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Effect of age of rootstocks and different growing media on the success of stone grafting in mango, *Mangifera indica* L

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ABSTRACT

The present study was conducted at the Horticulture Research Centre of Sardar Vallabhbhai Patel University of Agriculture and Technology during the year 2011-12. The influence of epicotyl (stone) grafting in different media on plant growth under shade conditions was studied. The experiment was laid out in randomized block design (RBD) with 7 treatments and five replications in two different aged seedlings. The mango stones of different unknown commercial cultivars were used for raising seedling rootstocks and Dashehari variety was used as scion. Among all the treatments the stone grafting on 10 days old seedling rootstocks resulted in highest success in terms of sprouting, survival, vegetative and root growth in comparison to grafts grafted on 13 day old seedling rootstocks. Among the growing media used in the study the soil + sawdust was found to be the best growing mixture in respect of sprouting, survival and overall performance of stone grafts over other growing mixtures.

Keywords: Grafting; epicotyl; scion; rootstock; sawdust

INTRODUCTION

Today mango, *Mangifera indica* L is recognized as one of the best fruits in the world market (Singh 2009). One of the main handicaps that has led to slow pace of evolution of the mango industry in India is the preponderance of seedling trees which are mostly of inferior type. However for the last few decades mango is vegetatively propagated on variable seedling rootstocks by different techniques. Because of its heterozygous nature significant changes have taken place in mango propagation. To overcome all these epicotyl grafting in recent years is gaining ground in propagation of fruit crops (Kaur and Malhi 2006, Gurudutta et al 2004). This technique of vegetative propagation has been considered a better method of establishing mango orchards. Grafting of scion on the germinating seedling through epicotyl method has been successfully used as an efficient, economic, rapid and convenient to adopt on commercial scale for propagation of mango. Moreover the

plants produced by this method are found to be uniform in canopy. So far the technique of epicotyl grafting in polybags particularly the age of rootstock and growing mixture has not been standardized under western Uttar Pradesh conditions. Therefore in order to make this technique commercially efficient and economical there is need to work on these aspects. Keeping these facts in view a propagation study on stone grafting in mango has been carried out with the objective to standardize the growing media and appropriate age of seedling rootstock to produce quality grafted plants for stone grafting in mango under western Uttar Pradesh conditions which has been identified as agri-export zone of mango.

MATERIAL and METHODS

The present investigations were carried out at the Horticulture Research Centre of Sardar Vallabhbhai Patel University of Agriculture and Technology during the year 2011-12. The influence of epicotyl (stone) grafting in different media on plant growth under shade conditions was studied. The experiment was laid out in randomized block design (RBD) consisting of 7 treatments viz T1= orchard soil (control), T2= soil + sawdust 1:1, T3= soil + FYM 1:1, T4= soil + vermicompost 1:1, T5= soil + vermicompost + sand 1:1:1, T6= soil + FYM + sand 1:1:1 and T7= soil + leaf mould 1:1 with five replications. The mango stones of different unknown commercial cultivars were used for raising seedling rootstocks and Dashehari variety was used as scion. The stone grafting was performed on 10 and 13 days old mango seedlings by the wedge technique as suggested by Majumdar and Rathore (1970). There were 2 grafts in each replication of all 14 treatment combinations. The data on days taken to bud sprouting from the date of grafting was recorded. The number of leaves, leaf size, graft height, root length per graft and survival percentage were recorded after one and six months of grafting.

