

RESPONSE OF ROOTSTOCKS AND VARIETIES ON GROWTH AND SURVIVAL PERCENTAGE IN EPICOTYL GRAFTING OF MANGO (*MANGIFERA INDICA* L.)

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ABSTRACT

A field trial was conducted at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari, Gujarat during 2012 to study the "Response of rootstocks and varieties on growth and survival percentage in epicotyl grafting of mango (*Mangifera indica* L.)". The results of experiment revealed that an early initiation of sprouting of mango graft was recorded with Rajapuri rootstock (8.33 days) and Sonpari as a variety (8.41 days). Maximum number of graft established and sprouting percentage of graft at 1 month after grafting (MAG) was observed in Rajapuri as a rootstock (9.80) and Amrapali as a variety (10.41). Height of graft was maximum in Rajapuri as a rootstock (27.46, 29.22 and 36.42 cm) and Kesar as a variety (26.97, 28.87 and 35.79 cm) at 2, 4 and 6 MAG respectively. Maximum survival percentage of graft at 6 month after grafting was found in *Deshi* as rootstock (60.88%) and Sonpari as a variety (58.88%). Regarding interaction between rootstock and varieties, *Deshi* × Alphonso (71.10%), Rajapuri × Sonpari (71.10%) and *Deshi* × Amrapali (71.10%) were found superior for maximum survival of graft at 6 month after grafting.

INTRODUCTION

Mango (*Mangifera indica* L.), the king of fruit, is grown in India for over 4000 years. India is the largest producer of mango (180.02 lakh MT) occupies about 2.5 million hectares of area. In Gujarat the area under mango is 1.41 lakhs hectares with 10.03 lakh MT production (Anon., 2013).

Regarding varieties of mango, Kesar and Alphonso are the leading commercial varieties of Gujarat and having good export potential. Other varieties like Sonpari, Neelphonso and Amrapali are also gaining popularity among the farmers of this region. Dashehari and Totapuri gave significantly better performance and got popularly in farmers (Singh *et al.*, 2014). So we are selecting these varieties under this investigation. Epicotyl grafting method appears to be the best with respect to fast and mass multiplication and less time consuming for preparation of graft but mortality percentage is higher due to various factors like management, skill of operation, selection of rootstock and scion and climatic conditions. Reddy and Melanta (1989) used Nekkare mango as a rootstock and highest grafts success (90%) was obtained with Dashehari and Totapuri scions. Patil *et al.* (2008) observed that Alphonso grafted on Sindhura showed significantly highest graft success (77.80%) followed by Nekkare.

Generally fresh mango stones extracted from ripe mango fruits of any varieties are used for raising rootstocks. There is possibility of using fresh mango stones of particular variety for raising rootstocks and then these rootstocks are used for grafting

of that particular variety. Hence, the present experiment was carried out with the objectives to know the response of mango varieties to epicotyl grafting and to standardize rootstock for epicotyl grafting in commercial mango varieties.

MATERIALS AND METHODS

The trial was conducted at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari, Gujarat during 2012.

The experiment was laid out in Completely Randomized Design with factorial concept (FCRD). There was two factors (1) mango rootstocks and (2) mango varieties as scion and repeated thrice. Four mango rootstocks viz., Rajapuri (R_1), Kesar (R_2), Totapuri (R_3) and *Deshi* (R_4) and five mango varieties as a scion Alphonso (V_1), Kesar (V_2), Sonpari (V_3), Neelphonso (V_4) and Amrapali (V_5) were used in this experiment. Fifteen epicotyl grafts were made in each treatment. Regarding methodology, stones of each varieties were collected from R.H.R.S., Navsari, washed with fresh water and treated with carbendazim 10g/10 lit of water. After drying, stones were sown in raised bed at 10 × 5 cm spacing in vertical position in the month of June. The healthy vigorous and strong seedlings of 12-15 days old were up rooted along with stone for making epicotyls grafts. Whereas healthy terminal shoots of more than 3 months old with plump buds were selected as scion from different mango varieties and 12-15 cm long, straight bud woods were used of grafting.

The epicotyl grafting was done by wedge technique of grafting as described by Bhan *et al.* (1969). After making grafts it was planted in polythene bags of 18 × 22 cm size with sufficient drainage holes filled up with mixture of 1:1:1 laterite soil, vermicompost and cocopit as described by Parasana *et al.*, 2013. This grafts was kept under poly tunnel for one month and then put under net house. Spray of carbaryl (0.2%) 40 EC (20 ml/10lit.), propiconazol (10 ml/lit.) and drenching of carbendazim (1g/1 lit.) was made for controlling leaf eating caterpillar and fungus.

