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Original Research Article

Studies on Exploration of Invigourated Khirni Rootstock Seedlings for Softwood Grafting in Sapota

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A B S T R A C T

An experiment entitled "Studies on exploration of invigourated Khirni rootstock seedlings for softwood grafting in sapota" was carried out at Main Garden, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, in the year 2015-2016. The experiment was conducted to study the effect of age of scion and rootstock on success of softwood grafting in sapota. The experiment was laid out in a Factorial Randomized Block Design. The treatment consisted of two different conditions of rootstocks viz., Vigourated and Invigourated rootstock seedling and three ages of scion viz., 3 months old scion, 6 months old scion, 9 months old scion with 6 treatment combinations and replicated thrice. The treatment combination of invigourated rootstock seedling with 3 month scion took minimum days for bud sprouting (19.21 days), Maximum length of scion (20.86 cm), sprout length (19.28 cm), number of leaves per graft (24.32), leaf area (49.63 cm^2) and final graft success (72.00 %) was observed in invigourated rootstock grafted with 3 months old scion was found most suitable for softwood grafting in sapota.

Keywords

Sapota, Softwood grafting, Age of rootstock, Age of scion

Introduction

Sapota (*Manilkara achras*) is one of the important tropical fruits. In recent years, it is drawing attention of many farmers due to its better adaptability to diversified soil and climatic conditions. But the expansion of area under this crop is limited mainly because of non-availability to diversified soil and climatic conditions. But the expansion of area under this crop is limited mainly because of non-availability of genuine planting material in required numbers. Maharashtra is a leading producer of sapota. In sapota softwood grafting is reported to be very easy, convenient in handling, involve simple skill and can be done with in short period. The most important feature of this method is detached scion method. The age of scion shoots play key role in the success of grafting. Therefore, it is necessary to standardize the age of scion. Hence, the present study was undertaken at the Main Garden, Department of Horticulture, Dr. P.D.K.V, Akola.

Materials and Methods

The experiment was conducted in factorial Randomized block design (FRBD). The one year old Khirni rootstock and two year old healthy Khirni seedlings of uniform height and stem thickness were selected as rootstock. Kalipatti variety of Sapota plant was selected as mother tree and sticks were characterized in three different group such

as 3 months old scion (green colour), 6 months old scion (pale green colour) and 9 months old scion (brown colour). These three groups scion sticks with 10 cm length were detached from the mother tree on the day of grafting. Grafting was carried out in the month of September. The wedge of scion so prepared was inserted in to the 'V' shaped slit of the rootstock and tied with white transparent polythene trip firmly and arranged in replications. All the observations were recorded at 30 days of interval after grafting.

Results and Discussion

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads.

Effect of age of rootstock and scion on days required for bud sprouting

The data regarding the days required for bud sprouting as influenced by age of rootstock and scion are presented in Table 1.

Effect of age of rootstock

From the Table 1, it is clearly indicated that the age of rootstock influenced significantly on days required for bud sprouting in grafting. Among different age of rootstock minimum days required for sprouting (20.40) in invigourated khirni rootstock seedling, whereas maximum days required for sprouting (24.12) in the plant grafted on vigourated rootstock seedling.

This may be due to rapid formation of callus tissues allows translocation of vital biochemical compounds between stock and scion might be the reason for minimum days to sprouting Syamal *et al.*, (2012). Results obtained are in accordance with the results of Mulla *et al.*, (2011) in Jamun, Rao and Kaul (1977) in veneer grafting of mango.

Effect of age of scion

The minimum days required for bud sprouting (20.20) was required in 3 months old scion followed by the 6 months old scion (22.71). However, maximum days required for bud sprouting was observed in 9 month old scion (23.87) grafted on khirni rootstock seedlings.

Effect of age of rootstock and scion

The interaction effect of age of rootstock and scion was found to be significant in days required for bud sprouting. However, minimum days required for sprouting (19.21) was recorded by 3 months old scion grafted on invigourated khirni rootstock seedling which was found superior to all other treatment combination followed by six month old scion grafted on invigourated khirni rootstock seedling (20.15), 9 months old scion with invigourated khirni rootstock seedling (21.20). Whereas, maximum days required for bud sprouting (25.90) was recorded in 9 months old scion grafted on vigourated rootstock seedling. Maximum days taken for bud sprouting might due to freezing of cell sap of scion stick, which leads to some physiological deterioration and delays bud sprouting in sapota grafts (Tandel and Patel 2009). These findings are in close agreement with Islam *et al.*, (2003) in Jackfruit, Panchbhai *et al.*, (2005) in anola, Roshan *et al.*, (2008) in anola.

