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Effect of soaking treatments and scion on growth and success of epicotyl grafting in mango

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Abstract

A trial was conducted at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari, Gujarat during 2016-17. The results of experiment revealed that minimum days taken to first sprout of mango grafts was recorded with *Vermiwash* 1 % as soaking treatment (10.33) and Kesar as variety of scion (12.27). Maximum number of successful grafts established at 1, 2, 4 and 6 month after grafting (MAG) was observed in *Vermiwash* 1 % as soaking treatment (17.50, 16.00, 14.50 and 13.50, respectively) and Kesar as variety of scion (16.08, 14.06, 12.17 and 10.72, respectively). Maximum number of leaves of grafts at 2, 4 and 6 MAG was noted in *Vermiwash* 1 % as soaking treatment (13.57, 19.60 and 25.57, respectively) and Kesar as variety of scion (12.01, 17.19 and 22.04, respectively). Height of graft was maximum in *Vermiwash* 1 % as soaking treatment (29.03 cm, 36.98 cm and 45.53 cm) and Kesar as variety of scion (26.69 cm, 33.25 cm and 40.11 cm) at 2, 4 and 6 MAG. Therefore, soaking treatments and scion of varieties can be utilized for maximum success, enhancing earliness and production of vigorous grafts.

Keywords: epicotyl grafting, mango, soaking treatments, rootstock, scion

Introduction

Mango (*Mangifera indica* L.), belongs to the family Anacardiaceae, is undoubtedly one of the preferable and most ancient fruit known to mankind, being successfully grown both in tropical as well as sub-tropical region of India. It has developed its own importance all over the World and its cultivation is nearly as old as Indian civilization. In the past two decades, India has witnessed an increase in the area under mango on account of demand for fresh fruits in the domestic as well as International market. In the past two decades, India has witnessed an increase in the area under mango on account of demand for fresh fruits in the domestic as well as International market. However, limited availability of genuine planting material is the most important bottleneck in the expansion of area under mango. As mango is a highly cross pollinated crop, there is an enormous variation in the seedlings raised even from the fruits of the same tree. When raised by seeds, mango plants are not true to type and lose many of their unique characteristics. Vegetative propagation thus became a necessity in mango to preserve and perpetuate the characteristics of each cultivar.

Rootstocks are always seedling origin irrespective of zygotic/ nucellar nature. In semi-arid regions the mango stones are available during the drier parts of the year (April- June) because of which the germination percentage and vigor is very low. Synchronization and rapid seed emergence are the benefits of bioformulations or organics on germination and seedling growth. The significant enhancement of germination was noticed in different pre-soaking treatments by Padma and Narayana Reddy (1998) [12] and Rao (2002) [19] in mango. Higher germination percentage of mango stones is the main criterion and strong base for successful grafts.

Due to graft-success, convenience and ease of stone grafting in commercial cultivars, it would be economically viable compared to traditional methods (Patil *et al.*, 1991) [16]. Earlier workers have reported varying degrees of success of stone grafting in different names such as bench grafting, epicotyl grafting, seedling grafting, *etc.* (Kashyap *et al.*, 1989) [8]. Success in stone grafting may vary depending upon use of rootstock, variety of scion, length of scion and grafting season. In couple of years, epicotyl method has been found the easiest, cheapest and less time consuming method for mango grafting. Epicotyl grafting has a good promise as it is easy to operate and very cheap (Bhan *et al.*, 1969) [2]. One of the striking advantages of this method is that the scion shoots of desired varieties can be collected from distant places,

because it can be stored up to 4 days with good result up to some days by providing favorable conditions. The cost of production of seedling rootstock is minimized up to a great extent. It is a scion detached method, very easy, simple and rapid (Majumder and Rathore, 1970) [11]. The research work carried out during the last few years have clearly shown that this technique can be adopted for large-scale multiplication of mango in Western India. Epicotyl grafting method is being employed for massive production of mango grafts in the Konkan region of Maharashtra (Gunjate, 1989) [5]. The present investigation was conducted to study the success and growth parameters of epicotyl grafting by soaking treatments and varieties.

