

Original Research Article

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Effect of Grafting Time on Success of Softwood Grafting in Mango (*Mangifera indica* L.)

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ABSTRACT

An experiment was conducted to assess the effect of grafting time on success of softwood grafting in mango (*Mangifera indica* Linn) was conducted during 2015-16 at the Department of Horticulture, College of Agriculture, JAU, Junagadh. Total six treatment of grafting time comprised of 15th August (T₁), 30th August (T₂), 15th September (T₃), 30th September (T₄), 15th October (T₅) and 30th October (T₆). The study revealed that low phenol content (1.23 %) was recorded in 15th September grafting (T₃). Significantly, highest graft success percentage (80 %), survival percentage (71.11 %), maximum shoot length (14.99 cm), number of leaves (14.85), plant height (56.61 cm), Scion girth (8.81 mm) and stock girth (9.25 mm) were registered in 15th September (T₃), however it was found at par with 30th August (T₂). Highest carbohydrate content (12.78 %) and numbers of days for shoot emergence (12.07) was noted at 30th August (T₂). Similarly, lowest carbohydrate content (11.52 %), maximum days to shoot emergence (15.40), minimum success percentage (23.33 %), survival percentage (20.00 %), shoot length of scion (9.85 cm), total number of leaves (8.66), plant height (50.67 cm), scion girth (6.75 mm) and stock girth (8.45 mm) were noted in 30th October (T₆) whereas, highest phenol content (2.95 %) was noted in 15th October (T₅).

Keywords

Time, Softwood,
Success percentage,
Growth parameter

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Introduction

The mango (*Mangifera indica* L.) is belongs to family anacardiaceae originated in South East Asia and one of the important fruit liked by all section of section of people of India. It occupies a prominent place among the fruit crops grown in India. It is also called the king of fruits and known as national fruit of India. Mango was originated in Indian sub-continent

during the pre-historic times (Mukherjee, 1998). India is the major producer of mango in the world with an area of 25.15 lakh hector and annual production is 184.31 lakh MT. In Gujarat total area under mango cultivation is about 1.42 lakh hector and production about 11.25 lakh MT (Anon., 2014). Generally the agro climactic condition of Gujarat is very important of mango cultivation. So there is a tremendous scope for increasing the area of

mango cultivation and this will require selected plants of superior quality and high yield potential. That is only possible when desirable mother trees are used for vegetative propagation. A wide range of variability occurs with regards to fruit size and quality owing to its seeds propagation True-to-type propagules could be multiplied from an elite tree that produces good quality fruits only by asexual methods of propagation. Generally mangos are propagated by many vegetative methods among those softwood grafting has distinct advantages over traditional method like approach grafting which is more tedious, costly and more labour intensive (Reddy *et al.*, 1994). However success of grafting depends upon many grafting time and environmental parameter (Hartman and Kertar, 1972, Patel and Amin, 1981 and Singh *et al.*, 1984). Hence, the present study was undertaken to find out the best time for softwood grafting in mango.

Materials and Methods

An experiment, on the effect of grafting time on success of softwood grafting in mango (*Mangifera indica* Linn) was conducted during the year 2015-16 at Sakkarbaug, Fruit Research Station, Department of Horticulture, Junagadh Agricultural University, Junagadh. It was laid out in completely Randomized Design (CBD) with Factorial concept having three repetitions. The experiment was conducted to find out to find out the influence of grafting time on success of softwood grafting in mango. The grafting was performed at 15 days intervals starting from 15th August 2015 to 30th October 2015 which act as treatment 15th August (T₁), 30th August (T₂), 15th September (T₃), 30th September (T₄), 15th October (T₅) and 30th October (T₆). For experiment purpose ten grafts were prepared in each treatment, which are replicated three times. For rootstock purpose the stone are removed from the pulp and treated with sting

@ 2%, contains carbendazim (50 WP) to avoid any fungal diseases. As the stone have low viability, they were immediately planted on the polythene bags of 12 inch x 10 inch and 300 gauge thickness containing potting mixture of soil and F.Y.M. in the ratio of 2:1. The stones were sown in the 1st June 2015 and the seedlings were ready for grafting on particular date as per programme from 15th August to 30th October 2015. 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 and observed for different growth characters, viz. carbohydrate and phenol content of scion at the time of grafting, days to shoot emergence, success percentage, shoot length of scion, scion girth, stock girth and survival percentage. The observation was recorded two month after grafting operation at intervals of 30 days until 120 days after grafting. The data were analyzed as per method suggested by Panse and Sukhatme (1985).

