



Original Research Article

Effect of Growing Media and Storage of Stone on the Success and Survival of Soft Wood Grafting in Mango (*Mangifera indica* L.)

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Abstract	Keywords
<p>A study using three different growing media and six storage duration of mango stones for success and survival of softwood grafts. The treatment M₃S₀ containing mixture of soil + FYM + leaf mould with zero week storage of stone recorded the least time to sprouting (13.27 days), highest graft height (29.29 cm), scion girth of grafts (4.63 mm), shoot length of scion (11.92 cm), number of leaves (11.07), length (39.68 cm) and girth (7.97 mm) of tap root. Whereas, the maximum success (83.89%) and survival (72.22%) of grafts was examined in the S₀ treatment (zero week storage of stone) while, the M₃ (soil + FYM + leaf mould in 1:1:1 proportion) media showed the highest success (77.78%) and survival (63.89%) of grafts.</p>	<p>Grafting Mango Media Softwood Storage</p>

Introduction

Mango (*Mangifera indica* L.) belongs to the family Anacardiaceae. It is a National fruit of India and also known as King of fruits. It is a tropical fruit originated from Indo-Burma region and grown almost all part of the world. In India it is cultivated at sub-continent for well over 4000 years. India is the largest producer of mango in the world with production of 151.88 lakh MT from an area of 22.97 lakh hectares. Among the important mango growing state of the country, Gujarat produced 9.11 lakh MT of fruit from 1.30 lakh hectares of area with productivity of 7.00 MT (Anon, 2011). Mango is mostly propagated by vegetative method viz. softwood grafting and approach grafting for commercial plantation. The seedling tree has some

major drawbacks. Propagation from seed, though easy and cheap, is unable to perpetuate characters of the parent tree because most commercial varieties in India are cross-pollinated and monoembryonic. Such plants are not uniform in growth, yield and fruit quality and it has long juvenile phase in comparison to vegetatively propagated fruit crops. In case of asexual method, propagation is brought by the plant parts. The asexually or vegetatively propagated fruit plants are true to type and are uniform in growth and fruit quality.

The performance of a compound horticultural tree is determined by both rootstock and the scion (Bose *et al.*, 1991). Scions are taken from the Kesar variety

which is the leading commercial variety of mango in Gujarat and having good export potential because it has attractive saffron colour and oval shaped. Growing media is the important input for the containerized seedling production. It is characterized by light weight, friable, good water holding capacity, drainage, porosity and low bulk density *etc.* (Chakrabarti et al., 1998). Normally the viability of stone is about 90-100 days. However, it depends on the storage conditions. Stones sown immediately after extraction will exhibit viability up to 60-80 per cent depending on the variety (Radha and Lila, 2007). Looking to above fact, the present experiment was undertaken to find out effect of different media and stone storage on soft wood grafting in mango.

Materials and methods

The present study was conducted to find out effect of different growing media and storage of stone on success and survival of soft wood grafting in mango at Lal Baug, Fruit Research Station, Department of Horticulture, Junagadh Agricultural University, Junagadh during 2012-13. The experiment was laid out in a Factorial Completely Randomized Design (CRD-F) with three repetitions and eighteen treatment combinations comprising of different growing media and storage of stones. The treatments consisted of three different growing media soil + FYM + sand (M₁), soil + FYM + rice husk (M₂) and soil + FYM + leaf mould (M₃) in 1:1:1 proportion and five storage period zero week (S₀), one week (S₁), two weeks (S₂), three weeks (S₃), four weeks (S₄) and five weeks (S₅). For this fully mature mangoes were selected from healthy and disease free local mango tree which were collected from Shakkar Baug Farm, Fruit Research Station, Dept. of Horticulture, JAU, Junagadh and were placed for ripening at ambient conditions. After that, stones were extracted from ripened mangoes and used for the sowing at weekly interval. After first sowing remaining stones were stored at room temperature. Stones were sown in the medium size black polythene bags having 12 inches length, width of 10 inches and 300 gauges of thickness on mid June 2012 in different growing media. Prepared rootstocks were used for softwood grafting after three months. The data on success and survival percentage and other graft observations were recorded and analysed statistically as per method given by Panse and Sukhatme.

Preparation of rootstock

Retain two pairs of bottom leaves and remove others from the selected seedlings using a sharp knife. Give a transverse cut on the main stem, 15 cm above ground level. A cleft of 4-5 cm deep was made in the middle of the decapitated stem of the seedling by giving a longitudinal cut.