Material and Methods

The present experiment was carried out during 2016-17 at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari under greenhouse conditions.

The experiment laid out in Completely Randomized Design with Factorial concept (FCRD). There was two factors (1) soaking treatments for mango stones and (2) mango varieties as scion and repeated thrice. experiment included twelve soaking treatments viz., P₁: *Neem seed* kernel extract (5%), P₂: *Neem seed* kernel extract (10%), P₃: Custard apple leaf extract (5%), P₄: Custard apple leaf extract (10%), P₅: Basil leaf extract (5%), P₆: Basil leaf extract (10%), P₇: Sucrose solution (1%), P₈: Sucrose solution (2%), P₉: *Vermiwash* (1%), P₁₀: *Vermiwash* (2%), P₁₁: Novel Liquid Organic Fertilizer (5%) and P₁₂: Novel Liquid Organic Fertilizer (10%) and two varieties as scion V₁: Kesar and V₂: Sonpari. Twenty epicotyl grafts were made in each treatment. Regarding methodology, the stones were sown in polythene bags after soaking for 24 hr as per the treatments.

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 10-12 cm long, straight scion were used of grafting. The epicotyl grafting was done by wedge technique of grafting as described by Bhan *et al.* (1969) [2]. After making grafts it was planted in polythene bags of 9" × 6" size with sufficient drainage holes filled up with mixture of red soil, well rotten farmyard manure and sand were mixed at a ratio of 2:1:1.

The data on days taken to first sprout, number of successful grafts, height and diameter 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 successful grafts was calculated. Height was measured from the base to the top of graft in centimeters with the help of scale and diameter of graft was measured at the centre of joint of grafts in centimeters with the help of vanier caliper at 2, 4 and 6 MAG. The experimental data were subjected to the statistical analysis by using variance technique as described by Panse and Sukhatme (1967) [14].

Results and Discussion

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

Days taken to first sprout

Regarding effect of soaking treatments, minimum days taken to first sprout (10.33) was noted with *Vermiwash* 1 % (P₉), It was at par with *Vermiwash* 2 % (10.60). Custard apple leaf extract 10 % took maximum days taken to first sprout (Table 1). It might be due to vigorous growth of rootstock. Wide variation in initiation of sprouting was observed in treatments due to heterozygous nature of rootstock. The good vigour of rootstock and scion compatibility might be resulted in early sprouting of buds. Singh and Srivastava (1979) [21], Patel and Amin (1981) [15] in mango observed similar result with respect to early sprouting in their study.

Considering the effect of varieties as a scion Kesar (V₁) had taken minimum days taken to first sprout (12.27) (Table 1). The minimum days taken to first sprout in Kesar variety of scion might be due to abundant supply of carbohydrate and defoliation which initiates bud activation and they are in a position to sprout early (Zimmerman, 1958) [22]. The results obtained by Purbiati *et al.* (1991) [18] and Gurudutta *et al.* (2004) [6] in mango are in consonance to the present study. An interaction effect between rootstock and varieties was found non-significant.

Number of successful grafts

The data presented in table 1 indicated that the number of successful grafts at 1, 2, 4, and 6 MAG was significantly affected due to different soaking treatments and varieties of scion.

Among the different soaking treatments *Vermiwash* 1 % (P₉) had maximum number of successful grafts at 1, 2, 4 and 6 MAG (17.50, 16.00, 14.50 and 13.50, respectively). The higher number of successful grafts might be due to the influence of weather parameter like humidity and temperature on graft survival might have given higher graft success by encouraging proper callus formation and strong union between the stock and scion. Similar results were reported by Patel and Amin (1981) [15] and Hima bindu and Srihari (2014) [7] in mango.