RESULTS and DISCUSSION

Days taken to bud sprouting

Data presented in Table 1 show significant influence of age of grafts and growing media on days taken to bud sprouting after grafting. The grafts grafted on 10 days old seedling rootstock sprouted earlier (13.86 days) than the mango grafts grafted on 13 days old seedling rootstock (16.91 days). Significantly higher sprouting was also observed by Brahmachari et al (1999) with the use of younger seedling rootstock than older seedling rootstock. Comparatively higher success and lesser time taken by grafts grafted on younger seedling rootstock might be due to better contact of cambial layers of stock and scion resulting in early callus formation and initiation of subsequent growth. Another reason for getting greater success and better sprouting in grafts grafted on younger

Table 1. Effect of age of rootstocks and growing media on days taken to bud sprouting and graft height after 1 and 6 months of grafting

Treatment	Days taken for bud sprouting in grafts after grafting			Graft height after 1 month of grafting (cm)			Graft height after 6 months of grafting (cm)		
	a	b	Mean	a	b	Mean	a	b	Mean
T1	14.40	18.00	16.20	13	12.64	12.82	16.90	14.90	15.90
T2	11.80	15.20	13.50	22.60	16.60	19.60	23.40	16.20	19.80
T3	14.20	17.60	15.90	16.92	15.08	16.00	18.00	17.10	17.55
T4	14.40	16.80	15.60	15.46	15.28	15.37	17.00	17.00	17.00
T5	14.40	17.40	15.90	15.56	15.14	15.35	17.10	15.90	16.50
T6	13.40	17.20	15.30	18.00	15.26	16.63	18.70	17.40	18.05
T7	14.40	16.20	15.30	14.30	14.28	14.29	17.20	15.60	16.40
Mean	13.86	16.91		16.55	14.89		18.33	16.30	
$CD_{0.05}$									
Growing media			0.96			1.02			1.13
Age			0.513			0.54			0.60

a= 10-day old seedling rootstock, b= 13-day old seedling rootstock, T1=Orchard soil (control), T2= Soil + sawdust 1:1, T3= Soil + FYM 1:1, T4= Soil + vermicompost 1:1, T5= Soil + vermicompost + sand 1:1:1, T6= Soil + FYM + sand 1:1:1, T7= Soil + leaf mould 1:1

seedling rootstock might be rapid sap flow in stock and scion which could have favoured the healing process and established the continuity of cambial and vascular tissue for sprouting and ultimately resulted into higher plant survival (Chandel et al 1998). Among the treatments earliest sprouting occurred in grafts grown in soil + sawdust (13.50 days). The higher survival and earliest sprouting in soil + sawdust in the present study might be due to better porous quality and high water retaining capacity of sawdust. The interaction effect of age of rootstock and growing media on days taken to bud sprouting was found to be non-significant.

Graft height and root length of mango grafts

The graft height and root length of mango grafts was significantly affected by the age of grafts and growing media as depicted in Table 1 and 2. The maximum graft height after one month of grafting (16.55 cm), after six months of grafting (18.33 cm) and maximum root length (17.46 cm) was found with 10 days old seedling rootstock than 13 days old seedling rootstock. Among the growing media the maximum graft height after one month of grafting (19.60 cm), after six months of grafting (19.8 cm) and maximum root length after six months of grafting (20.50 cm) was

Table 2. Effect of age of rootstocks and growing media on root length and number of leaves produced after 1 and 6 months of grafting in mango grafts

Treatment	Root length of grafts after 6 months of grafting (cm)			# leaves produced after 1 month of grafting			# leaves produced after 6 months of grafting		
	a	b	Mean	a	b	Mean	a	b	Mean
T1	14.20	13.00	13.60	3.20	3.80	3.50	6.40	5.40	5.90
T2	23.00	18.00	20.50	7.20	5.20	6.20	14.80	12.40	13.60
T3	15.20	14.40	14.80	3.80	4.00	3.90	7.40	6.20	6.80
T4	17.20	14.20	15.70	4.60	4.20	4.40	6.80	6.40	6.60
T5	17.40	14.80	16.10	4.20	3.80	4.00	7.80	8.00	7.90
T6	18.80	15.20	17.00	4.00	4.40	4.20	7.80	9.60	8.70
T7	16.40	13.60	15.00	4.20	4.00	4.10	7.00	6.80	6.90
Mean	17.46	14.74		4.46	4.20		8.28	7.83	
$CD_{0.05}$									
Growing media			1.81			0.76			0.98
Age			0.97			NS			0.52

