.47), maximum number of leaves (9.61), (11.73) and (13.97), graft height (53.17 cm), (54.65 cm) and (55.61 cm), rootstock girth (7.64 mm), (8.57 mm) and (9.34 mm), scion girth (6.78 mm), (7.94 mm) and (8.95 mm) at 60, 90 and 120 DAG. Similarly maximum leaf area (47.74 cm²), maximum graft success (76.67%) to (61.11%) and maximum graft survival (67.12%) to (54.99%) were also recorded grafted on 15th September (T₃) at 120 days after grafting under the plants.

Keywords: Mango, Langra, grafting time, softwood grafting, graft success, graft survival

Introduction

Mango (*Mangifera indica* L.) is a perennial tree of medium to large size with a symmetrical crown belonging to the family Anacardiaceae. Mango is the national fruit of India, Pakistan and the Philippines. It is known as the "King of Fruits". It is associated with certain rituals and ceremonies of ancient times (Chatopadhyay, 1976) [5]. Anacardiaceae is one of the most important and oldest fruit trees cultivated in India, dating back at least 4000 years. It is an important family of wild animals and has 73 genera. The genus *Mangifera* contains 69 species. According to reports, there are five species of mango trees in India. *Mangifera andamanica*, *M. indica*, *M. khasiana*, *M. Sylvatica* and *M. comptosperma* (Mukherjee, 1985) [11]. It is an evergreen tree, can be grown up to 1200 metres from mean sea level, but the fruiting is poor above 600 metres. Mango can be grown at temperatures between 44.40 °C and 43.33 °C. Ideal growth takes place at 23 °C to 26 °C (Singh and Saxena, 2008) [21].

The inflorescence of mango is small to broad conical panicle upto 45 cm the colour of panicle may be light green, yellowish green with patches on branches. Panicle bears flowers about 5000 - 6000 but only 1 to 70% are bisexual and other are male flowers. There are both male and hermaphrodite flower produced in mango. Floral size lies between 6 - 8 mm. in diameter (Bafod, 1988) [3].

Mango is a highly cross pollinated and heterozygous plant. Sexual propagation has long juvenile phase and may not give rise to true to type plants so vegetative propagation is desirable as it enables to retain the characteristics of the mother plant.

The production of mango in India is 20798 MT and area 2293 M ha (Anon, 2022a) [1]. The main mangoes producing states in India are Uttar Pradesh (23.86%) Andhra Pradesh (22.14%) and Karnataka (11.71%) etc. Chhattisgarh occupies an area of 78.235 M ha with an annual production of 471.146 MT of mango (Anonymous, 2022b) [2].

In Chhattisgarh it is mainly cultivated in districts of Raipur, Bastar, Korba, Bilaspur, Rajnandgaon, Bijapur, Kanker, Kondagaon, Janjgir-Champa and Surajpur.

Mango high delicacy, flavour, nutritional value, attractive appearance, wide adaptability and popularity. There are many health benefits of mango fruit and it can be used at all stages of development. Raw fruit is used for the preparation of curries, chutneys, preserves, cold drink, mango powder and pickles (Singh and Saxena, 2008) [21]. 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) [18].

Mango contains a variety of phytochemicals and nutrients. The fruit pulp is high in prebiotic dietary fiber, provitamin A, carotenoids, vitamin B, vitamin C, diverse polyphenols and essential nutrients such as potassium, copper and amino acids. Mango peel also contains pigment carotenoids, polyphenols omega-3 and omega-6 polyunsaturated fatty acids. The abundant bioactive compounds including carotenoids, phenolic compounds, reducing sugar and vitamin C in mango are good antioxidants and their daily intake in the diet has been related to prevention of degenerative processes such as cancer and cardio vascular diseases (Beradini *et al.*, 2005) [4].

In this method softwood grafting, it is easy to handle and quite efficient as well as grafts can normally rise within a year. Softwood grafting gives an excellent response in initial success with least possibility of mortality, better and uniform orchard establishment. Softwood grafting provides 80-90% success in guava, aonla and bael (Ram and Pathak, 2006) [17].