Results and Discussion

The data presented in table 1 revealed that treatment differences between different grafting times found significant on carbohydrate and phenol content. The maximum carbohydrate content (12.87 %) was

noted in grafting at 30th August (T₂) whereas, minimum carbohydrate content was found in 30th October (T₃). The carbohydrate content of scion was increasing from 15th August to 30th August but then it decreased drastically as grafting time increased. It may be due to immaturity stage of shoot and if shoot age is increased, the carbohydrate is decreased due to its maturity. The poor success is that the decrease in carbohydrates was partially responsible for the decrease in graft take, but at that time some other substances was low in supply and was the limiting factor at that time for graft success. This observation agreed with the finding of Rodrigues *et al.*, (1960) in avocados. The phenol content decreased constantly to a certain level as the grafting time increased and was observed minimum in 15th September grafting (T₃) but after onwards the phenol content increased. The lowest phenol content may be due to maturity of scion shoots. However, it increased as it becomes over mature. This fact was in accordance with the findings of Baskaran *et al.*, (2008) in jackfruit.

The effect of grafting time was found significant on days to shoot emergence. Lowest days required for sprouting was observed in 30th August (T₂) followed by 15th September (T₃). It may be due to higher meristamatic activity and also because of the optimal weather condition prevailing during that period due to which early sprouting occurs. This fact was in accordance with the findings of Sharma and Tiwari (1995) and Prasanth *et al.*, (2007) in mango. It may also be due to abundant supply of carbohydrate and defoliation which initiates bud activation and they are in a position to sprout early. Similar results were also obtained by Zimmerman (1958) and Purbiati *et al.*, (1991) in mango.

Grafting time had significantly influenced on success percentage of grafts. The result revealed that 15th September (T₃) recorded

maximum success percentage (80 %) and at par with T₂ and T₁. Likewise, minimum success percentage (23.33 %) was noted in 30th October (T₆). The maximum success percentage may be due to presence of enough 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 may also be due to abundance humidity in atmosphere during 15th August to 15th September resulted in more callusing at graft union as compared to 30th October (T₆), when humidity is very low in atmosphere. This result was supported by Mandal *et al.*, (2011). Significantly the highest survival percentage (71.11 %) at 120 days after grafting were recorded when grafting was done on 15th September (T₃). However, it was found at par with T₁ and T₂. The higher success of grafting during this grafting 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. These observations are in agreement with the Tayde *et al.*, (1988), Pereira *et al.*, (2004), Kumar *et al.*, (2006) and Mandal *et al.*, (2012) in mango; Bharad *et al.*, (1999) in tamarind and Giri and Lenka (2008) in wood apple.

Significantly maximum shoot lengths of scion (13.13, 13.89 and 14.99 cm) were recorded in 15th September grafting during 60, 90 and 120 DAG, respectively. The result may be due to favorable climactic parameters during monsoon helped in faster growths which act positively on the rootstock and scion shoot, which might had happened due to the longer time available for growth in meristamatic cells coupled with better physiological process like photosynthesis and lower respiration. This result is similar with Mandal *et al.*, (2011) in mango (Table 2 and 3).

Table.1 Effect of grafting time on carbohydrate, phenol, days to shoot emergence, success percentage and survival percentage of graft

Treatment	Carbohydrate content of scion (%) at the time of grafting	Phenol content of scion (%) at the time of grafting	Days to shoot emergence	Success percentage (%)	Survival percentage (%) at 120 DAG
15 th August (T ₁)	12.46	1.83	12.41	74.44	63.33
30 th August (T ₂)	12.78	1.48	12.07	77.77	68.88
15 th September (T ₃)	12.67	1.23	12.14	80.00	71.11
30 th September (T ₄)	12.15	2.45	13.99	38.88	27.77
15 th October (T ₅)	11.95	2.99	14.82	25.55	21.11
30 th October (T ₆)	11.52	2.85	15.40	23.33	20.00
S.Em.±	0.038	0.014	0.051	3.703	4.69
C.D. at 5%	0.11	0.04	0.14	10.69	13.54
C.V. %	4.80	6.59	5.05	10.82	14.63

