



Research Article



Response of grafts of different scion varieties on the different rootstock of mango (*Mangifera indica* L.) under nursery conditions

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ABSTRACT

The investigation was carried out at the College of Horticulture, Bidar to study the “Performance of grafts of different scion varieties on the different rootstock of mango (*Mangifera indica* L.) under nursery conditions” with thirty-six treatments comprising of twelve rootstocks (Kurukkan, Kitchner, Olour, EC-95862, Kensington, Peach, Nekkare, Muvandan, Bappakai, Mylepelian, Starch and Local) and three scions (Baneshan, Dashehari and Kesar). Among different rootstocks, Nekkare registered minimum days for sprouting, maximum sprout length, graft success, the height of grafted plant and number of leaves per graft (12.47 days, 6.08 cm, 89.17%, 29.4 cm and 18.33 respectively) whereas the maximum scion girth and root-collar diameter was registered with Bappakai (5.67 and 6.57mm respectively). In scion varieties Kesar recorded minimum days for the emergence of sprouts (15.92 days), maximum sprout length (5.39 cm), graft success (85.83 %), the height of grafted plant (26.74 cm), scion girth (5.55 mm) and root-collar diameter (6.51mm). In the case of different rootstock scion combinations, Nekkare grafted with Kesar recorded a minimum number of days taken for sprouting (11.4 days), maximum sprout length (7.15 cm), graft success (95 %), the height of grafted plant (33.55 cm) and several leaves per graft (19.7) whereas, scion girth and root-collar diameter were found non-significant.

Keywords: Rootstock, Scion, Stionic combination, mango, grafting success.

INTRODUCTION

Mango belongs to the family Anacardiaceae with having chromosome number of $2n=40$. Mango is native to the Indo-Burma region and is a centre of origin of mango. The fruit is widely accepted as the king of fruit by knowing its adaptability and nutritional value. Hence, In India, It has the privilege of being ‘National fruit. The fruit is being utilized at every developmental stage for one or another purpose like pickling and table purpose. Further, ripe fruits are utilized for preparing fresh invigorating and refreshing drinks. In India mango leads in production and area. leads with an area of 23.13 lakh ha and in production with 223.53 lakh tonnes (Anon., 2019). It is grown in almost all states of India. Andhra Pradesh stands first in the area with 3.33 lakh ha and second in production with 45.40 lakh tonnes (Anon., 2019).

However, from the nursery perspective of raising mango plant saplings, farmers and nurserymen raise through stones due to its highly cross-pollinated nature; wide variability exists in the progeny and is a limitation for commercial orcharding.

The plant takes 8-10 years for fruiting and the canopy of the plant to become large. But moving up in the technology of multiplication, now it has become simple to multiply mango by different vegetative grafting methods. The original superior mango varieties of seed origin still exist in various parts of the country but the occurrence of promising types is frequent as mango is cross-pollinated. To obtain true-to-type progeny and to establish uniformity in plant growth, there is a need to propagate mango by vegetative means.

To obtain successful graft union, rootstocks must be strong, healthy and vigorous (Patel et al. 2017) and such rootstock shows a greater effect on production efficiency and yield. However, the stionic relationship is very important for the production of the vegetative method of propagation. If the rootstock is from a tall plant and the scion is from a dwarf plant or vice versa, the graft union may occur but the growth of both stock and scion may not be uniform. The difference in uniformity may affect the growth and development of plants (Bhuiyan et al. 2010).

Increasing demand for the best planting material, there is a necessity to raise a seedling/rootstock, to ensure higher graft success, better growth and stem girth, along with good field establishment.