Material and Method

The experiment was conducted in the shade net of Horticulture Research Farm in Pt. K.L.S. College of Horticulture and Research Station Rajnandgaon, Chhattisgarh. The experiment was laid out in Completely Randomized Design (CRD) with 8 treatments and three replications. The treatment consists of (T₁) 15th August, (T₂) 30th August, (T₃) 15th September, (T₄) 30th September, (T₅) 15th October, (T₆) 30th October, (T₇) 15th November and (T₈) 30th November. The seedlings were ready for grafting on particular date as per programme from 15th August to 30th November 2024. The mature healthy, terminal, vigorous and 3-4 month old shoots were selected for scion and leaves were defoliated 7-10 days before for grafting. Scions were collected from an elite tree. The tree scion shoots were collected from mother trees in the morning time on the day of grafting. Immediately after separation of the scions 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. Watering was done using rose can regularly. The sprouts that emerged from stocks below the graft portion were removed manually as and when they appeared in stocks. Necessary plant protection measures were taken. Five representative plants from each treatment were selected

Result and Discussion

Days taken to bud sprouting

The experiment data presented in table 1. Revealed that early bud sprouting was observed (11.08 days) in treatment 15th September (T₃). However, the longest time taken for

bud sprouting (21.89 days) was recorded on 30th November (T₈).

The early sprouting could be brought on by both the ideal meteorological conditions at that time of year and increased meristematic activity. It may also be due to abundant supply of carbohydrates and defoliation which initiates bud activation and they are in a position to sprout early. This result was reported by Zimmerman (1958) [25], Sharma and Tiwari (1995) [20] and Prasanth *et al.* (2007) [14] in mango.

Days required for first leaf opening

The observations recorded on days required for first leaf opening after grafting was presented in Table 1. Significantly minimum days required for the first leaf opening (14.17 days) was observed in treatment 15th September (T₃). This shows significantly superiority over other treatments. Maximum days required for first leaf opening (24.94 days) was recorded in treatment 30th November (T₈).

The minimum number of days required for first leaf opening may be due to presence of higher meristematic activity in swallowed buds which is associated with better translocation of vital compounds between stock and scion. Which starts the process of bud activation resulted early first leaf opening. This result is closely related to the findings of Nahar *et al.* (2015) [12] in lime.

Number of sprouts per graft

The experimental data given in Tables 1. The highest number of sprouts per graft (8.47) was observed on 15th September (T₃). However, the lowest number of sprouts per graft (2.03) was recorded on 30th November (T₈).

The production of maximum number of sprouts could be due to the physiological activity of plants which increased carbohydrate accumulation, resulting in a higher number of sprouts. The results are supported by the studied of Raghavendra *et al.* (2011) [16] in wood apple and Swetha (2012) [23] in Jackfruit.

Number of leaves per graft

The data regarding number of leaves in various treatments were recorded at 60, 90 and 120 DAG presented in Table 1. The highest number of leaves (9.61), (11.73) and (13.97) was produced in grafts which were grafted during (T₃) 15th September which was at par (9.27), (11.54) and (13.61) with (T₂) 30th August at 60, 90 and 120 days after grafting, respectively. Whereas the lowest number of leaves (5.07), (5.54) and (7.47) was noted in grafts which were grafted during (T₈) 30th November at 60, 90 and 120 days after grafting, respectively.

The height of grafted plant was significantly affected by various treatments where data was recorded at 60, 90 and 120 DAG. The data are presented in Table 4.5 It's maybe due to favourable climatic condition such as temperature and humidity, which encouraged increased cell activity and early sprouting and photosynthetic accumulation in newly grafted plants which is increased the number of nodes and absorption of nutrients by leaf primordial leading to production in maximum number of leaves per graft. This result is in accordance with the findings of Kalabandi *et al.* (2014) [8] and Pampanaa *et al.* (2001) [13] in softwood grafting of sapota.

Graft height (cm)

The height of grafted plant was significantly affected by various treatments where data was recorded at 60, 90 and 120 DAG. The data are presented in Table 1. The maximum graft height (53.17cm), (54.65 cm) and (55.61 cm) was recorded, when softwood grafting performed on 15th September (T₃) which was followed by (52.67 cm), (53.23 cm) and (55.35 cm) with 30th August (T₂) at 60, 90 and 120 days after grafting, respectively. However, the grafts whose grafting was performed on 30th November (T₈) showed minimum graft height (47.00 cm), (47.28 cm) and (48.01 cm) at 60, 90 and 120 days after grafting, respectively.

