



E-ISSN: 2278-4136  
P-ISSN: 2349-8234  
JPP 2017; SP1: 299-303

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## Studies on success of epicotyl grafting as affected by age of seedling rootstock in mango (*Mangifera indica* L.)

**Pallavi Chaudhary, Satya Prakash, Ankur Kumar and Rajendra Singh**

### Abstract

Epicotyl grafting was performed in the month of August on 7 days and 9 days old seedling rootstocks of mango using Dashehari as scion stock. The objective was to analyze the effect of age of root stock on the performance of epicotyl grafting in mango. Based on the results of two years study, it can be concluded that epicotyl grafting in mango was found to be most successful in terms of bud sprouting growth and survival percent when performed on 7 days old seedling rootstock (17.39 % increase in percent success) over 9 days old seedling rootstock.

**Keywords:** Mango, Rootstock, Epicotyl grafting, Bud sprouting, Survival

### Introduction

Mango (*Mangifera indica* L.) is the most popular fruit crop in the orient particularly in India, where it is considered as the best choice among all indigenous fruits. Non availability of quality planting material of desired variety in required number is one of the most important bottlenecks in increasing area under mango cultivation. The researchers have suggested a number of propagation techniques in mango like inarching, veneer grafting and softwood grafting which have been practiced commercially (Ram and Bistt 1982, Pathak and Ram 2003) [16]. However, epicotyl grafting in recent years is gaining ground in propagation of fruit crops (Kaur and Malhi 2006, Gurudatta *et al.*, 2004) [8, 5]. It is being easy, cheap and one of the most rapid technique to produce high quality and quantity planting material in less time and area. Therefore, it has been considered a better method of establishing mango orchard. The technique is becoming popular in the states like Maharashtra, Karnataka and Kerala (Majumdar, 1989) [10]. The success of epicotyl grafting depends on different factors such as temperature, relative humidity, light, soil moisture, cultivar of scion, pre-defoliation of scion, length of scion, age of rootstock, time and method of grafting and the skills of the grafter. The cultivar and age of rootstocks have been found to be important factors for the higher percentage of grafts success, survival and growth (Jose and Velselkumari, 1991) [7]. Rootstocks play an important role for tree survival and establishment in the field, tree productivity and dwarfing of grafted fruit trees (Mng'omba *et al.*, 2008) [12]. The graft success can be improved when rootstock of proper age is considered. (Simons, 1987) [17]. Therefore, in the present study efforts have been made to take up seedling rootstocks of different age groups to find out their impact on various parameters of stone grafts including their survival.

### Materials and Methods

The experiment was conducted at Horticultural Research Centre (HRC) of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, Uttar Pradesh, during 2013-14 and 2014-15.

### Selection of seedling rootstocks

Seven and nine days old germinating healthy and straight seedlings of uniform height, thickness and growth were used as root stock for the epicotyl grafting. Freshly extracted healthy stones were used for the study.

### Selection of scion

Dashehari cultivar of mango was chosen as scion for epicotyl grafting.

### Selection of mother plant for scion collection

Selection of scion mother plant is the important factor for the propagation of fruit plants by grafting. Quality scion mother with appropriate growing conditions assures higher percentage of graft success. Considering this fact, pest and disease free, vigorous and uniform bearing scion mother plants of cv. Dashehari growing in mother block of HRC were selected for the collection of scion shoots.

### Selection of the scion materials

The non-flowering shoots of fresh growth having dark green color leaves, about 8-15 cm long, straight, smooth, healthy, pest and disease free with swollen terminal bud in bulging condition were selected. The scion shoots of about 3-4 months old were likely to contain sufficient reserved food to provide energy for respiration, callus formation, successful graft union and early sprouting.

### Defoliation of scion shoots

The selected scion shoots were defoliated 7 days leaving one-fourth of the petiole before the detachment. After 7 days of defoliation, the defoliated scion sticks were detached from the mother plants with the help of sharp secateur.

### Collection of defoliated scion sticks

The defoliated scion sticks were collected in moist sphagnum mass and wrapped with poly ethylene sheet in order to protect them against desiccation.

### Time of grafting

The epicotyl grafting was performed on 7 and 9 days old mango seedlings in August, during 2013-14 and 2014-15. The grafting operation was completed on the same day of grafting.

### Technique of operation

The epicotyl grafting was performed by the wedge technique as suggested by Majumdar and Rathore (1970) [11]. After placing the scion into stock, the graft was properly tied with 200-gauge poly ethylene film.

