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Influence of rootstock girth in softwood grafting on growth and survival of different varieties of mango (*Mangifera indica* L.)

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Abstract

The result revealed that among the grafts of different varieties of mango, treatment (A₁)- Kesar recorded highest influence on the parameters like height of graft (30.03 cm), girth of stock (5.87 mm), girth of scion (5.79 mm), number of leaves per graft (11.31), fresh weight of shoots (20.52 g), dry weight of shoots (13.48 g) and survival percentage (75.00%). However, minimum days for sprouting (14.37) were recorded in Totapuri and Neelam varieties. Similarly, the maximum girth of stock (5.85 mm), girth of scion (5.67 mm), number of leaves per graft (10.23), fresh weight of shoots (19.40 g), dry weight of shoots (12.40 g) and survival percentage (77.00%) was found in treatment (B₁)-5 mm girth of rootstock. While, the minimum days required for sprouting and height of graft shown non-significant differences among the girth of rootstocks. The significant interaction for above traits was observed in treatment combination of (A₁B₁) where, Kesar variety of mango was grafted on 5 mm girth of rootstock.

Keywords: Girth of rootstock, mango, softwood grafting, survival, varieties

Introduction

Mango (*Mangifera indica* L.) is a member of the Anacardiaceae family, it is a native tree to South Asia from where the Indian or common mango has been distributed worldwide and it has become one of the most widely cultivated fruits in the tropics. India is graced with vast germplasm of mango and there are many commercial cultivars as per excellence in quality than the rest of the world. India has plentiful scope for the export of mango pulp and nectar to abroad. Therefore, the mango orcharding promises a lucrative income to India. However, for the economic mango orcharding and growing it is necessary that the cultivars to be planted are productive, of good quality and adaptable to the climate (Yadav *et al.*, 2019) ^[1]. In India mango occupies 2.29 million hectares area with 20.44 million tonnes production and 9.66 Mt ha⁻¹ productivity during 2019-20. In Maharashtra mango occupies area of 0.166 million ha with 0.791 million tonnes production and 4.75 Mt ha⁻¹ productivity (Anon., 2019) ^[1].

Mango can be propagated both by sexual and asexual method but asexually propagated plants are true to type, uniform in growth and take lesser time for fruiting. Generally fresh mango stones which are extracted from ripe mango fruits of local varieties are used for raising rootstocks and then these rootstocks are used for grafting of desired variety. Among different varieties of mango Kesar, Ratna, Totapuri, Neelam and Parbhani Hapus are popular varieties and are widely cultivated in India, but due to poor growth with less survival percent in mango grafts nurserymen are unable to fulfil the demand of mango growers in respect to the supply of quality planting material in ample quantity for commercial cultivation.

In view of the above, present investigation entitled “Influence of rootstock girth in softwood grafting on growth and survival of different varieties of mango (*Mangifera indica* L.)” was undertaken to overcome the poor growth and survival of grafts in different commercially cultivated varieties of mango.

Materials and Methods

The present experiment was conducted at College of Horticulture, Vasant Rao Naik Marathwada Krishi Vidyapeeth, Parbhani during the year 2020-21. The experiment was laid out in a Factorial Randomized Block Design with two replications having 15 treatment combinations. These treatments comprise of five different varieties *viz.*, Kesar, Ratna, Totapuri, Neelam, Parbhani Hapus and three different girth of rootstock *viz.*, 5 mm, 6 mm and 7 mm were used.

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Rootstocks were prepared by sowing mango stones of local variety in black polythene bag and six months old seedlings were used as rootstock for grafting.