Preparation of scion

Collected scion sticks were treated with Bavistin @ 0.5 % solution to protect from incidence of fungal diseases. Scion sticks were kept in wet gunny bags to conserve moisture. Select a matching scion stick (same thickness as that of the rootstock). The cut end of the scion is shaped to a wedge of 4-5 cm long by chopping the bark and wood from two opposite sides.

Actual procedure of grafting

This method of grafting is done when the rootstock is overgrown and thus not suitable for stone grafting. Three months old rootstocks were used for the grafting. The steps followed in grafting were given below:

- The wedge of the scion is inserted into the cleft of the rootstock, taking care to ensure that the cambium layers of stock and scion were in perfect contact with each other.
- The graft joint was secured firmly by a polythene tape (1.5 cm wide and 30 cm long).
- The scion of the graft was covered with a polythene cap (15 cm x 12.5 cm, 100 gauge thickness) and tied at the bottom by thread to maintain humidity inside it and to protect the apical bud from drying. But, care was taken that the polythene cap should not touch the terminal bud.
- The grafted plants were kept under shade for 10-15 days to enable sprouting of the terminal buds.
- Then the polythene caps were removed when buds sprouted.

The softwood grafting was done during the period from 28 September to 02 November 2012 according to treatments at weekly interval.

Results and discussion

Effect of growing media

The data given in the Table 1 showed the significantly highest success (77.78%) and survival (63.89%) of grafts was obtained in media M₃ (soil + FYM + leaf mould in 1:1:1 proportion) which was at par with M₂ media. However, it also recorded the minimum time to sprouting (15.51 days), maximum number of leaves per graft (8.94), length (36.95 cm) and girth (7.53 mm) of tap root of graft. Same treatment reported the maximum periodical graft height (25.12 cm, 25.43 cm, 25.92 cm and 26.01

cm) and scion girth of graft (3.32 mm, 3.43 mm, 3.54 mm and 3.67 mm) which was at par with M₂ media at 30, 40, 50 and 60 days after grafting, respectively (Table 2).

The results of present study are also in close conformity with the findings of Prasanth et al. (2007) in mango observed that September grafting in mango showed early sprouting (24.50 days). Significantly maximum percentage of sprouting (82.50 %) and graft take (54.56 %) was observed in first fortnight of September grafting.

Table 1. Effect of growing media and storage of stone on the success and survival percentage of soft wood grafts.

Treatments	Success of grafts (%)	Survival of grafts (%)
Growing Media (M)		
M ₁ - Soil + Sand + FYM (1:1:1)	73.89	55.56
M ₂ - Soil + FYM + Rice husk (1:1:1)	74.17	60.56
M ₃ -Soil + FYM + Leaf mould (1:1:1)	77.78	63.89
S.Em.±	1.19	1.76
C.D. at 5%	3.41	5.04
Storage of Stone (S)		
S ₀ - Zero week	83.89	72.22
S ₁ - One week	78.89	66.67
S ₂ - Two weeks	76.11	62.22
S ₃ - Three weeks	74.44	57.78
S ₄ - Four weeks	71.67	53.33
S ₅ - Five weeks	66.67	47.78
S.Em.±	1.68	2.48
C.D. at 5%	4.83	7.13
Interaction: M x S		
S.Em.±	2.91	4.30
C.D. at 5%	NS	NS
C.V.%	6.70	12.42

Effect of storage of stone

The treatment S₀ (zero week storage of stone) recorded the maximum success (83.89%) and survival (72.22%) of grafts which was at par with S₁ treatment. It also has significantly superior results in case of periodical observations like graft height (28.05 cm, 28.42 cm, 28.88 cm and 29.21 cm) and scion girth of graft (3.98 mm, 4.10 mm, 4.21 mm and 4.34 mm), at 30, 40, 50 and 60 days after grafting, respectively. The least time taken to

sprouting (13.62 days), highest number of leaves per graft (10.81), length (38.57 cm) and girth (7.82 mm) of tap root of graft were recorded in the same treatment which was at par with S₁ treatment in case of days to sprouting, number of leaves and tap root girth. Similarly Simon et al. (2010) reported that the higher survival percentage (> 75%) was achieved with the thicker rootstock than thinner rootstock. They also found that the early emerging plants produced more leaves than late emerging plants after grafting.