Regarding varieties of scion, maximum number of successful grafts was recorded with Kesar (V₁) 16.08, 14.06, 12.17 and 10.72 at 1, 2, 4 and 6 MAG, respectively. The higher number of successful grafts might be due to precured scion sticks and smaller area of transpiration as well as thin cell wall of bud sticks which might have involved in better callus formation and graft take. The results obtained by Chakrabarti and Sadhu (1984) [4], Patil *et al.* (1984) [17] and Reddy and Kohli (1989) [20] found the same trend while working on mango as well as other fruit crops. An interaction effect between rootstock and varieties was found non-significant.

Table 1: Effect of soaking treatments and varieties for scion on days taken to first sprout and number of successful grafts in mango

Treatments	Days taken to first sprout	Number of successful grafts			
		1 MAG	2 MAG	4 MAG	6 MAG
Soaking treatments for 24 hrs (P)					
P ₁ - <i>Neem Seed</i> kernel extract (5%)	14.13	15.50	13.00	10.83	8.83
P ₂ - <i>Neem Seed</i> kernel extract (10%)	14.37	14.50	12.17	9.83	7.83
P ₃ - Custard apple leaf extract (5%)	14.70	14.67	12.00	9.50	7.50

P ₄ - Custard apple leaf extract (10%)	15.53	15.17	12.33	10.00	7.83
P ₅ - Basil leaf extract (5%)	11.17	16.50	14.33	12.33	11.33
P ₆ - Basil leaf extract (10%)	11.80	16.33	14.33	12.33	11.17
P ₇ - Sucrose solution (1%)	12.20	16.33	14.17	12.17	11.00
P ₈ - Sucrose solution (2%)	12.47	16.17	14.00	11.83	10.67
P ₉ - Vermiwash (1%)	10.33	17.50	16.00	14.50	13.50
P ₁₀ - Vermiwash (2%)	10.60	16.67	14.83	13.33	12.33
P ₁₁ - Novel Liquid Organic Fertilizer (5%)	12.73	15.67	13.33	11.17	9.33
P ₁₂ - Novel Liquid Organic Fertilizer (10%)	12.97	15.33	12.83	10.50	8.67
S. Em. ±	0.251	0.376	0.350	0.319	0.293
C.D. at 5%	0.714	1.070	0.997	0.908	0.833
Varieties for scion (V)					
V ₁ - Kesar	12.27	16.08	14.06	12.17	10.72
V ₂ - Sonpari	13.23	15.64	13.17	10.89	9.28
S. Em. ±	0.102	0.153	0.143	0.130	0.119
C.D. at 5%	0.292	0.437	0.407	0.371	0.340
Interaction effect (P×V)					
S. Em. ±	0.355	0.531	0.495	0.451	0.414
C.D. at 5%	NS	NS	NS	NS	NS
CV%	4.82	5.80	6.30	6.78	7.17

Number of leaves

The number of leaves per graft was significantly affected by different soaking treatments at 2, 4 and 6 MAG. *Vermiwash* 1 % (P₉) had higher number of leaves per graft (13.57, 19.60 and 25.57, respectively). It was at par with *Vermiwash* 2 % at 2 and 6 MAG (Table 2). This might be related to vigorous growth of grafts induced by simulative organs and also influenced by maximum number of sprouts leading to maximum number of leaves. Similar results were obtained by Kumar *et al.* (2008) [9] and Hima bindu and Shrihari (2014) [7] in mango.