The highest increase in graft height may be due to favourable agro-meteorological conditions prevailing during the grafting period. This could be attributed to the vigorous growth of stock, which increased the growth and leading to maximum accumulation of stored metabolites at the time of grafting. Similar results were also found by Radha and Aravindakshan. (2000) [15] and Gurudutta *et al.* (2004) [7] in epicotyl grafting of mango.

Rootstock girth (mm)

The data regarding rootstock girth in different treatments were recorded at 60, 90 and 120 DAG presented in Table 1. Different grafting time on success of softwood grafting had a significant increase in scion girth. Maximum rootstock girth (7.64 mm), (8.57 mm) and (9.34 mm) was found in grafts which were grafted on 15th September (T₃) which was at par (7.58 mm), (8.51) and (9.33 mm) with grafts which were grafted on 30th August (T₂) at 60, 90 and 120 days after grafting, respectively. However, grafts which were grafted during 30th November (T₈) showed minimum rootstock girth (6.92 mm), (7.03 mm) and (7.22 mm) at 60, 90 and 120 days after grafting, respectively.

Maximum rootstock girth of graft might be due to suitable temperature and relative humidity present in shade net house, prevailing during the graft growth period which ultimately enhances rootstock girth. Similar findings were obtained in mangoes during 15th September reported by Singh *et al.* (2012) [22] and Karna *et al.* (2018) [9].

Scion girth (mm)

The observations in respect of scion girth above 1 cm of grafting operation were taken at an interval of 30 days to 120 DAG. The data has been presented in Table 1. Different grafting time on success of softwood grafting had a significant increase in scion girth. Maximum scion girth (6.78 mm), (7.94 mm) and (8.95 mm) was found in grafts which were grafted on 15th September (T₃) which was at par (6.67 mm), (7.69 mm) and (8.84 mm) with grafts which were grafted on 30th August (T₂) at 60, 90 and 120 days after grafting, respectively. However, grafts which were grafted during 30th November (T₈) showed minimum scion girth (4.51 mm), (4.89 mm) and (5.40 mm) at 60, 90 and 120 days after grafting, respectively.

Maximum scion girth of graft might be due to suitable temperature and relative humidity present in shade net house, prevailing during the graft growth period which ultimately enhances scion girth. Similar result findings were obtained in mangoes during 15th September reported by Singh *et al.* (2012) [22] and Karna *et al.* (2018) [9].

Leaf area (cm²)

Data which is presented in Table 1. The Maximum leaf area (47.74 cm²) was recorded when plants were grafted on 15th September (T₃) which was at par (46.49 cm²) with grafts which were grafted on 30th August (T₂) at 120 DAG. Whereas the minimum leaf area (37.05 cm²) was obtained on the grafts which were grafted on 30th November (T₈) at 120 DAG.

The maximum leaf area might be due to when 12 days defoliated scion stick used for grafting produced a greater number of leaves in present investigation which ultimately produced more carbohydrates by photosynthesis and increased leaf area. Similar results were also found by Majeed *et al.* (2015) [10] and Roy *et al.* (1994) [19] in mango.

Graft success (%)

Percentage of grafts success was recorded 120 DAG of the plants and have been presented in Table 1. The grafting performed during different grafting times had significant impact on graft success percent. The maximum graft success percentage (76.67%) to (61.11%) was recorded when plants were grafted on 15th September (T₃) which was at par (74.89%) to (59.91) with grafts which were grafted on 30th August (T₂) at 120 DAG. Whereas the minimum graft success percentage (5.49%) to (13.54%) was obtained on the grafts which were grafted on 30th November (T₈) at 120 DAG.

The maximum graft success percentage might be due to sufficient amounts of carbohydrates and other food material in the rootstock and scion. The accumulated food material is then mobilized for new development, which raises the meristematic activity in the scion. There might also be a reason for the increased callusing at graft union from 15th August to 15th September compared to 30th November (T₈), when the climate is much less humid. Studies on mango Tayde *et al.*, (1988) [24] and wood apple Giri and Lenka (2008) [6].

Graft survival (%)

Percentage of grafts survival was recorded 120 DAG of the plants and have been presented in Table 1. The grafting performed during different grafting times had significant impact on graft success percent. The maximum graft survival percentage (67.12%) to (54.99%) was recorded when plants were grafted on 15th September (T₃) which was at par (65.83%) to (54.21%) with grafts which were grafted on 30th August (T₂) at 120 DAG. Whereas the minimum graft survival percentage (6.61%) to (14.89%) was obtained on the grafts which were grafted on 30th November (T₈) at 120 DAG.