MATERIALS AND METHODS

Description of the experiment

The investigation was conducted at College of Horticulture, Bidar which is situated in North-Eastern transitional zone of Karnataka (Zone- I) located at 17° 53' North latitude, 77° 32' East longitude and at an altitude of 576.28 m above the mean sea level during 2019-2020 to study the performance of grafts of different scion varieties on the different rootstock of mango (*Mangifera indica* L.) under nursery conditions with thirty-six treatments comprising of twelve rootstocks (Kurukkan, Kitchner, Olour, EC-95862, Kensington, Peach, Nekkare, Muvandan, Bappakai, Mylepelian, Starch and Local) over three scions (Baneshan, Dashehari and Kesar) varieties. In this context, the experiment was carried out using a factorial randomized complete block design with two replications. The following observations were recorded for sprouting, sprout length (cm) at 15, 30 and 45 DAG, graft success (%) at 15, 30 and 45 DAG, the height of grafted plant (cm) at 15, 30 and 45 DAG, scion girth (mm) at 30, 60 and 90 DAG, root-collar diameter (mm) at 30, 60 and 90 DAG and number of leaves per graft at 30, 60 and 90 DAG were recorded.

Statistical analysis

The data recorded on graft parameters were subjected to Fisher's method of analysis of variance and the interpretation of data was done as given by Panse and Sukhatme (1967).

RESULTS AND DISCUSSION

The results of the performance of the plants produced by veneer grafting with different rootstock-scion combinations have been presented and discussed. The results of different graft parameters have been discussed.

3.1. Number of days taken for the emergence of sprouts
Among different rootstocks and scion varieties, Nekkere (R₇) (12.47 days) and Kesar (15.92 days) recorded a minimum number of days for the emergence of sprouts respectively. In the case of different treatment combinations, the lowest number of days for the emergence of sprouts (11.40 days) was registered in R₇S₃ (Nekkere + Kesar) and the highest was registered with R₅S₂ (Kensington + Dashehari) (21.30 days) and R₁₁S₂ (Starch + Dashehari) (21.30 days). This wide variation might be due to differences in the vigour of various rootstocks and the heterozygous nature. The ideal relative humidity and temperature also play a crucial role in the early emergence of sprouts by avoiding the drying up of buds and inducing sap flow in grafts. Similar results were documented by Jana (2007) in mango and Somkuwar et al. (2009) in grapes.

Sprout length

The rootstock R₇ (Nekkere) (6.08 cm) and scion variety S₃ (Kesar) (5.39 cm) registered the highest sprout length at 45 days after grafting. Among different interaction effects, the treatment combination R₇S₃ (Nekkere + Kesar) registered the highest sprout length (7.15 cm). This maximal sprout length might be due to better initial graft union formation, the vigorous activity of vascular cambium and proper healing of union which helped in early sprouting. Similar results were documented by Satisha et al. (2004) in grapes.

Graft success

The rootstock Nekkere (R₇) (89.17 %) and scion variety Kesar (S₃) (85.83 %) registered the maximal graft success. The interaction effect of rootstocks and varieties was not influenced for graft success. This divergence in the rate of graft success might be due to prevailing temperature (minimum, optimum and maximum), relative humidity and also genetic variations influencing histological and physiological developments within the shoots (Maiti and Biswas, 1980). Findings are in confirmation with Chandrashekar (1982) in mango, Veeraraghavan (1990) in cashew and Kaur (2018) in sapota.

Height of grafted plant

The rootstock R₇ (Nekkere) (29.40 cm) and scion variety S₃ (Kesar) (26.74 cm) recorded the highest plant height. Among different rootstocks, R₇S₃ (Nekkere + Kesar) registered the maximum height of grafted plant (33.55 cm). The height of the grafted plant is highly determined by growth parameters like leaf number and leaf area which helped in better production and synthesis of food material. The higher the leaf number more will be the photosynthetic rate which in turn helps in better growth of graft. Similar results were documented by Bobade et al. (2018) and Bose et al. (2019) in mango.

Scion girth

Among different rootstocks, the maximum scion girth was registered with R₉ (Bappakai) (5.67 mm). This better increase in scion girth might be due to the compatibility of the rootstock and scion with enhanced vigorous vascular cambium activity resulting in rapid graft union combined with conducive climatic conditions and higher leaf number which synthesize more food both in stock and scion. Similar results were documented by Bharatbhai et al. (2013) and Sukhjit Kaur et al. (2017) in mango. Scion girth was found non-significant for different scion varieties and the interaction effect between rootstock and scion.