Effect of age of rootstock and scion on length of scion at 180 days after grafting

Effect of age of rootstock

From the Table 2, it is clearly indicated that the age of rootstock significantly influenced

on the length of scion at 180 days after grafting. Among different age of rootstock maximum length of scion (19.00 cm) was exhibited from the plant grafted on invigourated rootstock seedling while, minimum length of scion was exhibited by the plant grafted on vigourated rootstock seedling (17.25 cm).

Effect of age of scion

Significantly maximum length of scion (19.59 cm) was observed in the 3 months old scion followed by 6 months old scion (18.64 cm). However, minimum length was recorded from 9 month old scion (16.15 cm).

More quantity of food material stored in invigourated rootstocks which help in boosting the growth of young scion this might be the reason for more length of scion. The results are corroborated with findings of the scientists Pampanna and Sulikeri (1995) in sapota, Samiullah *et al.,* (2004) in guava, Patil *et al.,* (2012) in sapota.

Effect of age of rootstock and scion

Perusal of data in Table 3 revealed that, the interaction effect of age of rootstock and scion significantly influenced the length of scion at 180 days after grafting. However, maximum length of scion (20.86 cm) was recorded by the graft of 3 months old scion grafted on invigourated rootstock seedling found to be at par with 6 months scion grafted on invigourated rootstock seedling (19.88 cm). Whereas, minimum length (16.13 cm) was recorded from the graft of 9 months old scion grafted on vigourated rootstock seedling.

Highest length of scion might be due to early bud break in such grafts which results in early growth, grafts sprouted early received fairly long period of favourable weather for vegetative growth and minimum length of scion might be due to late bud break in grafts (Kumar and Thakur, 2016). Islam *et al.,* (2003) in Jackfruit obtained the similar results on length of scion which were agreement with the present study.

Effect of age of rootstock and scion on sprout length of graft at 180 days

The data regarding sprout length of graft as influenced by age of rootstock and scion are presented in Table 3.

Effect of age of rootstock

Significantly maximum sprout length (18.00 cm) was observed in invigourated rootstock seedling, whereas the vigourated khirni rootstock seedling showed minimum sprout length (16.47 cm).

Effect of age of scion

The data regarding age of scion presented in Table 19 showed significant effect on sprout length 180 days after grafting. The maximum sprout length (18.80 cm) was observed in 3 months old scion while, minimum sprout length noticed in plants grafted with 9 months old scion (14.95 cm).

Before the grafting, defoliation of scion has been done, due to defoliation the maximum food material accumulated in scion when this scion grafted on invigourated rootstock seedling, the stored food material utilized for sprouting of the buds in scion.

The findings are in agreement with earlier researchers Ganacharya (2005) in tamarind, Awasthi and Shukla (2003) in Tamarind, Kaur and Malhi (2006) in mango, Mulla *et al.,* (2011) in Jamun.

Effect of age of rootstock and scion

The age of rootstock and scion significantly influenced on sprout length at 180 days after grafting. The maximum sprout length (19.28 cm) obtained by the plants grafted on invigourated rootstock seedling with 3 months old scion was found to be at par with six months old scion (18.61 cm) with invigourated rootstock. However, minimum sprout length obtained from the plants grafted on vigourated seedling with 9 months old scion (13.79 cm).

The growth response and the vigour of the scion indicated better success in union of grafts in stone grafting of mango (Kaur and Malhi 2006). Similar results were observed by Barman *et al.,* (2007) in lime, Mulla *et al.,* (2011) in Jamun, Sivudu *et al.,* (2014) in mango.

Effect of age of rootstock and scion on number of leaves at 180 days after grafting

The data regarding number of leaves on graft as influenced by age of rootstock and scion at 180 days after grafting is presented in Table 4.