### Nursery practices

The colored poly bags of 22:13:10 cm size were used for sowing the freshly extracted healthy uniform stones to ensure the availability of seedlings to be used as rootstocks. The stones were covered with different growing media to facilitate better germination. The uniform cultural practices with regard to watering, hoeing, weeding, manuring and plant protection measures were adopted.

### Recording of observation

Total number of sprouted stone grafts was counted and the percentage of sprouting grafts was calculated on the basis of total number of grafts per treatment. The diameter of the rootstock of the graft was recorded in mm with the help of Vernier calipers after 30 days and 180 days of grafting. The diameter of the scion of the graft was recorded in mm with the help of Vernier calipers after 30 days and 180 days of grafting. Survival percentage calculated on the grafts surviving after 180 days of grafting were considered. The growth parameters were recorded after 30 days and 180 days of grafting. The data obtained on different traits of epicotyl grafting were statistically analyzed by using the factorial RBD as per the method described by Gomez and Gomez (1994) [4].

## Results and Discussion

### Days taken for bud sprouting

The impact of different age groups rootstock on days taken for bud sprouting in mango grafts were significantly higher when grafting was performed on 9 days old seedling rootstock, while minimum days for bud sprouting were recorded when grafting was performed on 7 days old seedling rootstock during both the years of study (Table 1 and 2). Significantly early sprouting was also observed by Kaur and Malhi 2006 [8], Brahmachari *et al.*, 1999 [2] and Kumar 2012 [9]. The comparatively lesser time for sprouting taken by grafts made on younger seedling root stock in the present study might be due to better contact of cambial layers of stock and scion resulting in early callus formation and initiation of subsequent growth (Chandel *et al.*, 1998) [3]. Another reason for early sprouting in grafts made on younger seedling root stock might be due to rapid sap flow in stock and scion which could have favored the healing process and established the continuity of cambial and vascular tissue for sprouting.

### Rootstock and scion diameter

The diameter of rootstock and scion of grafts was significantly influenced in the present study due to the effect of age of rootstock. The grafts made on 7 days old seedling root stock had recorded highest root stock and scion diameter as compared to older seedling root stock. Kumar 1996 while studying the age of root stock on survival of mango grafts also observed that scion girth of grafts made on 8 days old seedling root stock was significantly higher as compared to remaining rootstocks of other age group. The minimum girth of scion as per the findings of their study was recorded on older (16 days) seedling root stock.

### Graft height

The plant height is the primary character which decides the vigour of the plant and in turn the dry matter production (Nalage *et al.*, 2010) [13]. It increased as the age of the plant progressed from vegetative to harvesting stage. When the data on graft height in the present study was critically examined, the maximum graft height was found to be with grafts made on 7 days old seedling rootstock rather than 9 days old seedling root stock. Increase in height of grafts made on younger seedling rootstock in the present study was also reported by Alam *et al.*, 2006 and Jha and Brahmachari 2002 [1, 6] who observed tallest shoots in stone grafts made on younger seedling. The results of the present study also confirmed the findings of Kumar, 1996 who had observed that grafts made on 8 days old seedling root stock exhibited significantly maximum graft height than the grafts made on root stock of other age groups. Another reason for greater height of grafts made on young root stock in the present study might be because of the fact that the grafts made on 7 days old seedling rootstocks received fairly long period of favorable weather for vegetative growth because of early sprouting in such grafts (Singh, 2007) [18].

### Survival percentage

The data recorded on survival of mango grafts after six month of grafting displayed significant influence of age of rootstock (Table -3 and 4). The survival percentage of grafts decreased with increase in age of root stock irrespective of growing media and growing conditions. The data pertaining to survivability of mango graft showed that grafts had maximum

percent success when grafting was made on younger (7 days old) seedling rootstock, while minimum survivability of grafts was observed when grafting was performed on older (9 days old) seedling rootstock. Significantly higher survival rate of grafts was also observed by Kaur and Malhi 2006, [8] Brahamchari *et al.*, 1999 [2] and Kumar 2012 [9] with younger seedling rootstock for epicotyl grafting in mango. The findings of the present study were also supported by Alam *et al.*, 2006 [1] who had recorded minimum success per cent of grafts with very young or very old seedlings rootstock. The

comparatively higher per cent success made on younger seedling root stock in the present study might be due to better contact of cambial layers of stock and scion resulting in early callus formation and initiation of subsequent growth (Chandel *et al.*, 1998) [3]. Another reason for maximum survival percentage in grafts made on younger seedling root stock might be due to rapid sap flow in stock and scion which could have favored the healing process and established the continuity of cambial and vascular tissue for sprouting.