Table 2: Effect of soaking treatments and varieties for scion on number of leaves per grafts in mango

Treatments	Number of leaves		
	2 MAG	4 MAG	6 MAG
Soaking treatments for 24 hrs (P)			
P ₁ - <i>Neem Seed</i> kernel extract (5%)	10.87	14.02	18.60
P ₂ - <i>Neem Seed</i> kernel extract (10%)	10.67	13.00	18.13
P ₃ - Custard apple leaf extract (5%)	10.47	12.50	18.20
P ₄ - Custard apple leaf extract (10%)	10.10	12.17	17.10
P ₅ - Basil leaf extract (5%)	12.97	17.50	24.17
P ₆ - Basil leaf extract (10%)	12.07	16.80	23.13
P ₇ - Sucrose solution (1%)	12.03	16.70	22.60
P ₈ - Sucrose solution (2%)	11.63	16.57	22.50
P ₉ - <i>Vermiwash</i> (1%)	13.57	19.60	25.57
P ₁₀ - <i>Vermiwash</i> (2%)	13.17	18.00	24.43
P ₁₁ - Novel Liquid Organic Fertilizer (5%)	11.00	15.53	20.67
P ₁₂ - Novel Liquid Organic Fertilizer (10%)	10.93	14.97	20.13
S. Em. ±	0.175	0.290	0.420
C.D. at 5%	0.498	0.826	1.196
Varieties for scion (V)			
V ₁ - Kesar	12.01	17.19	22.04
V ₂ - Sonpari	11.23	14.03	20.49
S. Em. ±	0.071	0.118	0.172
C.D. at 5%	0.203	0.337	0.488
Interaction effect (P×V)			
S. Em. ±	0.248	0.410	0.594
C.D. at 5%	NS	NS	NS
CV%	3.69	4.55	4.84

Regarding varieties of scion, number of leaves per graft was significantly affected with different varieties at 2, 4 and 6 MAG. More number of leaves per graft (12.01, 17.19 and 22.04, respectively) was recorded with Kesar (V₁). According to Zimmerman (1958) [22] maximum number of leaves were recorded when fresh scion sticks were used for epicotyl grafting which may be due to more stored carbohydrates and other food substances available in the scion sticks after defoliation leads to more growth in terms of number of leaves. The sprouting percentages of grafts were positively correlated with survival percentage of grafts and number of leaves per grafts (Pandey and Singh, 2001) [13]. An interaction effect between rootstock and varieties was found non-significant.

Height of grafts

Among the different soaking treatments, *Vermiwash* 1 % (P₉) had maximum height *i.e.*, 29.03 cm, 36.98 cm and 45.53 cm at 2, 4 and 6 MAG, respectively. It was at par with *Vermiwash* 2 % at 2 MAG, Basil leaf extract at 2 MAG, *Vermiwash* 2 % at 4 MAG and *Vermiwash* 2 % at 6 MAG (Table 3). It might be due to better growth of rootstocks and weather conditions like temperature and humidity which played an important role in vegetative growth of grafts. The results are in conformity with Patel and Amin (1981) [15] and Kumar *et al.* (2008) [9] in mango.

Regarding varieties of scion, maximum height of grafts was recorded with Kesar (V₁) *i.e.*, 26.69 cm, 33.25 cm and 40.11 cm at 2, 4 and 6 MAG, respectively (Table 3). It might be due to the longer time available for growth in meristmatic cells coupled with better physiological process along with better graft union due to the better contact of cambium layers of the stock and scion causing better subsequent growth. The results are in accordance with Bajpai *et al.* (1989) [11] and Kumar *et al.* (2006) [10] in mango. An interaction effect between rootstock and varieties was found non-significant.

Table 3: Effect of soaking treatments and varieties for scion on height grafts (cm) in mango