The data on days taken for first sprouting and sprouting percentage, survival percentage, height and girth of grafts, number of leaves per grafts at two months interval were recorded and subjected to statistical analysis. Number of days counted after preparation of graft to first sprouting, at one month after grafting the number of graft sprouted and its percentage was calculated. Height was measured from the base to the top of graft in centimeters with the help of scale and girth of graft was measured at the centre of joint of grafts in millimeter with the help of vanier caliper at 2, 4 and 6 MAG. The graft survival percentage was calculated at 6 MAG.

RESULTS AND DISCUSSION

The results obtained during study was described with the help of statistical analysis and discuss critically with relevant reference and literature.

Sprouting period and sprouting percentage at one month after epicotyl grafts

Regarding effect of rootstock, early initiation of sprouting of graft (8.33 days) was noted with Rajapuri rootstock (R₁), it was par with Totapuri rootstock (R₃) (8.47 days). *Deshi* rootstock (R₄) took more days for initiation. Rajapuri (R₁) rootstock was also found better with respect to more number of graft established (9.80) and higher sprouting percentage (65.32%) at 1 month of epicotyl grafting (Table 1). It might be due to vigorous growth nature in Rajapuri rootstock. Wide variation

in initiation of sprouting and sprouting percentage were observed in different rootstocks due to its heterozygous nature. Singh and Srivastava (1979), Purbiati *et al.* (1993) in mango and Patel *et al.* (2013) in cashew and Madhge *et al.* (2013) in citrus also observed similar results with respect to early sprouting and higher success percentage in their study.

Considering the effect of mango varieties as a scion Sonpari (V₃) had taken minimum days to initiation of sprouting of graft (8.41 days) which was followed by Kesar, Neelphonso and Amrapali. The maximum number of grafts established at one month after grafting and its percentage were reported in Amrapali variety of mango as scion (table-1). Thus present studies confirm the existence of genotypic differences. This type of results were previously noted by Kulwal and Tayde (1988) and Dhakal (1979) and observed wide variation in sprouting percentage with different varieties of mango. An early initiation of sprouting in Langra was noted by Alam *et al.* (2006).

Height of grafts

Among the different rootstock, Rajapuri (R₁) rootstock had maximum height i.e. 27.46cm, 29.22cm and 36.42cm at 2, 4 and 6 month after grafting, respectively. Second best rootstock was Kesar (R₂) in present study (table-2). Various research workers noted variation in height with different rootstocks.

Singh and Singh (1976) with Dashehari seedling, Samaddar and Chakrabarti (1988) with *Mangifera sylvatica* and Chandan *et al.*, (2006) with Bappakai rootstock produced maximum height of grafts.

Regarding varieties of mango, maximum height of grafts was recorded with Kesar (V₂) variety (26.97cm, 28.87cm and 35.79cm) followed by Sonpari (V₃) i.e. 26.75cm, 28.75cm and 35.54 cm at 2, 4 and 6 month after grafting, respectively. Least height of graft was noted with Amrapali (V₅) variety i.e. 23.74 cm, 25.72 cm and 33.19 cm at 2, 4 and 6 month after grafting, respectively. It may be due to its dwarfing nature of growth. Varietal difference in response to height of grafts in

Table 1: Effect of rootstocks and varieties on days taken for first sprouting, number of grafts establishment and percentage (%) 1 month after grafting

Treatments	Days taken for first sprouting	No. of grafts establishment at 1 month	Percentage (%) at 1 month after grafting
Rootstocks (R)			
R ₁ - Rajapuri	8.33	9.8	65.32
R ₂ - Kesar	8.73	8.33	55.55
R ₃ - Totapuri	8.47	8.73	58.21
R ₄ - <i>Deshi</i>	9.07	8.47	56.44
S.Em. ±	0.12	0.108	2.16
C.D. at 5 %	0.35	0.31	6.19
Varieties (V)			
V ₁ - Alphonso	9	8.75	58.32
V ₂ - Kesar	8.5	6.33	42.21
V ₃ - Sonpari	8.41	9.83	65.55
V ₄ - Neelphonso	8.59	8.83	58.88
V ₅ - Amrapali	8.75	10.41	69.44
S.Em. ±	0.13	0.121	2.42
C.D. at 5 %	0.39	0.35	6.92
Interaction R × V			
S.Em. ±	0.278	0.242	1.61
C.D. at 5 %	0.79	0.692	4.61
C.V. %	5.59	4.75	4.75

Table 2: Effect of rootstocks and mango varieties on height of graft in epicotyl grafting of mango (cm)