a= 10-day old seedling rootstock, b= 13-day old seedling rootstock, T1=Orchard soil (control), T2= Soil + sawdust 1:1, T3= Soil + FYM 1:1, T4= Soil + vermicompost 1:1, T5= Soil + vermicompost + sand 1:1:1, T6= Soil + FYM + sand 1:1:1, T7= Soil + leaf mould 1:1

recorded in grafts grown in soil + sawdust and least in grafts grown in control. The maximum height recorded in grafts grafted on 10 days old seedling rootstock in the present study was also reported by Alam et al (2006) who observed tallest shoots in stone grafts grafted on younger seedling. The higher graft height recorded in grafts grafted on 10 days old seedling rootstock in the present study could be possible due to early bud break in such grafts which resulted in early growth. The lesser height recorded in grafts grafted on 13 days old seedling rootstock might be due to late bud break in such grafts. As a result vegetative growth started late in such grafts. Another reason for greater height of grafts grafted on young rootstock in the present study might be that the grafts sprouted early received fairly long period of favourable weather for vegetative growth (Singh 2007). Better root growth in grafts on 10 days old seedling rootstock in the present study could be due to early sprouting, better union, quick callus formation and healing leading to better growth of the scion shoots. In early sprouted grafts due to greater nutrient uptake the subsequent growth started early and therefore such stone grafts grew more vigorously. As a result the root growth of grafts might have also increased. The comparatively greater height and root length of grafts grown in soil + sawdust might be due to better water

retaining capacity and porous quality of sawdust. Due to lack of organic matter in orchard soil the height of the grafts grown in control could not improve. In comparison to control better performance of other growing media in improving the graft height in the present study might be because of addition of organic matter in the growing media in the form of FYM, leaf mould or vermicompost. Owing to the presence of moisture for longer period in soil + sawdust there might be regular vegetative growth of sprouted grafts which resulted in better root growth as compared to grafts grown in other growing media.

Number of leaves and leaf length in mango grafts

The number of leaves and leaf length of the grafts were significantly affected by the age of the grafts and the growing media but the effect of age of rootstock on the number of leaves produced after one month of grafting was found to be non-significant as depicted in Table 2 and 3. The grafts grafted on 10 days old seedling rootstock had more number of leaves (4.46) after one month of grafting and maximum leaf length (14.94 cm) in comparison to grafts grafted on 13 days old seedling rootstock. When these grafts were grown in different growing media the soil + sawdust responded better in producing more leaves and maximum leaf length (15.80 cm) in grafts. The emergence of more number of leaves and maximum leaf size in grafts grafted on young seedling rootstock in the present study might be because of early sprouting in grafts grafted on younger seedling rootstock. Due to early sprouting the leaves emerged early in such grafts. As a result the number of leaves might have improved. The emergence of less number of leaves in grafts grafted on 13 days old seedling rootstock might be due to late bud break in such grafts. The finding of the current study are confirmed by the results of Jha and Brahmachari (2002) who recorded the higher values for leaf area in stone graft grafted on one week old seedling rootstock rather than two weeks old rootstock. The production of larger leaves in grafts grafted on younger seedling rootstock in the present study might be due to early sprouting and rapid sap flow in stock and scion of such grafts. The grafts grown in soil + sawdust produced more number of leaves and large sized leaves as compared to grafts grown in other growing media. It might be because of the fact that water holding capacity and porous quality of sawdust are comparatively better than other growing media such as vermicompost, leaf mould, FYM etc.