Table 2. Interaction effect of growing media and storage of stone on days to sprouting, number of leaves and graft height of mango

M x S	Days to sprouting				Number of leaves per graft			
	M ₁	M ₂	M ₃	Mean	M ₁	M ₂	M ₃	Mean
S ₀	14.18	13.41	13.27	13.62	10.62	10.75	11.07	10.81
S ₁	14.24	13.53	14.21	13.99	9.90	10.60	11.06	10.52
S ₂	15.38	17.15	15.15	15.89	8.90	9.03	9.70	9.21
S ₃	16.71	18.13	16.02	16.95	7.67	7.53	8.20	7.80
S ₄	17.52	18.82	16.45	17.59	7.01	7.02	6.95	6.99
S ₅	18.37	19.38	17.93	18.56	6.72	6.76	6.63	6.71
Mean	16.07	16.74	15.51		8.47	8.62	8.94	
	Media	Storage	Int.		Media	Storage	Int.	
S.Em.±	0.11	0.15	0.27		0.07	0.10	0.18	
C.D. at 5%	0.31	0.44	0.77		0.21	0.29	0.51	
C.V.%	2.88	2.88	2.88		3.55	3.55	3.55	
M x S	Graft height at 30 DAG				Graft height at 40 DAG			
	M ₁	M ₂	M ₃	Mean	M ₁	M ₂	M ₃	Mean
S ₀	27.99	27.94	28.22	28.05	28.40	28.29	28.55	28.42
S ₁	26.66	27.30	27.71	27.22	27.01	27.66	28.14	27.60
S ₂	24.33	25.26	27.65	25.75	24.74	25.66	28.02	26.14
S ₃	22.89	22.39	22.73	22.67	23.26	22.73	23.10	23.03
S ₄	20.72	20.86	22.65	21.41	21.08	21.20	22.69	21.66
S ₅	19.59	20.12	21.77	20.49	19.96	20.48	22.09	20.84
Mean	23.70	23.98	25.12		24.08	24.34	25.43	
	Media	Storage	Int.		Media	Storage	Int.	
S.Em.±	0.18	0.26	0.44		0.17	0.25	0.43	
C.D. at 5%	0.52	0.73	1.27		0.50	0.71	1.23	
C.V.%	3.15	3.15	3.15		3.01	3.01	3.01	
M x S	Graft height at 50 DAG				Graft height at 60 DAG			
	M ₁	M ₂	M ₃	Mean	M ₁	M ₂	M ₃	Mean
S ₀	28.87	28.75	29.01	28.88	29.09	29.27	29.29	29.21
S ₁	27.47	28.07	28.58	28.04	28.03	28.58	28.82	28.48
S ₂	25.22	26.10	28.43	26.58	25.82	26.62	28.58	27.01
S ₃	23.70	23.15	23.54	23.46	24.25	23.64	23.93	23.94
S ₄	21.58	21.66	23.42	22.22	22.09	22.43	23.42	22.65
S ₅	20.41	20.89	22.55	21.28	20.98	21.40	22.03	21.47
Mean	24.54	24.77	25.92		25.04	25.32	26.01	
	Media	Storage	Int.		Media	Storage	Int.	
S.Em.±	0.18	0.25	0.43		0.15	0.22	0.38	
C.D. at 5%	0.50	0.71	1.23		0.44	0.63	1.08	
C.V.%	2.97	2.97	2.97		2.57	2.57	2.57	

Table 3. Interaction effect of growing media and storage of stone on length and girth of tap root and scion girth of mango grafts