Mature and healthy terminal shoots were selected from different cultivars of mango and according to the different scion girth of mango. Scion sticks were preferably straight, uniform, round and having prominent terminal or side bud. Only healthy prominent terminal sticks with pencil size thickness and free from pest and diseases were selected. Scion sticks were collected 15 days after defoliation and softwood grafting was done on rootstocks of having different girths *viz.*, 5 mm, 6 mm and 7 mm in different mango varieties (Kesar, Ratna, Totapuri, Neelam, Parbhani Hapus) during September, 2020. The wedge of scion was inserted into the cleft of rootstock, taking care to ensure that the cambium layers of stock and scion were in perfect contact with each other. The graft joint was secured by wrapping material like polythene stripe (1.5 cm wide, 200 gauge thickness) and grafted plants were kept under shade net to enable sprouting of the terminal buds. Sprouting on grafts were started in 2nd week after grafting and since then growth and survival observations were recorded on monthly intervals, eventually data obtained at 150 days after grafting was analyzed by using analysis of variance method suggested by Panse and Sukhatme (1985) [7].

Results and Discussion

The perusal of data presented in Table 1 regarding growth and survival of mango grafts as influenced by girth of stock and variety recorded significant differences. Among different varieties, minimum days required for sprouting (14.37 days) was found in Totapuri (A₃) and Neelam (A₄) while, maximum days required for sprouting (15.10 days) in Kesar (A₁). However, effect of girth of rootstock was found non-significant with regards to days required for sprouting. The interaction effect of variety and girth of rootstock was revealed to be significant, the minimum days required for sprouting (14.05 days) was observed in T₉-A₄B₂ which was found to be at par with treatment T₈- A₃B₂ and maximum days were required in treatment T₁-A₁B₁ (15.35 days). The success in grafting depends upon the good cambial bridge between stock and scion may result into better callus formation, union and eventually early sprouting. These results were in conformity with the results obtained by Nalage *et al.*, (2010) [8] and Kaur (2017) [5]. The highest graft height was observed in (A₁) Kesar variety (30.03 cm) which was followed by (A₂) Ratna (28.91cm) while the lowest height was noticed in (A₅) Parbhani Hapus (27.94 cm) at 150 DAG respectively. The effect of girth of rootstock was found non-significant with regards to height of the graft. The interaction effect of variety and girth of graft was found to be significant. The height of graft was observed maximum in treatment

combination T₁-A₁B₁ (31.67 cm) and minimum in treatment combination T₄-A₄B₁ (26.93 cm) at 150 DAG respectively. The varietal difference in response to height of grafts in grafting may be due to variations in their genetical make up influencing histological and physiological development within the scion shoots of similar growth in different ways. The present results are in harmony with the findings of Chakrabati and Sandhu (1983) and Kaur (2017) [3, 5]. The result pertaining to the girth of rootstock revealed that, treatment (A₁) Kesar had maximum girth of stock (5.87 mm) which was followed by (A₂) Ratna (5.75 mm) while minimum girth of stock was recorded in (A₅) Parbhani Hapus (5.38 mm) at 150 DAG respectively. Among the treatments, (B₁) 5 mm girth of graft recorded maximum girth of rootstock (5.85 mm) which was followed by treatments B₂ and B₃ (5.41mm). The girth of stock was observed maximum in treatment combination T₁-A₁B₁ (6.76 mm) which was followed by T₂-A₂B₁ (6.39 mm) and minimum in T₃-A₃B₁ (5.30 mm). The highest result might be due to the active growth of the rootstock. An excellent sap flow and continued food supply from the stored food that enhanced the graft union process resulting higher growth. These are in agreement with the findings of Singh *et al.*, (2014) [10]. The effect of variety, girth of rootstock and interaction of treatments combination was also found significant on girth of scion. The girth of scion was found maximum in (A₁) Kesar (5.79 mm) which was followed by (A₄) Neelam (5.52 mm) and the minimum was recorded in (A₃) Totapuri (5.34 mm) at 150 DAG. The Maximum girth of scion was observed in treatment (B₁) 5 mm girth of rootstock (5.67 mm) which was followed by (B₃) 7 mm girth of rootstock (5.49 mm) and minimum was found in (B₂) 6 mm girth of rootstock (5.36 mm). The maximum girth of scion was observed in treatment combination T₁-A₁B₁ (6.68 mm) and minimum was found in T₄- A₄B₁ (5.18 mm). The scion diameter depends on the performance of stionic compatibility and the perfectness of union. The present results are in harmony with the findings of Nalage *et al.*, (2010) [8]. The maximum number of leaves per graft was found in (A₁) Kesar (11.31) which was followed by (A₂) Ratna (9.64) while minimum was found in (A₄) Neelam (7.80). The maximum number of leaves was observed in (B₁) 5 mm girth of rootstock (10.23) which was followed by (B₂) 6 mm girth of rootstock (9.32) while minimum was found (B₃) 7 mm girth of rootstock (8.00).The maximum number of leaves was observed in treatment combination T₁- A₁B₁ (13.27) and minimum was noticed in T₁₄- A₄B₃ (7.10) at 150 DAG respectively. It might be due to perfect union of stock and scion resulted into proper supply of food material and ultimately emergence of maximum number of leaves per graft. However, the perusal of the literature available fails to throw light on these findings.