Root collar diameter

Among different rootstocks, scion varieties and interaction effects on root collar diameter not influenced. However, the maximum root collar diameter was recorded with rootstock R₉ (Bappakai) (6.57 mm), scion variety (Kesar) (6.51 mm) and among interaction effects, the maximum root collar diameter was recorded with R₇S₃ and R₉S₁ (5.75 mm) at 30 DAG and R₉S₃ (6.32 mm) at 60 DAG and R₉S₂ (6.71 mm) at 90 DAG and the minimum was recorded with R₁₁S₂ (5.34, 5.89 and 5.97

mm) at 30, 60 and 90 DAG. This might be due to differential reduced variations in the growth of scion and rootstocks. Similar results were documented by Minja et al. (2017).

Number of leaves per graft

The rootstock R₇(Nekkere) and scion variety S₃ (Kesar) (16.88/ graft) registered the highest number of leaves (18.33 /graft). In the case of interactions, the maximum number of leaves per graft (16.20/graft) was registered

with R₇S₃ (Nekkere + Kesar). This increase in the number of leaves might be due to the vigorous growth of seedlings and high photosynthates accumulation in newly grafted plants which in turn helps in increased absorption of nutrients and production of a greater number of leaves on the grafted plant. Similar results were documented by Jana (2007) and Ram et al. (2012) in mango.

Table 1. Effect of different mango rootstocks and scion combinations on days for sprout emergence, sprout length and graft success

Treatment	Days for emergence of sprouts				Sprout length				Graft success			
	45 DAG				45 DAG				45 DAG			
	S ₁	S ₂	S ₃	Mean	S ₁	S ₂	S ₃	Mean	S ₁	S ₂	S ₃	Mean
R ₁	17.00 ^c	17.60 ^c	16.50 ^c	17.03 ^f	5.18 ^d	4.40 ^e	4.80 ^e	4.79 ^f	82.50	82.50	90.00	85.55 ^b
R ₂	17.70 ^c	18.10 ^b	18.40 ^b	18.07 ^d	4.71 ^e	4.34 ^e	5.04 ^d	4.70 ^g	70.00	70.00	90.00	76.67 ^d
R ₃	17.10 ^c	16.40 ^c	15.60 ^d	16.37 ^g	5.11 ^d	4.96 ^d	5.35 ^d	5.14 ^d	85.00	72.50	85.00	80.83 ^c
R ₄	18.00 ^b	18.00 ^b	16.90 ^c	17.63 ^e	4.67 ^e	4.87 ^d	5.59 ^c	5.04 ^e	70.00	75.00	92.50	79.17 ^d
R ₅	18.50 ^b	21.30 ^a	19.00 ^b	19.60 ^b	4.62 ^e	4.67 ^e	4.30 ^e	4.59 ^g	67.50	65.00	75.00	69.17 ^e
R ₆	18.80 ^b	18.60 ^b	19.10 ^b	18.83 ^c	4.74 ^e	4.60 ^e	5.10 ^d	4.81 ^f	67.50	60.00	72.50	66.67 ^e
R ₇	12.70 ^e	13.30 ^e	11.40 ^f	12.47 ^g	5.37 ^d	5.73 ^c	7.15 ^a	6.08 ^a	85.00	67.50	95.00	89.17 ^a
R ₈	16.00 ^c	14.20 ^d	14.90 ^d	15.03 ^g	5.21 ^d	5.45 ^d	5.58 ^c	5.41 ^c	80.00	77.50	92.50	83.33 ^b
R ₉	13.30 ^e	12.30 ^f	11.90 ^f	12.50 ^g	5.33 ^d	5.50 ^c	6.21 ^b	5.68 ^b	85.00	80.00	95.00	86.67 ^a
R ₁₀	13.00 ^e	14.30 ^d	12.30 ^f	13.20 ^h	4.95 ^d	5.00 ^d	5.84 ^c	5.26 ^d	70.00	70.00	90.00	76.67 ^d
R ₁₁	19.00 ^b	21.30 ^a	20.40 ^a	20.23 ^a	4.43 ^e	2.95 ^g	3.70 ^f	3.69 ^h	55.00	55.00	65.00	58.33 ^f
R ₁₂	17.40 ^c	18.00 ^b	14.60 ^d	16.67 ^f	4.75 ^e	5.14 ^d	5.98 ^c	5.29 ^d	82.50	77.50	87.50	82.50 ^c
Mean	16.54 ^a	16.96 ^a	15.92 ^b		4.92 ^b	4.80 ^b	5.39 ^a		75.00 ^b	72.71 ^c	85.83 ^a	
Comparison	S.E.m ±		CD (0.05)		S.E.m ±		CD (0.05)		S.E.m ±		CD (0.05)	
R	0.18		0.51		0.07		0.19		1.14		3.26	
S	0.36		1.03		0.13		0.38		2.27		6.52	
R×S	0.62		1.78		0.23		0.65		3.94		NS	
CV (%)	5.32				6.37				7.15			
R= Rootstocks	S= Scions											
R ₁ - Kurukkan	R ₃ - Olour	R ₅ -Kensington	R ₇ - Nekkere	R ₉ -Bappakai	R ₁₁ -Starch	S ₁ - Baneshan	S ₃ - Kesar					
R ₂ - Kitchner	R ₄ - EC-95862	R ₆ - Peach	R ₈ - Muvandan	R ₁₀ -Mylepelian	R ₁₂ -Local	S ₂ - Dashehari	DAG- Days after Grafting					