Saleable percentage of mango grafts

Data presented in Table 3 reveal that percentage of saleable plants was influenced by age of rootstock and growing media. The highest percentage of saleable plants (57.14) was obtained with grafts grafted on 10 days old seedling rootstock than 13 days old seedling rootstock. When

Table 3. Effect of age of rootstocks and growing media on leaf length and saleable plant per cent of mango grafts after 6 months of grafting

Treatment	Leaf length after 6 months of grafting (cm)			Saleable plant percentage of grafts after 6 months of grafting		
	a	b	Mean	a	b	Mean
T1	13.90	13.50	13.70	40.00	40.00	40.00
T2	17.20	14.40	15.80	80.00	60.00	70.00
T3	14.66	14.40	14.53	60.00	40.00	50.00
T4	14.74	14.20	14.47	40.00	40.00	40.00
T5	15.00	14.30	14.65	60.00	40.00	50.00
T6	15.20	13.90	14.55	60.00	40.00	50.00
T7	13.90	13.70	13.80	60.00	40.00	50.00
Mean	14.94	14.57		57.14	42.86	
Growing media			0.96			8.78
Age			0.51			4.27

a= 10-day old seedling rootstock, b= 13-day old seedling rootstock, T1= orchard soil (control), T2= soil + sawdust 1:1, T3= soil + FYM 1:1, T4= soil + vermicompost 1:1, T5= soil + vermicompost + sand 1:1:1, T6= soil + FYM + sand 1:1:1, T7= soil + leaf mould 1:1

these grafts were grown in different growing media the maximum saleable plant percentage was recorded with soil + sawdust (70). Higher percentage of saleable plants achieved with grafts grafted on younger rootstock might be because of the fact that due to early sprouting, quick healing and greater nutrient uptake, the subsequent growth of the grafts started early and therefore grafts grafted on 10 days old seedling rootstock grew more vigorously as compared to the grafts grafted on 13 days old seedling rootstock (Pathak and Shrivastva 1973). Hence developed grafts were comparatively taller and vigorous. The other possible reason might be due to rapid sap flow in grafts grafted on younger rootstock. As a result callus formation in such grafts completed early. The grafts grown in soil + sawdust in the present study had also higher saleable plant percentage as compared to other growing media. It might be because of early sprouting and better cambial contact of stock and scion which might have favoured the healing process. As a result the growth of stone grafts started early. Further due to better moisture retaining capacity and better porous quality of sawdust the grafts grew faster in such growing medium as

compared to other growing media. The lowest saleable plant percentage of grafts grown in control might be because of low level of organic matter and poor water retaining capacity of soil in control treatment. As a result the grafts grew poorly in such growing medium.

REFERENCES

Alam MA, Islam MS, Uddin MZ, Barman JC and Quamruzzaman AKM 2006. Effect of age of seedling and variety of scion in stone grafting of mango. International Journal of Sustainable Crop Production **1(2):** 27-32.

Brahmachari VS, Singh MP and Bishwas RC 1999. Effect of period of defoliation of scion and age of rootstock on success of epicotyl grafting in mango (*Mangifera indica* L) cv Amrapali. Orissa Journal of Horticulture **27(2):** 1-4.

Chandel JS, Negi KS and Jindal KK 1998. Studies on vegetative propagation in kiwi (*Actindia delicious* Chev). Indian Journal Horticulture **55:** 52-54.

Gurudutta PS, Jain V and Singh PN 2004. Response of mango cultivars to epicotyl grafting. Indian Journal of Horticulture **61(3):** 267.

Jha UN and Brahmachari VS 2002. Success in stone grafting of mango as influenced by the defoliation of scion and age of rootstocks and scion shoots. Horticultural Journal **15(1):** 9-17.

Kaur G and Malhi CS 2006. Effect of age of rootstock and growing medium on the success of epicotyl grafting in mango. Indian Journal Horticulture **63(3):** 244-247.

Majumdar PK and Rathore DS 1970. Epicolyl grafting in mango (*Mangifera indica* L). Current Science **39:** 42.

Pathak RK and Shrivastva RP 1973. Studies on vegetative propagation of apple by grafting. Progressive Horticulture **4:** 57-76.

Singh R 2007. Standardization of height and time of wedge grafting in mango (*Mangifera indica* L) under western UP condition. PhD (Hort) thesis, Sardar Vallabh Bhai Patel University of Agriculture and Technology, Meerut, UP, India.

Singh RN 2009. Establishing the orchard. In: Mango. Indian Council of Agricultural Research, New Delhi, India.

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