Effect of age of rootstock

Age of rootstock showed significant effect on number of leaves. The maximum number of leaves was observed in invigourated rootstock seedling (22.45), whereas the vigourated khirni rootstock showed minimum number of leaves (21.29).

Better growth of grafts with young rootstock may be attributed to the higher meristematic activity and juvenility of younger scion, which internally helped for early sprout initiation. Perhaps early sprouting followed by optimum temperature and humidity might be responsible for production of more number of leaves and higher shoot length. This may be due to synthesis of more photosynthates. The age of rootstocks did not influence vegetative growth of grafts and it may be the environmental conditions that influence the growth of grafts Patel and Amin (1981). The results are in accordance with Islam *et al.,* (2003) in Jackfruit, Raghuvendra *et al.,* (2011) in wood apple.

Effect of age of scion

Age of scion used for grafting significantly influenced the number of leaves. The maximum number of leaves was observed in 3 months old scion (23.23) which was at par with 6 months old scion, while minimum number of leaves noticed by the plants in which grafting operation performed with 9 months old scion (20.19).

Maximum number of leaves might be due to stored carbohydrates and other food substances available in the scion sticks of sapota after 10 days of defoliation (Tandel *et al.,* 2009). The above findings are in close agreement with Patil *et al.,* (2012) in chiku and Dambal *et al.,* (1999) in sapota.

Effect of age of rootstock and scion

The age of rootstock and scion showed significant effect on number of leaves. The maximum number of leaves (24.32) observed in the plants grafted on invigourated rootstock seedling with 3 months old scion. However, minimum number of leaves observed in the plants grafted on vigourated seedling with 9 months old scion (20.17 leaves per graft).

The highest number of leaves might due to photosynthetic accumulation in newly grafted plants which in turn increased the number of nodes and absorption of nutrients

by leaf primordial in sapota (Mandal *et al.*, 2012). The findings are in agreement with earlier researchers Pampanna and Sulikeri (1995) in sapota and Patil *et al.*, (2012) in chiku.

Effect of age of rootstock and scion on leaf area at 180 days after grafting

Data regarding the leaf area as influenced by the age of rootstock and scion is presented in Table 5.

Effect of age of rootstock

The age of rootstock used for grafting showed significant effect in leaf area. The maximum leaf area was observed in invigourated rootstock seedling (45.63cm^2), whereas the vigourated rootstock showed minimum leaf area (40.93cm^2).

Effect of age of scion

Significant variation was observed due to the age of scion in leaf area of the grafts. The maximum leaf area was observed in the grafting operation performed on invigourated rootstock seedling with 3 months old scion (47.44cm^2), while minimum leaf area was noticed from the plants grafted with 9 month old scion (37.34 cm^2).

Effect of age of rootstock and scion

The maximum leaf area (49.63 cm^2) obtained from the plants grafted on invigourated rootstock seedling with 3 months old scion. However, minimum leaf area was obtained from the plants grafted on vigourated seedling with 9 months old scion (35.20 cm^2). The expansion of leaves on the grafts may be attributed to the higher meristematic activity and juvenility of younger scion which help for more leaf area. This may be due to more synthesis of photosynthates by favourable environmental conditions. The findings are in line with Alam *et al.*, (2006) in mango, Mulla *et al.*, (2011) in Jamun.

Effect of age of rootstock and scion on final survival of graft

The data pertaining to final survival of grafts as influenced by age of rootstock and scion is presented in Table 6.

Effect of age of rootstock

The age of rootstock significantly influenced the final survival of the graft. Among different age of rootstock maximum final survival of grafts (67.66%) was obtained by plant grafted on invigourated rootstock seedling, whereas minimum graft success was obtained in the plant grafted on vigourated rootstock seedling (65.72%).

This is might be due to the fact that, higher activity of meristematic cells resulting in faster formation of callus and quick healing of grafting union Phadnis (1971). Similar results were recorded in cashew by Nagabhushanam and Rao (1978), Sulikeri and Rao (1999) in Mango.

Effect of age of scion

Maximum final survival of grafts, (71.08%) was observed in the 3 months old scion followed by the 6 months old scion (69.50%) grafted on khirni rootstock seedlings. However, minimum graft success (59.50%) was recorded by 9 month old scion.