Table 2. Effect of different mango rootstocks and scion combinations on height of grafted plant, scion girth and root collar diameter

Treatment	Height of grafted plant				Scion girth (mm)				Root collar diameter (mm)			
	45 DAG				90 DAG				90 DAG			
	S ₁	S ₂	S ₃	Mean	S ₁	S ₂	S ₃	Mean	S ₁	S ₂	S ₃	Mean
R ₁	26.44 ^c	25.41 ^c	26.82 ^c	26.22 ^d	5.65	5.56	5.49	5.57 ^b	6.45	6.42	6.62	6.50
R ₂	25.21 ^c	25.95 ^c	26.70 ^c	25.95 ^e	5.55	5.60	5.47	5.54 ^b	6.44	6.46	6.50	6.46
R ₃	26.79 ^c	27.15 ^c	28.41 ^b	27.45 ^c	5.62	5.42	5.56	5.53 ^b	6.46	6.43	6.59	6.49
R ₄	27.34 ^c	25.90 ^c	27.24 ^c	26.82 ^d	5.63	5.46	5.56	5.55 ^b	6.47	6.49	6.57	6.51
R ₅	25.55 ^c	24.97 ^c	26.31 ^c	25.61 ^e	5.48	5.60	5.54	5.54 ^b	6.46	6.47	6.43	6.45
R ₆	21.50 ^e	21.42 ^e	22.70 ^d	21.87 ^g	5.56	5.53	5.44	5.51 ^c	6.37	6.41	6.45	6.41
R ₇	26.93 ^c	27.72 ^c	33.55 ^a	29.40 ^a	5.44	5.63	5.69	5.59 ^b	6.53	6.42	6.45	6.47
R ₈	27.15 ^c	24.65 ^d	25.71 ^c	25.84 ^e	5.59	5.51	5.60	5.57 ^b	6.39	6.54	6.52	6.48
R ₉	27.04 ^c	28.47 ^b	29.24 ^b	28.25 ^b	5.63	5.60	5.78	5.67 ^a	6.37	6.71	6.63	6.57
R ₁₀	25.20 ^c	23.08 ^d	28.40 ^b	25.56 ^e	5.48	5.48	5.54	5.50 ^c	6.40	6.52	6.42	6.45
R ₁₁	21.10 ^e	16.50 ^f	21.40 ^e	19.67 ^h	5.39	5.31	5.33	5.34 ^d	6.52	5.97	6.44	6.31
R ₁₂	24.65 ^d	24.75 ^d	24.42 ^d	24.61 ^h	5.49	5.50	5.58	5.52 ^c	6.48	6.37	6.52	6.46
Mean	25.41 ^a	24.66 ^b	26.74 ^a		5.54	5.52	5.55		6.44	6.43	6.51	
Comparison	S.E.m ±		CD (0.05)		S.E.m ±		CD (0.05)		S.E.m ±		CD (0.05)	
R	0.29		0.84		0.03		0.07		0.04		NS	
S	0.58		1.67		0.05		NS		0.07		NS	
R×S	1.01		2.90		0.09		NS		0.13		NS	
CV (%)	5.58				2.20				2.73			
R= Rootstocks	S= Scions											
R ₁ - Kurukkan	R ₃ - Olour	R ₅ -Kensington	R ₇ - Nekkere	R ₉ -Bappakai	R ₁₁ -Starch	S ₁ - Baneshan	S ₃ - Kesar					
R ₂ - Kitchner	R ₄ - EC-95862	R ₆ - Peach	R ₈ - Muvandan	R ₁₀ -Mylepelian	R ₁₂ -Local	S ₂ - Dashehari	DAG- Days after Grafting					