Table 1: Effect of girth of rootstocks on growth and survival of grafts in different varieties of mango

Treatments	Days required for sprouting	Height of graft (cm)	Girth of stock (mm)	Girth of scion (mm)	No. of leaves per graft	Fresh weight of shoots (g)	Dry weight of shoots (g)	Survival percentage	
Factor A (Varieties)									
A ₁	Kesar	15.10	30.03	5.87	5.79	11.31	20.52	13.48	75.00
A ₂	Ratna	14.40	28.91	5.75	5.40	9.64	15.33	10.00	66.67
A ₃	Totapuri	14.37	28.41	5.39	5.34	8.37	15.88	9.98	63.33
A ₄	Neelam	14.37	28.33	5.40	5.52	7.80	15.60	10.67	61.67
A ₅	Parbhani Hapus	14.42	27.94	5.38	5.49	8.79	15.37	10.70	68.33
SE(m)±		0.11	0.32	0.03	0.06	0.17	0.29	0.22	2.64
CD @ 5%		0.36	0.97	0.10	0.18	0.52	0.89	0.69	8.01
Factor B (Girth)									

B ₁	5 mm	14.65	28.85	5.85	5.67	10.23	19.40	12.40	77.00
B ₂	6 mm	14.40	28.74	5.41	5.36	9.32	15.17	10.09	62.00
B ₃	7 mm	14.54	28.59	5.41	5.49	8.00	15.11	10.41	62.00
SE(m)±		0.08	0.24	0.02	0.04	0.13	0.22	0.17	2.04
CD @ 5%		NS	NS	0.08	0.14	0.40	0.69	0.53	6.20
Interaction Effect									
T ₁	A ₁ B ₁	15.35	31.67	6.76	6.68	13.27	27.70	18.35	95.00
T ₂	A ₂ B ₁	14.60	29.34	6.39	5.42	11.58	17.45	10.70	70.00
T ₃	A ₃ B ₁	14.75	28.50	5.30	5.51	9.11	17.35	10.00	70.00
T ₄	A ₄ B ₁	14.40	26.81	5.41	5.18	8.72	17.90	11.90	65.00
T ₅	A ₅ B ₁	14.15	27.93	5.37	5.55	8.48	16.60	11.05	85.00
T ₆	A ₁ B ₂	15.20	29.42	5.43	5.24	10.56	15.65	9.95	80.00
T ₇	A ₂ B ₂	14.40	28.08	5.49	5.22	9.69	14.75	9.00	55.00
T ₈	A ₃ B ₂	14.10	29.21	5.47	5.32	8.57	16.65	10.80	55.00
T ₉	A ₄ B ₂	14.05	29.27	5.35	5.75	7.57	13.90	10.30	55.00
T ₁₀	A ₅ B ₂	14.25	27.71	5.33	5.28	10.22	14.90	10.40	65.00
T ₁₁	A ₁ B ₃	14.75	29.00	5.43	5.46	10.09	18.20	12.15	50.00
T ₁₂	A ₂ B ₃	14.20	29.33	5.37	5.54	7.67	13.88	10.30	75.00
T ₁₃	A ₃ B ₃	14.25	27.51	5.39	5.19	7.44	13.65	9.15	65.00
T ₁₄	A ₄ B ₃	14.65	28.91	5.43	5.63	7.10	15.00	9.80	65.00
T ₁₅	A ₅ B ₃	14.85	28.19	5.44	5.66	7.68	14.90	10.65	55.00
SE(m)±		0.19	0.55	0.06	0.10	0.29	0.51	0.39	4.57
CD @ 5%		0.58	1.69	0.18	0.32	0.90	1.55	1.20	13.8