Treatments	Height of graft (cm)		
	2 MAG	4 MAG	6 MAG
Rootstocks (R)			
R ₁ - Rajapuri	27.46	29.22	36.42
R ₂ - Kesar	25.84	27.62	35.09
R ₃ - Totapuri	24.59	26.72	33.79
R ₄ - <i>Deshi</i>	25.43	27.38	34.17
S.Em. +	0.439	0.433	0.414
C.D. at 5 %	1.25	1.24	1.18
Varieties (V)			
V ₁ - Alphonso	25.21	26.79	34.09
V ₂ - Kesar	26.97	28.87	35.79
V ₃ - Sonpari	26.75	28.75	35.54
V ₄ - Neelphonso	25.49	27.56	34.73
V ₅ - Amrapali	23.74	25.72	33.19
S.Em. +	0.491	0.485	0.414
C.D. at 5 %	1.25	1.24	1.18

Table 3: Effect of rootstocks and mango varieties on girth of graft in epicotyl grafting of mango (mm)

Treatments	Girth of graft (mm)		
	2 MAG	4 MAG	6 MAG
Rootstocks (R)			
R ₁ - Rajapuri	6.45	6.83	6.99
R ₂ - Kesar	6.29	6.71	6.82
R ₃ - Totapuri	6.3	6.64	6.79
R ₄ - <i>Deshi</i>	6.33	6.8	6.92
S.Em. +	0.11	0.113	0.107
C.D. at 5 %	NS	NS	NS
Varieties (V)			
V ₁ - Alphonso	6.15	6.55	6.67
V ₂ - Kesar	6.44	6.83	7.01
V ₃ - Sonpari	6.5	6.89	7.01
V ₄ - Neelphonso	6.39	6.77	6.88
V ₅ - Amrapali	6.25	6.69	6.83
S.Em. +	0.123	0.127	0.119
C.D. at 5 %	NS	NS	NS

epicotyl grafting may be due to variations in their genetical make up influencing histological and physiological development within the scion shoots of similar age and growth in different ways. Chakrabarti and Sadhu (1983), Madalageri *et al.*, (1984) Gurudutta *et al.*, (2004) obtained maximum height of grafts in Langra, Dashaheri and Mulgoa, respectively. Various research workers observed varied growth pattern with different varieties of mango. It may be due to their genetical make up using different media and environmental condition. An interaction between different rootstock and varieties of mango were found to be non significant with respect to height of graft at 2, 4 and 6 MAG.

Girth of graft

Girth of graft was unaffected by different mango rootstocks in present study. However, maximum value of girth of graft was noted with Rajapuri rootstock (6.99cm) followed by *Deshi* rootstock (6.92cm) at 6 MAG (table-3). Likewise, there was nonsignificant different in girth of graft with respect to different varieties of mango. However, Sonpari (V₃) and Kesar (V₂) had higher value of girth of graft (7.01cm) at 6 MAG (table-3). Chakrabarti and Sadhu (1983) also reported non-significant

Table 4: Effect of rootstocks and mango varieties on number of leaves per graft in epicotyl grafting of mango

Treatments	Number of leaves per graft		
	2 MAG	4 MAG	6 MAG
Rootstocks (R)			
R ₁ - Rajapuri	16.06	20.26	25.12
R ₂ - Kesar	15.4	20.08	25.72
R ₃ - Totapuri	13.76	20.25	25.73
R ₄ - <i>Deshi</i>	14.24	22.68	28.12
S.Em. +	0.369	0.773	0.433
C.D. at 5 %	1.05	NS	1.23
Varieties (V)			
V ₁ - Alphonso	14.97	20.31	25.49
V ₂ - Kesar	15.7	21.1	26.07
V ₃ - Sonpari	15.63	21.43	26.51
V ₄ - Neelphonso	14.23	21.45	26.97
V ₅ - Amrapali	13.8	19.8	25.83
S.Em. +	0.412	0.865	0.484
C.D. at 5 %	1.17	NS	NS

differences with three varieties of mango. An interaction between rootstock and varieties of mango were found non-significant with respect to girth of graft at 2, 4 and 6 MAG.

Number of leaves per graft

The number of leaves per graft was significantly affected by different rootstocks of mango at 2 and 6 MAG, at initial stage. Rajapuri rootstock (R₁) had higher number of leaves per graft (16.06) whereas at 6 MAG, *Deshi* rootstock (R₄) was found better with producing higher number of leaves per graft (Table 4). Similar results were not available with Rajapuri and *Deshi* rootstock, but Chandan *et al.* (2006) note that Bappakai rootstock produce maximum number of leaves per graft.

Regarding varieties of mango, number of leaves per graft was significantly affected with different varieties at 2 MAG. More number of leaves per graft (15.70) was recorded with Kesar (V₂) variety and it was at par with Sonpari (V₃) and Alphonso (V₁). At 4 MAG and 6 MAG, number of leaves was found non-significant in different varieties (table-4). However, Radhamony *et al.*, (1989), Jana (2007) and Patil *et al.*, (2008) also recorded more number of leaves per plant with different varieties of mango in their studies. An interaction effect between rootstock and varieties was found non-significant.

