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Standardization of time and technique of grafting for quality production of nursery plants of amrapali mango (*Mangifera indica* L.)

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Abstract

The present investigation was conducted at Horticultural Research Centre, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, Uttar Pradesh, during 2013-14 under subtropical climatic conditions of western Uttar Pradesh with a view to find out the response of Amrapali mango to time and techniques of grafting. The experiment was carried out in factorial RCBD with five replications in each treatment. There were four grafts in each replication of all 9 treatment combinations. The treatment combinations were comprised of three time of grafting i.e. (25th July, 10th August and 25th August) with three methods of grafting viz, veneer grafting, softwood grafting and epicotyl grafting. Studies revealed that epicotyl grafting performed on 10th August recorded minimum time (15.70 days) for bud sprouting while as softwood grafting performed on 25th August recorded maximum time (20.80 days) for bud sprouting. Veneer grafting performed on 10th August was found to be the best technique in terms of sprouting percentage (79.60 %) after one and six month of grafting. Therefore, veneer grafting should be preferred over softwood and epicotyl grafting in order to get better survival and over all sprout growth for commercial propagation of quality plants of Amrapali mango.

Keywords: Amrapali, Veneer Grafting, Mango, Softwood Grafting, Epicotyl Grafting

Introduction

Mango (*Mangifera indica* L.) belonging to the family Anacardiaceae is one of the most important fruit crops grown in India and is acknowledged as the “King of Fruits” of this country. Mango is cross pollinated crop and is heterozygous in nature, therefore, plants raised by seeds leads to enormous variability and are never true to type. The plants raised through seed are tall and spreading type which causes lot of hazards in performing various cultural operations and also plants take long time to come into bearing. Therefore, vegetative methods are adopted to get true to type plants. The techniques of vegetative propagation which have been standardized in most of the fruit crops have substantially revolutionized the fruit industry in our country (Singh, 2009) [22]. Various researchers have suggested a number of propagation techniques in mango like inarching, veneer, softwood and epicotyl grafting which have been practiced commercially (Ram and Bist 1982 and Pathak and Ram 2003) [18]. Mango is propagated by veneer, softwood and epicotyl grafting techniques for high success rate. The above three techniques have some merits and demerits one upon the other. Veneer grafting fails to produce erect and stout plants of uniform canopy, which is one of the most important prerequisites for successful modern mango orcharding (Singh, 2009) [22]. The softwood grafting operations are similar to that of epicotyl grafting but the former is performed on one-year-old seedling while the later on newly germinated seedlings. The epicotyl grafting has been standardized (Bhan *et al.*, 1969 and Majumder and Rathore, 1970) [2, 8] and holds great promise for multiplying plants in larger number and in lesser time. The plants produced through epicotyl grafting are found to be uniform in canopy, straight, healthy, require less area for propagation and ultimately cheaper in cost. The cost of production of seedling rootstock is minimized to a great extent. Taking into consideration these vital aspects of grafting operations and also to meet the growing demand of quality mango grafts with best architecture, an attempt was made to study the effect of time and technique of grafting on the performance of mango graft in western Uttar Pradesh conditions which has been identified as Agri-Export Zone of mango.

Materials and methods

The present investigation was conducted at Horticultural Research Centre (HRC) of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, Uttar Pradesh, during

2013-14. Geographically, Meerut is situated at 29°05'5" North latitude and 77° 41'5" East longitude. It is located at an altitude of 237 meters above mean sea level. The mango stones of unknown commercial cultivars were used for raising seedling rootstocks for grafting. These stones were sown in black poly bags. Veneer and softwood grafting were performed on one-year-old seedlings, while epicotyl grafting was done on 10 day old seedlings. The media used for filling of poly bags consisting of soil, sand and FYM in the ratio of 1:1:1. The black poly bags of 22× 13× 10 cm size were used and each poly bag was filled with 1-1.5 Kg of growing media. The growing media were disinfected before sowing of stone. The single mango stone was sown in each poly bag. Just after sowing of mango stone, watering was done with the help of sprinkler. The poly bags were then kept in net house. One to two months old healthy scion shoots having 0.4 cm thickness and 8.0 cm length were selected from current season growth of mother tree of Amrapali. The selected scion shoots on mother plants were defoliated eight days before the actual operation and were detached from mother plant just prior to grafting operation.