**Table 1:** Effect of age of rootstock, growing media and growing conditions on the days taken for bud sprouting in mango grafts during 2013-14

Treatments	Days taken for bud sprouting						Treatment Mean
	Open condition			Shade condition			
	7 days old seedling	9 days old seedling	Mean	7 days old seedling	9 days old seedling	Mean	
Orchard soil (Control)	23.20	24.18	23.69	21.10	22.22	21.66	22.68
Soil+ Sand	22.91	23.75	23.33	20.81	21.59	21.20	22.27
Soil+ FYM	20.89	21.79	21.34	19.00	19.90	19.45	20.39
Soil+ Vermicompost	20.59	21.41	21.00	18.68	19.64	19.16	20.08
Soil+ Leaf mould	22.56	23.27	22.91	20.56	21.49	21.02	21.97
Soil+ Saw dust	22.13	22.80	22.46	20.19	21.03	20.61	21.54
Soil + Sand+ FYM	20.25	21.16	20.70	18.45	19.40	18.92	19.81
Soil+ Saw dust +FYM	19.83	20.81	20.32	18.13	19.09	18.61	19.47
Soil+ Saw dust +Vermicompost	19.09	20.19	19.64	17.31	18.62	17.96	18.80
Soil+ Sand + Vermicompost	19.39	20.52	19.95	17.64	18.90	18.27	19.11
Soil+ Saw dust +Leaf mould	21.11	22.20	21.65	19.28	20.27	19.78	20.71
Soil+ Sand+ Leaf mould	21.67	22.40	22.04	19.60	20.67	20.13	21.08
Mean	21.13	22.04	21.59	19.23	20.23	19.73	

**LSD (<0.05%)**

Age of rootstock = 0.027

Growing media = 0.066

Growing conditions = 0.027

Growing media x Growing conditions = 0.093

Growing media x Age of rootstock = 0.093

Growing conditions x Age of rootstock = 0.038

Growing media x Growing conditions x Age of rootstock = NS

**Table 2:** Effect of age of rootstock, growing media and growing conditions on the days taken for bud sprouting in mango grafts during 2014-15

Treatments	Days taken for bud sprouting						Treatment Mean
	Open condition			Shade condition			
	7 days old seedling	9 days old seedling	Mean	7 days old seedling	9 days old seedling	Mean	
Orchard soil (Control)	27.39	28.39	27.89	25.50	26.61	26.05	26.97
Soil+ Sand	27.57	28.27	27.92	25.36	26.54	25.95	26.94
Soil+ FYM	24.71	25.50	25.11	22.57	23.76	23.16	24.13
Soil+ Vermicompost	24.57	25.55	25.06	22.27	23.74	23.01	24.03
Soil+ Leaf mould	26.48	27.68	27.08	24.49	25.45	24.97	26.02
Soil+ Saw dust	26.55	27.58	27.06	24.38	25.37	24.88	25.97
Soil + Sand+ FYM	23.71	24.80	24.26	21.74	22.49	22.12	23.19
Soil+ Saw dust +FYM	23.43	24.59	24.01	21.53	22.20	21.87	22.94
Soil+ Saw dust +Vermicompost	22.59	23.39	22.99	19.68	21.58	20.63	21.81
Soil+ Sand + Vermicompost	22.61	23.42	23.01	19.74	21.53	20.63	21.82
Soil+ Saw dust +Leaf mould	24.84	26.71	25.78	23.41	24.40	23.90	24.84
Soil+ Sand+ Leaf mould	24.79	26.61	25.70	23.79	24.66	24.23	24.96
Mean	24.94	26.04	25.49	22.87	24.03	23.45	

**LSD (<0.05%)**

Age of rootstock = 0.077

Growing media = 0.189

Growing conditions = 0.077

Growing media x Growing conditions = 0.267

Growing media x Age of rootstock = 0.267

Growing conditions x Age of rootstock = NS

Growing media x Growing conditions x Age of rootstock = 0.377

**Table 3:** Effect of age of rootstock, growing media and growing conditions on survival in mango grafts after six months of grafting during 2013-14