Table 3. Effect of different mango rootstocks and scion combinations on number of leaves per graft

Scion varieties	Number of leaves per graft (90 DAG)			
Rootstocks	S ₁	S ₂	S ₃	Mean
R ₁	16.30	15.20	16.80	16.20 ^f
R ₂	15.20	15.00	15.50	15.23 ^g
R ₃	17.00	17.10	17.60	17.23 ^e
R ₄	18.00	17.50	18.00	17.83 ^b
R ₅	14.30	14.20	15.80	14.77 ^h
R ₆	12.90	12.40	13.30	12.87 ⁱ
R ₇	17.90	17.40	19.70	18.33 ^a
R ₈	17.20	16.80	18.00	17.33 ^d
R ₉	17.60	17.10	18.40	17.70 ^c
R ₁₀	17.90	17.20	18.50	17.87 ^b
R ₁₁	12.40	11.90	13.10	12.47 ^j
R ₁₂	17.10	16.40	17.90	17.13 ^e
Mean	16.15 ^b	15.71 ^c	16.88 ^a	
Comparison	S.Em ±		CD (0.05)	
R	0.10		0.28	
S	0.19		0.56	
R×S	0.34		NS	
CV (%)	2.92			
R= Rootstocks	S= Scions		DAG- Days after Grafting	
R ₁ - Kurukkan	R ₃ - Olour		R ₅ -Kensington	R ₇ - Nekkere
R ₉ -Bappakai	R ₁₁ -Starch		S ₁ - Baneshan	S ₃ - Kesar
R ₂ - Kitchner	R ₄ - EC-95862		R ₆ - Peach	R ₈ - Muvandan
R ₁₀ -Mylepelian	R ₁₂ -Local		S ₂ - Dashehari	

CONCLUSION

From the present investigation, it can be concluded that the rootstocks named Olour, Kitchner, Bappakai and Nekkere performed best with respect to germination percentage, days taken for 50 per cent germination, root length and seedling height. Polyembryonic rootstocks Nekkere, Bappakai, Muvandan, EC-95862 and Mylepelian showed higher seedling vigour whereas, Starch, Peach and Kitchner showed less seedling vigour. Extent of polyembryony was registered highest with Kurukkan and Peach. Among different scion varieties, Kesar outperformed Dashehari and Baneshan. In case of rootstock-scion combinations Nekkere grafted with Kesar was the best treatment with respect to number of days taken for emergence of sprout, sprout length, graft success, height of grafted plant, scion girth, root collar diameter and number of leaves per graft.

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