Table.2 Effect of grafting time on shoot length, number of leaves and plant height at 60, 90 and 120 day after grafting (DAG)

Treatment	60 DAG			90 DAG			120 DAG		
	Shoot length (cm)	Number of leaves	Plant height (cm)	Shoot length (cm)	Number of leaves	Plant height (cm)	Shoot length (cm)	Number of leaves	Plant height (cm)
15 th August (T ₁)	12.60	9.21	52.70	13.68	11.49	54.27	14.56	14.03	55.72
30 th August (T ₂)	12.97	9.46	53.28	13.75	12.47	54.99	14.88	14.54	56.38
15 th September (T ₃)	13.13	9.80	53.68	13.89	12.61	55.16	14.99	14.85	56.61
30 th September (T ₄)	9.87	7.43	50.85	10.96	8.56	52.15	12.03	9.74	53.37
15 th October (T ₅)	8.58	6.27	48.89	9.44	7.79	50.13	10.25	8.98	51.16
30 th October (T ₆)	8.19	6.09	48.24	8.76	7.19	49.28	9.85	8.66	50.67
S.Em.±	0.037	0.027	0.09	0.027	0.023	0.128	0.012	0.026	0.145
C.D. at 5 %	0.10	0.08	0.26	0.07	0.06	0.37	0.03	0.07	0.42
C.V. %	5.30	6.22	1.76	4.19	4.60	2.04	2.58	3.44	2.12

Table.3 Effect of grafting time on scion and stock girth at 60, 90 and 120 days after grafting

Treatment	60 DAG		90 DAG		120 DAG	
	Scion girth (mm)	Stock girth (mm)	Scion girth (mm)	Stock girth (mm)	Scion girth (mm)	Stock girth (mm)
15 th August (T ₁)	6.90	7.64	7.81	8.34	8.61	9.14
30 th August (T ₂)	7.04	7.79	7.96	8.44	8.79	9.25
15 th September (T ₃)	7.03	7.75	8.14	8.47	8.81	9.25
30 th September (T ₄)	6.00	7.30	6.97	8.02	7.73	8.66
15 th October (T ₅)	5.28	7.09	6.19	7.78	7.04	8.62
30 th October (T ₆)	5.01	7.17	5.88	7.67	6.75	8.49
S.Em.±	0.011	0.005	0.008	0.007	0.007	0.005
C.D. (P= 0.05)	0.03	0.01	0.02	0.02	0.02	0.01
C.V. %	5.15	3.17	3.83	3.16	3.17	2.40

The result was also found significant and maximum numbers of leaves (9.80, 12.61 and 14.85) were noted in grafting time 15th September (T₃) during 60, 90 and 120 DAG, respectively. Whereas, minimum number of leaves recorded in 30th October (T₆). It may be due to the quick and strong union formation and better nutrient uptake might have caused for better plant growth and more number of leaves per plant.

These findings are in line with the results of Patel and Amin (1981) in mango; Chovatia and Singh (2000) in Jamun and Palande *et al.*, (2004) in Tamarind. The maximum plant heights (53.68, 55.16 and 56.61cm) were registered during 15th September (T₃) at 60, 90 and 120 DAG, respectively. However, they were found at par with treatment 30th August (T₂) at 90 and 120 DAG. Lowest plant heights (48.24, 49.28 and 50.67 cm) were noted at 30th October (T₆) during all periodicals.

Highest increment of scion (7.04 mm) was noted in 30th August (T₂) recorded at 60 days which was at par with T₂ but at 90 and 120 days, 15th September (T₃) recorded highest in scion girth (8.44 and 8.81 mm, respectively) at 90 and 120 DAG as compared to other grafting times. This might be due to the suitable temperature and relative humidity prevailing during this period in nursery condition which was responsible for increment of scion girth.

Significantly maximum stock girth at 60 DAG was noted in 30th August but at 90 & 120 DAG, it was observed in 15th September. This might be due to the suitable temperature and relative humidity prevailing during this period in nursery condition which was responsible for increment of stock girth.

The investigation revealed that better performance in majority of parameter like success and survival percentage, shoot length,

plant height, number of leaves, scion girth and stock girth, were observed in grafting on 15th September (T₃).

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