Treatments	Per cent survival in mango grafts						Treatment Mean
	Open condition			Shade condition			
	7 days old seedling	9 days old seedling	Mean	7 days old seedling	9 days old seedling	Mean	
Orchard soil (Control)	52.75	50.25	51.50	60.25	57.75	59.00	55.25
Soil+ Sand	55.75	53.75	54.75	62.50	60.00	61.25	58.00
Soil+ FYM	63.75	61.50	62.63	68.75	66.25	67.50	65.07
Soil+ Vermicompost	66.25	63.25	64.75	71.25	68.50	69.88	67.32
Soil+ Leaf mould	56.75	54.25	55.50	63.75	61.25	62.50	59.00
Soil+ Saw dust	57.50	55.50	56.50	65.00	62.50	63.75	60.13
Soil + Sand+ FYM	67.25	65.50	66.38	73.75	71.25	72.50	69.44
Soil+ Saw dust +FYM	70.00	67.25	68.63	75.00	72.50	73.75	71.19
Soil+ Saw dust +Vermicompost	73.50	69.50	71.50	78.75	76.25	77.50	74.50
Soil+ Sand + Vermicompost	71.75	68.50	70.13	76.50	73.75	75.13	72.63
Soil+ Saw dust +Leaf mould	61.25	58.75	60.00	67.50	65.00	66.25	63.13
Soil+ Sand+ Leaf mould	58.75	57.50	58.13	66.25	64.25	65.25	61.69
Mean	62.94	60.46	61.70	69.10	66.60	67.85	

LSD (&lt;0.05%)

Age of rootstock = 1.729

Growing media = 4.235

Growing conditions = 1.729

Growing media x Growing conditions = NS

Growing media x Age of rootstock = NS

Growing conditions x Age of rootstock = NS

Growing media x Growing conditions x Age of rootstock = NS

**Table 4:** Effect of age of rootstock, growing media and growing conditions on survival in mango grafts after six months of grafting during 2014-15

Treatments	Per cent survival in mango grafts						Treatment Mean
	Open condition			Shade condition			
	7 days old seedling	9 days old seedling	Mean	7 days old seedling	9 days old seedling	Mean	
Orchard soil (Control)	60.25	58.50	59.38	65.50	63.75	64.63	64.63
Soil+ Sand	64.75	63.25	64.00	68.75	67.50	68.13	68.13
Soil+ FYM	74.00	72.50	73.25	78.75	76.75	77.75	77.75
Soil+ Vermicompost	76.50	74.75	75.63	80.00	78.75	79.38	79.38
Soil+ Leaf mould	65.25	64.25	64.75	70.00	68.75	69.38	69.38
Soil+ Saw dust	66.75	65.50	66.13	72.50	70.75	71.63	71.63
Soil + Sand+ FYM	78.75	76.50	77.63	82.00	80.25	81.13	81.13
Soil+ Saw dust +FYM	80.50	78.75	79.63	83.75	81.75	82.75	82.75
Soil+ Saw dust +Vermicompost	82.25	81.25	81.75	86.25	84.25	85.25	85.25
Soil+ Sand + Vermicompost	81.50	80.00	80.75	85.00	83.75	84.38	84.38
Soil+ Saw dust +Leaf mould	70.50	69.25	69.88	75.25	73.75	74.50	74.50
Soil+ Sand+ Leaf mould	69.25	67.50	68.38	73.75	72.50	73.13	73.13
Mean	72.52	71.00	71.76	76.79	75.21	76.00	

LSD (&lt;0.05%)

Age of rootstock = 1.22

Growing media = 2.988

Growing conditions = 1.22

Growing media x Growing conditions = NS

Growing media x Age of rootstock = NS

Growing conditions x Age of rootstock = NS

Growing media x Growing conditions x Age of rootstock = NS

### Conclusion

Based on the results of two years study, it can be concluded that epicotyl grafting in mango was found to be most successful in terms of sprouting and survival percentage of grafts when performed on 7 days old seedling rootstock (17.39 % increase in percent success) over 9 days old seedling rootstock. Therefore, it is confirmed that the age of rootstock has definite effect on survival of the grafted plants. The seven days old rootstock in present study gave highest survival

percentage of graft using Dashehari as scion cultivar.

### Acknowledgements

Authors are highly thankful to the facilities and funds provided by Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, Uttar Pradesh.

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