The maximum fresh weight of shoots (20.52 g) was recorded in (A₁) Kesar which was followed by (A₃) Totapuri (15.88 g) whereas, minimum (15.33 g) was noticed in (A₂) Ratna. In respect to girth of stock the maximum fresh weight of shoots was observed in (B₁) 5 mm girth of rootstock (19.40 g) which was followed by (B₂) 6 mm girth of rootstock (15.17 g) and (B₃) 7 mm girth of graft (15.11 g) at 150 DAG. However, the maximum fresh weight of shoots was observed in treatment combination T₁-A₁B₁ (27.70 g) and minimum was noted in T₁₃-A₃B₃ (13.65 g). It might be due to higher vegetative growth in Kesar graft and proper nutrition present in the graft. These are in agreement with the findings of Pugalendhi (1990) and Bobade *et al.*, (2018)^[9, 2]. Significantly maximum dry weight of shoots was found in (A₁) Kesar (13.48 g) followed by (A₅) Parbhani Hapus (10.70 g) and minimum was recorded in (A₃) Totapuri (9.98 g). The maximum dry weight of shoot was observed in (B₁) 5 mm girth of graft (12.40 g) which was followed by treatment B₃ (10.41 g) while minimum was noticed in B₂ (10.09 g). Interaction effect of dry weight of shoots shown maximum weight in treatment combination T₁- A₁B₁ (18.35 g) followed by the T₁₁-A₁B₃ (12.15 g) and minimum was observed in T₇- A₂B₂ (9.00 g). The higher dry weight of shoot might be due to its high fresh weight of shoots and a greater number of functional leaves. However, scanning of the available literature could not throw any light on these aspects of the present study. The data regarding survival percentage shown maximum survival in (A₁) Kesar (75.00%) which was found to be at par with (A₃) Totapuri (68.33%) and minimum survival was observed in (A₄) Neelam (61.67%) at 150 DAG respectively. The maximum survival percentage in girth of graft was noted in treatment B₁ (77.00%) which was followed by in treatments B₂ and B₃ (62.00%). The maximum survival percentage was observed in treatment combination T₁-A₁B₁ (95.00%) which was found to be at par with treatment T₅-A₅B₁ (85.00%) and minimum was recorded in T₁₁-A₁B₃ (50.00%) at 150 DAG respectively. The higher survival percent in 5 mm girth of rootstock might be due to rapid sap flow in stock and scion which might have favoured the healing process and established the continuity of cambium and vascular tissues. Better root growth and vegetative growth of the grafts, which might have also resulted in the higher survival percentage in

grafts of the variety. Similar findings were observed by Lohakare *et al.*, (2015), Bobade *et al.*, (2018) and Kaur (2019)^[6, 2, 4].

Conclusion

The influence of 5 mm girth of rootstock was found best in order to get higher survival percentage and growth of mango grafts which was at par with 7 mm girth of rootstock. Similarly, the interaction effect of variety and girth of rootstock (A₁B₁) showed maximum survival percentage and growth of mango grafts under present study. Hence in nutshell it can be concluded that the variety Kesar should be grafted on 5 mm girth of rootstock for better success and vigour of mango grafts.

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