All the techniques of grafting were performed on 25th July, 2013, 10th August, 2013 and 25th August, 2013. The grafting operation was completed on the same day. The techniques as suggested by Mukherjee and Majumdar (1961) [15] and Desai and Patil (1984) [4] were followed for performing veneer and softwood grafting, respectively. The epicotyl grafting was performed by wedge technique as suggested by Mujumdar and Rathore (1970) [8]. The experiment was carried out in factorial RCBD with five replications in each treatment. There were four grafts in each replication of all 9 treatment combinations. The treatment combinations were comprised of three time of grafting i.e. (25th July, 10th August and 25th August) with three methods of grafting viz, veneer grafting, softwood grafting and epicotyl grafting. The observations of mango grafts were recorded on every alternate day for sprout initiation and after one month and six month of grafting for all other observations.

Results

Effect of time and technique of grafting on days taken for bud sprouting in mango grafts after grafting:

There was a significant effect of time and technique of grafting on days taken for bud sprouting in mango grafts. It is evident from data (Table 1) that minimum time required for bud sprouting was observed when grafting was performed on 10th August followed by 25th July and 25th August. Among the treatments, it was the epicotyl grafted grafts which sprout earliest followed by veneer and softwood grafted grafts. The interaction effect of time and technique of grafting indicates that earliest sprouting was observed when epicotyl grafting was performed on 10th August (15.70 days) and latest sprouting was observed when softwood grafting was performed on 25th August (20.80 days). The various interactions between time and technique of grafting on days taken for bud sprouting were also found to be significant.

Effect of time and technique of grafting and scion cultivars on per cent success in mango grafts after one month of grafting

From the data presented in table 2, it's evident that the effect of time and technique of grafting significantly influences the sprouting percentage in mango grafts. The maximum per cent success was observed when grafting was performed on 10th August followed by 25th July and 25th August. Among the

treatments, veneer grafted grafts recorded the maximum per cent success followed by softwood and epicotyl grafted grafts. The interaction effect of time and technique of grafting indicates that maximum per cent success was observed in veneer grafting when performed on 10th August (85.64%) and minimum per cent success was observed in epicotyl grafting when performed on 25th August (62.20%). The various interactions between time and technique of grafting on per cent success were also found to be significant.

Effect of time and technique of grafting and scion cultivars on per cent success in mango grafts after six month of grafting

From the data presented in table 3, it's evident that the effect of time and technique of grafting significantly influences the sprouting percentage in mango grafts after six months. Among the treatments, veneer grafted grafts gave maximum per cent success followed by softwood grafted grafts while as epicotyl grafted grafts gave least. The highest per cent success was recorded when grafting operation was performed on 10th August followed by 25th July and 25th August.

The interaction effect of time and technique of grafting on per cent success was highest when veneer grafting was performed on 10th August (82.30%) while as per cent success was least when epicotyl grafting was performed on 25th August (58.06%). The various interactions between time and technique of grafting on per cent success were found to be significant.

Discussion

Effect of time of grafting on success of mango grafts:

The influences of time of grafting were examined under the present investigation. It was observed that among the different dates of grafting, the grafts made on 10th August took minimum time for bud breaking closely followed by grafting performed on 25th July and 25th August. The findings of the current study are in accordance with the findings obtained by Singh *et al.* (2012) [21] who observed earliest sprouting when grafting was done during wet season (July and August), while latest sprouting was recorded in September. Similarly, Islam and Rahim (2010) [5] observed maximum time for bud sprouting (11.07 days) when grafting was done on 26 August, while, it was minimum (10.12 days) when grafting was performed on 6 August. Earlier emergence during the first and second week of August in the present study might be due to the favorable temperature and relative humidity prevailing at that time. While investigating the effect of epicotyl grafting, Pandey and Singh (2001) [16] recorded the earliest sprouting and highest survival percentage in August. Patel and Amin (1981) [17] also obtained maximum sprouting per cent (100%) in the month of August followed by July. Their findings further revealed minimum sprouting per cent in October. In the present study, the grafts made on 10th August exhibited more sprouting closely followed by the grafts made on 25th July and 25th August. Moderate temperature and high humidity prevailing during rainy season (July-August) in the region accelerate the graft union formation and subsequently sprouting of shoots.