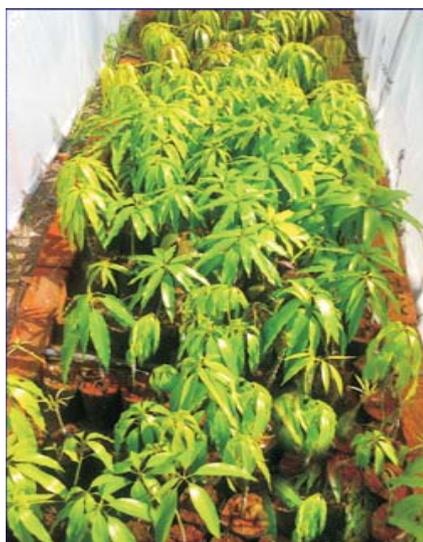
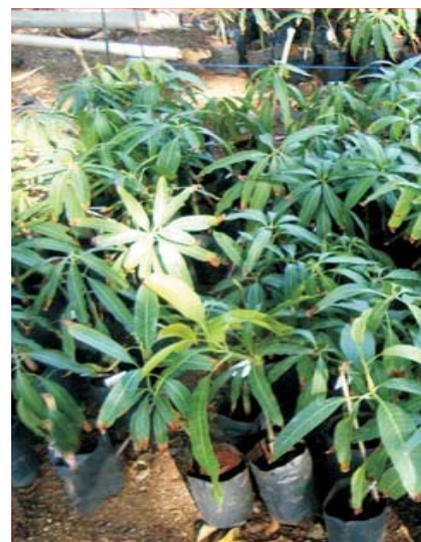
Survival percentage of grafts after 6 month of epicotyl grafting

The data presented in table 5 indicated that the survival percentage of graft after 6 month of epicotyl grafting was significantly affected due to different rootstocks and varieties of mango. The *Deshi* rootstock (R₄) was found better for maximum survival percentage of epicotyl grafting (60.88 %) which was remained at par with R₁ (Rajapuri) and R₂ (Kesar). Where as survival percentage was minimum in Totapuri rootstock (R₃). Oppenheimer (1956) show the high degree of uncertainty when mango grafts prepared out of heterozygous seedling stock. Singh and Srivastva (1979) also reported good success with different rootstocks of mango in Rataul, Mallika and Dashehari varieties of mango. Where as poor success was observed with Chausa.

Among the different varieties, Sonpari (V₃) rank first with higher survival percentage (58.88 %) followed by Amrapali (V₅) in

Table 5: Effect of rootstocks and mango varieties on survival percentage of grafts after 6 months of epicotyl grafting

Treatments	Percentage				
Rootstocks (R)					
R ₁ - Rajapuri	57.77				
R ₂ - Kesar	54.21				
R ₃ - Totapuri	38.21				
R ₄ - Deshi	60.88				
S.Em +	3.12				
C.D. at 5 %	8.93				
Varieties (V)					
V ₁ - Alphonso	48.88				
V ₂ - Kesar	48.88				
V ₃ - Sonpari	58.88				
V ₄ - Neelphonso	48.88				
V ₅ - Amrapali	58.32				
S.Em +	3.49				
C.D. at 5 %	9.99				
Interaction R × V					
	V ₁ - Alphonso	V ₂ - Kesar	V ₃ - Sonpari	V ₄ - Neelphonso	V ₅ - Amrapali
R ₁ - Rajapuri	64.44	57.77	71.1	46.66	48.88
R ₂ - Kesar	33.33	51.1	55.55	68.88	62.22
R ₃ - Totapuri	26.66	37.77	46.66	28.88	51.1
R ₄ - Deshi	71.1	48.88	62.22	51.1	71.1
S.Em ±	2.33				
C.D. at 5 %	6.66				
CV %	7.65				

T₁₆- Deshi + AlphonsoT₃- Rajapuri + SonpariT₂₀- Deshi + Amrapali**Figure 1: Growth of grafts at month after grafting under promising treatments**

present investigation. Various workers viz., Maiti and Biswas (1980), Singh and Srivastava (1981), Chakrabarti and Sadhu (1983), Kulwal and Tayde (1988), Patil *et al.*, (1991) and Radha and Arvindakishan (1998) recorded different percentage of success with different varieties of mango.

Regarding interaction between rootstock and varieties, Deshi × Alphonso (71.10%), Rajapuri × Sonpari (71.10%) and Deshi × Amrapali (71.10%) were found superior for maximum survival of graft at 6 month after grafting. (Table 5 and Fig.1).

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