Treatments	Height of grafts (cm)		
	2 MAG	4 MAG	6 MAG
Soaking treatments for 24 hrs (P)			
P ₁ - <i>Neem Seed</i> kernel extract (5%)	24.58	30.74	36.16
P ₂ - <i>Neem Seed</i> kernel extract (10%)	24.39	30.52	35.76
P ₃ - Custard apple leaf extract (5%)	24.26	30.35	35.09
P ₄ - Custard apple leaf extract (10%)	24.07	29.95	34.93
P ₅ - Basil leaf extract (5%)	28.19	35.00	43.24
P ₆ - Basil leaf extract (10%)	27.13	33.34	40.91
P ₇ - Sucrose solution (1%)	27.04	33.35	39.50
P ₈ - Sucrose solution (2%)	26.55	32.81	39.06
P ₉ - <i>Vermiwash</i> (1%)	29.03	36.98	45.53
P ₁₀ - <i>Vermiwash</i> (2%)	28.78	36.39	44.67
P ₁₁ - Novel Liquid Organic Fertilizer (5%)	25.76	31.65	37.12
P ₁₂ - Novel Liquid Organic Fertilizer (10%)	25.35	31.63	37.06
S. Em. ±	0.375	0.575	0.621
C.D. at 5%	1.067	1.637	1.767
Varieties for scion (V)			
V ₁ - Kesar	26.69	33.25	40.11
V ₂ - Sonpari	25.83	32.20	38.06
S. Em. ±	0.153	0.235	0.253
C.D. at 5%	0.436	0.668	0.721
Interaction effect (P×V)			
S. Em. ±	0.530	0.813	0.878
C.D. at 5%	NS	NS	NS
CV%	3.50	4.30	3.89

Diameter of grafts

Diameter of grafts was unaffected by different soaking treatments in present study. However, maximum value of diameter of grafts was noted with *Vermiwash* 1 % i.e., 0.87 cm, 0.89 cm and 0.93 cm at 2, 4 and 6 MAG, respectively (Table 4). Likewise, there was non-significant different in diameter of grafts with respect to varieties for scion.

However, Kesar variety (V₁) had higher value (0.85 cm, 0.87 cm and 0.91 cm) at 2, 4 and 6 MAG, respectively (Table 4). Chakrabarti and Sadhu (1983) [3] also reported non-significant differences with three varieties of mango. An interaction effect between rootstock and varieties was found non-significant.

Table 4: Effect of soaking treatments and varieties for scion on diameter grafts (cm) in mango

Treatments	Diameter of grafts (cm)		
	2 MAG	4 MAG	6 MAG
Soaking treatments for 24 hrs (P)			
P ₁ - <i>Neem Seed</i> kernel extract (5%)	0.82	0.84	0.88
P ₂ - <i>Neem Seed</i> kernel extract (10%)	0.81	0.84	0.87
P ₃ - Custard apple leaf extract (5%)	0.81	0.83	0.87
P ₄ - Custard apple leaf extract (10%)	0.81	0.83	0.86
P ₅ - Basil leaf extract (5%)	0.86	0.89	0.92
P ₆ - Basil leaf extract (10%)	0.85	0.88	0.91
P ₇ - Sucrose solution (1%)	0.85	0.88	0.91
P ₈ - Sucrose solution (2%)	0.85	0.88	0.91
P ₉ - <i>Vermiwash</i> (1%)	0.87	0.89	0.93
P ₁₀ - <i>Vermiwash</i> (2%)	0.86	0.89	0.92
P ₁₁ - Novel Liquid Organic Fertilizer (5%)	0.84	0.87	0.90
P ₁₂ - Novel Liquid Organic Fertilizer (10%)	0.84	0.87	0.90
S. Em. ±	0.017	0.018	0.017
C.D. at 5%	NS	NS	NS
Varieties for scion (V)			
V ₁ - Kesar	0.85	0.87	0.91
V ₂ - Sonpari	0.84	0.86	0.89
S. Em. ±	0.007	0.007	0.007
C.D. at 5%	NS	NS	NS
Interaction effect (P×V)			
S. Em. ±	0.024	0.025	0.024
C.D. at 5%	NS	NS	NS
CV%	4.90	5.05	4.67

Conclusion

Based on the above trial conducted in green house condition, it can be concluded that soaking mango stones in 1 %

Vermiwash and grafted by Kesar variety of scion proved best with respect to days taken to first sprout, number of successful grafts, number of leaves and height of grafts.

Therefore, soaking treatments and scion of varieties can be utilized for maximum success, enhancing earliness and production of vigorous grafts.

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