The maximum graft survival percentage might be due to sufficient amounts of carbohydrates and other food material in the rootstock and scion. The accumulated food material is then mobilized for new development, which raises the meristematic activity in the scion. There might also be a reason for the increased callusing at graft union from 15th August to 15th September compared to 30th November (T₈), when the climate is much less humid. Studies on mango Tayde *et al.*, (1988) [24] and wood apple Giri and Lenka, (2008) [6].

Table 1: Effect of different grafting time on success of softwood grafting in mango cv. Langra under Chhattisgarh plain zone

Treatment details	Days taken to bud sprouting	Days required for first leaf opening	Number of sprouts per graft	Number of leaves			Graft height (cm)			Rootstock girth (mm)			Scion girth (mm)			Leaf area (cm ²) 120 DAG	Graft success (%) 120 DAG	Graft survival (%) 120 DAG
				60 DAG	90 DAG	120 DAG	60 DAG	90 DAG	120 DAG	60 DAG	90 DAG	120 DAG	60 DAG	90 DAG	120 DAG			
T ₁ (15 th August)	13.87	16.87	5.21	9.03	11.02	13.03	51.39	52.96	54.42	7.54	8.41	9.19	6.38	7.54	8.73	46.21	72.02 (58.05)	61.89 (51.86)
T ₂ (30 th August)	13.13	16.30	6.80	9.27	11.54	13.61	52.67	53.23	55.35	7.58	8.51	9.33	6.67	7.69	8.84	46.49	74.89 (59.91)	65.83 (54.21)
T ₃ (15 th September)	11.08	14.17	8.47	9.61	11.73	13.97	53.17	54.65	55.61	7.64	8.57	9.34	6.78	7.94	8.95	47.74	76.67 (61.11)	67.12 (54.99)
T ₄ (30 th September)	14.85	17.91	3.63	7.51	8.35	9.53	50.23	51.53	52.39	7.20	8.12	8.76	5.91	6.88	7.68	45.65	41.02 (39.81)	26.15 (30.73)
T ₅ (15 th October)	15.28	18.75	3.25	6.35	7.76	9.10	49.00	49.73	50.85	7.17	7.80	8.72	5.22	6.06	7.47	44.12	28.45 (32.22)	20.62 (26.99)
T ₆ (30 th October)	20.67	24.19	2.32	5.91	7.27	8.59	48.24	49.58	50.23	7.13	7.65	8.18	4.89	5.85	6.65	38.91	24.18 (29.44)	18.86 (25.72)
T ₇ (15 th November)	20.82	24.55	2.20	5.50	6.50	8.27	48.13	48.43	48.83	7.08	7.29	7.61	4.67	5.36	5.64	38.16	8.33 (16.77)	6.67 (14.96)
T ₈ (30 th November)	21.89	24.94	2.03	5.07	5.54	7.47	47.00	47.28	48.01	6.92	7.03	7.22	4.51	4.89	5.40	37.05	6.67 (14.96)	5.00 (14.89)
SEM	0.31	0.36	0.08	0.13	0.16	0.19	0.89	1.01	1.14	0.16	0.17	0.18	0.11	0.13	0.17	0.60	0.71 (0.46)	0.59 (0.39)
CD at 5%	0.93	1.10	0.23	0.39	0.48	0.58	2.70	3.04	3.45	0.49	0.52	0.55	0.34	0.41	0.50	1.81	2.14 (1.39)	1.79 (1.19)
CV%	3.24	3.19	3.16	3.03	3.13	3.18	3.10	3.42	3.80	3.86	3.77	3.70	3.44	3.57	3.87	2.41	2.96 (2.04)	3.01 (1.99)

Conclusion

On the basis of research findings we may be concluded that "Effect of different grafting time on success of softwood grafting in mango cv. Langra under Chhattisgarh plain zone" it may be concluded as below, The observations viz., minimum number of days taken to bud sprouting, minimum number of days required for first leaf opening, maximum number of sprouts per graft, number of leaves per graft, graft height, rootstock girth, scion girth, leaf area and highest graft success and survival percentage was found superior in the treatment T₃ (15th September).

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