M x S	Length of tap root of graft (cm)				Girth of tap root of graft (mm)			
	M ₁	M ₂	M ₃	Mean	M ₁	M ₂	M ₃	Mean
S ₀	37.43	38.60	39.68	38.57	7.61	7.87	7.97	7.82
S ₁	36.41	36.90	38.93	37.41	7.34	7.61	7.92	7.62
S ₂	33.27	35.24	36.54	35.02	6.14	7.10	7.64	6.96
S ₃	28.25	34.27	37.12	33.21	5.68	6.52	7.82	6.67
S ₄	27.17	32.87	36.47	32.17	5.24	6.15	7.46	6.28
S ₅	25.37	32.07	32.97	30.13	4.46	5.71	6.38	5.52
Mean	31.32	34.99	36.95		6.08	6.83	7.53	
	Media	Storage	Int.		Media	Storage	Int.	
S.Em.±	0.22	0.31	0.54		0.05	0.08	0.13	
C.D. at 5%	0.64	0.90	1.56		0.15	0.22	0.38	
C.V.%	2.74	2.74	2.74		3.33	3.33	3.33	
M x S	Scion girth at 30 DAG				Scion girth at 40 DAG			
	M ₁	M ₂	M ₃	Mean	M ₁	M ₂	M ₃	Mean
S ₀	3.45	4.22	4.26	3.98	3.59	4.34	4.37	4.10
S ₁	3.26	3.77	3.92	3.65	3.35	3.89	4.04	3.76
S ₂	2.79	3.30	3.34	3.14	2.99	3.43	3.44	3.29
S ₃	2.77	2.85	3.17	2.93	2.87	2.95	3.30	3.04
S ₄	2.69	2.67	2.79	2.72	2.78	2.76	2.90	2.81
S ₅	2.44	2.63	2.42	2.50	2.80	2.75	2.54	2.70
Mean	2.90	3.24	3.32		3.06	3.35	3.43	
	Media	Storage	Int.		Media	Storage	Int.	
S.Em.±	0.05	0.07	0.12		0.05	0.07	0.12	
C.D. at 5%	0.14	0.20	0.35		0.15	0.21	0.36	
C.V.%	6.65	6.65	6.65		6.53	6.53	6.53	
M x S	Scion girth at 50 DAG				Scion girth at 60 DAG			
	M ₁	M ₂	M ₃	Mean	M ₁	M ₂	M ₃	Mean
S ₀	3.69	4.44	4.49	4.21	3.81	4.57	4.63	4.34
S ₁	3.51	3.99	4.15	3.88	3.64	4.10	4.29	4.01
S ₂	3.28	3.55	3.54	3.46	3.49	3.68	3.68	3.61
S ₃	3.09	3.07	3.39	3.18	3.37	3.21	3.52	3.36
S ₄	3.07	2.88	3.01	2.99	3.21	3.00	3.12	3.11
S ₅	2.72	2.87	2.65	2.75	2.78	2.98	2.77	2.84
Mean	3.23	3.47	3.54		3.38	3.59	3.67	
	Media	Storage	Int.		Media	Storage	Int.	
S.Em.±	0.04	0.06	0.11		0.04	0.06	0.11	
C.D. at 5%	0.12	0.18	0.30		0.13	0.18	0.31	
C.V.%	5.39	5.39	5.39		5.21	5.21	5.21	

Interaction effect of growing media and storage of stone

The data pertaining to interaction effect of growing media and storage of stone on the growth parameters of rootstock was presented in Table 2. It has significant effect on the days to sprouting, graft height, number of leaves per graft, length and girth of tap root.

The treatment M₃S₀ containing mixture of soil + FYM + leaf mould (1:1:1) with zero week storage of stones required the minimum time to sprouting (13.27 days) which was at par with M₂S₀ and M₂S₁ treatments. However, highest graft height (28.22 cm, 28.55 cm, 29.01 cm and 29.29 cm) which was at par with M₁S₀, M₂S₀, M₂S₁, M₃S₁ and M₃S₂ treatments at all the storage period and scion girth of grafts (4.26 mm, 4.37 mm, 4.49 mm and 4.63 mm) which was at par with M₂S₀ treatment at all storage period and M₃S₁ treatment up to 40 DAG. Similarly, maximum shoot length of scion (11.92 cm) and number of leaves per graft (11.07) was observed in M₃S₀ treatment which was at par with M₁S₀, M₂S₀, M₂S₁ and M₃S₁ treatments. The treatment M₃S₀ showed maximum length (39.68 cm) which was at par with M₂S₀ and M₃S₁ and girth (7.97 mm) of tap root which was at par with M₁S₀, M₂S₀, M₂S₁, M₃S₁, M₃S₂ and M₃S₃ treatments. These results were supported by the findings of Amin (1974) in mango, he tried softwood grafting and obtained 91.5% success in nursery and 76% in field at Anand by wedge method.

Conclusion

Results have clearly indicated that the mango seedling raised when stone sown at zero to two

week storage of the stones in growing media mixture of soil + FYM + leaf mould (1:1:1) produced higher success and survival percentage of quality mango graft through soft wood grafting method under South Saurashtra agro-climatic condition.

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