Effect of grafting techniques on success of mango grafts:

The influence of grafting techniques on bud break and survival were examined under the present investigation. During the study, it was observed that of the three techniques of grafting performed on the same day, earliest sprouting and maximum survival were recorded in epicotyl and veneer

grafting, respectively. Similarly, earliest sprouting and maximum survival were recorded in epicotyl and veneer grafting, respectively when grafting was performed on 10th August followed by 25th July and 25th August. It was also observed that of the two techniques of grafting earliest sprouting and maximum survival were recorded in veneer grafting followed by softwood grafting. Various workers under different climatic conditions have studied the influence of different techniques of grafting on bud break and survival per cent in mango (Bajpai *et al.* 1989; Brahmachari *et al.* 1999; Jane, 2007; Kumar *et al.* 2000; Mngomba *et al.* 2010; Nalage *et al.* 2010; Nayak and Sen, 2000; Sabeky, 2005; Singh *et al.* 2012) [1, 3, 6, 7, 9-14, 20, 21]. Singh *et al.* (2012) [21] observed that among different techniques of grafting, veneer grafting took minimum number of days (17.00) for bud sprouting as compared to other methods of grafting. Similarly, the sprout initiation in veneer grafting in the present study took about 17.33 days. The findings of present study obtained on the above aspects are quite comparable to the findings of earlier workers namely; Kumar *et al.* (2000) [7]; Nayak and Sen (2000) [12-14] and Sabeky (2005) [20]. The later researcher had reported highest success in veneer (65.8%) than softwood (63.7%) grafting. The earliest sprouting as observed with veneer grafting in the present study was also recorded by Mngomba *et al.* (2010) [9], who observed sprout initiation in veneer grafting in 19 days. Similarly, the sprout initiation in veneer grafting in the present study also took about 17.33 days. The earliest sprouting in veneer grafting in the present study might be due to early and better contact of cambial layers of stock and scion resulting in early callus formation as compared to those grafted by softwood grafting. The other possible reason for earliest sprouting with this technique can be attributed to the firmness with which the scion stick is held with the stem of rootstock without any interference from the plant tissue (Roy *et al.*, 1999) [19].

Table 1: Effect of time and technique of grafting on days taken for bud sprouting in mango grafts after grafting

Grafting techniques	Cultivar Amrapali			mean
	Time of grafting			
	25 th July	10 th August	25 th August	
Softwood	19.60	16.90	20.80	19.1
Veneer	18.50	16.10	19.70	18.1
Epicotyl	16.40	15.70	19.05	17.05
Mean	18.17	16.23	19.85	18.08
C.D. at 5%	1.08	0.37	1.37	
Date-0.375, Grafting-0.375: Date × Grafting-0.650				

Table 2: Effect of time and technique of grafting on days per cent success in mango grafts after one month of grafting

Grafting techniques	Cultivar Amrapali			mean
	Time of grafting			
	25 th July	10 th August	25 th August	
Softwood	80.26	83.72	79.20	81.06
Veneer	82.76	85.64	80.80	83.07
Epicotyl	63.80	65.52	62.20	63.84
Mean	75.61	78.29	74.07	75.99
C.D. at 5%	2.47	0.96	1.32	
Date-0.589:Grafting-0.589: Date × Grafting-1.020				

Table 3: Effect of time and technique of grafting and scion cultivars on per cent success in mango grafts after six month of grafting

Grafting techniques	Cultivar Amrapali			mean
	Time of grafting			
	25 th July	10 th August	25 th August	
Softwood	71.54	74.56	67.30	71.13
Veneer	73.80	79.60	70.80	74.73
Epicotyl	60.80	63.74	58.06	60.86
Mean	68.71	72.63	65.39	68.91
C.D. at 5%	1.45	1.10	1.41	
Date-0.464:Grafting-0.656 : Date × Grafting-0.804				

Conclusion

From the findings of research, it can be concluded that veneer grafting should be preferred over softwood and epicotyl grafting in order to get better survival and over all sprout growth for commercial propagation of quality plants of Amrapali mango.

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