Effect of age of rootstock and scion

The interaction effect of age of rootstock and scion influenced significantly on final

survival of graft. Maximum final survival of grafts (72.00%) was observed when 3 months old scion grafted on invigourated rootstock seedling which was at par with the 6 months old scion grafted on invigourated rootstock seedling (71.00%). whereas, minimum final survival of graft (59.00%) was recorded in 9 months old scion grafted on vigourated rootstock seedling. Higher survival percentage in mango was due to the environmental condition favourable weather conditions which could have resulted in maximum cambial activity in both stock and scion. Besides, the scion seemed to be in a physiologically active condition for better sap flow at that time (Sivudu *et al.,* 2014).

Similar results were obtained by Hartmann and Kester (1979) in mango and Islam *et al.,* (2003) in Jackfruit.

Table.1 Effect of age of rootstock and scion on days required for sprouting

Treatment	Days required for sprouting			
	Age of scion			
Age of rootstock	**3 months old scion**	**6 months old scion**	**9 months old scion**	**Mean**
Vigourated	21.20	25.28	25.90	24.12
Invigourated	19.21	20.15	21.84	20.40
Mean	20.20	22.71	23.88	
	Rootstock	Scion	Interaction	
'F' test	Sig	Sig	Sig	
SE (m)±	0.15	0.18	0.26	
CD at 5%	0.48	0.58	0.83	

Table.2 Effect of age of rootstock and scion on length of scion at 180 days after grafting

Treatment	Length of scion (cm)			
	Age of scion			
Age of rootstock	**3 months old scion**	**6 months old scion**	**9 months old scion**	**Mean**
Vigourated	18.32	17.30	16.13	17.25
Invigourated	20.86	19.98	16.16	19.00
Mean	19.59	18.64	16.15	
	Rootstock	Scion	Interaction	
'F' test	Sig	Sig	Sig	
SE (m)±	0.25	0.31	0.43	
CD at 5%	0.79	0.96	1.36	

Table.3 Effect of age of rootstock and scion on sprout length at 180 days after grafting

Treatment	Sprout length (cm)			
	Age of scion			
Age of rootstock	3 months old scion	6 months old scion	9 months old scion	Mean
Vigourated	18.32	17.30	13.79	16.47
Invigourated	19.28	18.61	16.12	18.00
Mean	18.80	17.95	14.95	
	Rootstock	Scion	Interaction	
'F' test	Sig	Sig	Sig	
SE (m)±	0.14	0.17	0.25	
CD at 5%	0.45	0.55	0.82	

Table.4 Effect of age of rootstock and scion on number of leaves at 180 days after grafting

Treatment	Number of leaves			
	Age of scion			
Age of rootstock	3 months old scion	6 months old scion	9 months old scion	Mean
Vigourated	22.13	21.58	20.17	21.29
Invigourated	24.32	22.80	20.21	22.45
Mean	23.23	22.19	20.19	
	Rootstock	Scion	Interaction	
'F' test	Sig	Sig	Sig	
SE (m)±	0.21	0.26	0.36	
CD at 5%	0.66	0.81	1.15	

Table.5 Effect of age of rootstock and scion on Leaf area at 180 days after grafting

Treatment	Leaf area (cm^2)			
	Age of scion			
Age of rootstock	3 months old scion	6 months old scion	9 months old scion	Mean
Vigourated	45.25	42.35	35.20	40.93
Invigourated	49.63	47.77	39.49	45.63
Mean	47.44	45.06	37.34	
	Rootstock	Scion	Interaction	
'F' test	Sig	Sig	Sig	
SE (m)±	0.08	0.10	0.14	
CD at 5%	0.25	0.31	0.44	

Table.6 Effect of age of rootstock and scion on final survival of grafts

Treatment	Final survival of grafts (%)			
	Age of scion			
Age of rootstock	3 months old scion	6 months old scion	9 months old scion	Mean
Vigourated	70.16	68.00	59.00	65.72
Invigourated	72.00	71.00	60.00	67.66
Mean	71.08	69.50	59.50	
	Rootstock	Scion	Interaction	
'F' test	Sig	Sig	Sig	
SE (m)±	0.04	0.05	0.07	
CD at 5%	0.12	0.15	0.21	

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