Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.4025

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **5 (5):** 1445-1451 (2017)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Influence of Different Mango Varieties and Time of Grafting on Graft Survivability (%) in Both Polyhouse and Shade Net Under Northrn Dry Zone of Karnataka

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Received: 10.06.2017 | Revised: 26.07.2017 | Accepted: 1.08.2017

ABSTRACT

An experiment was carried out to study the effect of variety and time of grafting on graft survivability at University of Horticultural Sciences, Bagalkot. The results revealed that among the six scion varieties, significantly the highest graft survivability (%) was noticed in Baneshan (88.50 and 86.00) whereas, the lowest graft survivability (%) noticed in Khadar (55.54 and 48.60) at 90 and 120 DAG respectively. Among the different time of grafting, significantly the highest graft survivability (%) was recoded on 15th August (72.60 and 66.00) grafted plants at 90 and 120 DAG whereas, the lowest graft survivability (%) noticed on 30th September (60.30) grafted plants and in 30th August (54.40) grafted plants at 90 and 120 DAG under polyhouse condition. Under shade net condition, significantly the highest graft survivability (%) noticed in in Baneshan (81.00 and 74.13) at 90 and 120 DAG whereas, the lowest graft survivability (%) noticed in Khadar (48.00 and 43.60) at 90 and 120 DAG. The highest graft survivability (%) recorded on 30th August (65.50) at 90 DAG whereas, the lowest graft survivability (%) noticed on 15th August (58.10) grafted plants and at 120 DAG the highest graft survivability (%) noticed on 15th September (58.34) whereas, the lowest graft survivability (%) noticed on 30th September (52.54) grafted plants.

Key words: *Time of grafting, Varieties, Graft survivability (%).*

INTRODUCTION

Mango (*Mangifera indica* L.) belongs to the family Anacardiaceae, with a chromosome number 2n=40. It is the choicest among all fruits of India and enjoys a great popularity. It is considered as the "King of fruits". Besides, having delicious taste, captivating flavor with multifarious colour, it is an excellent source of dietary nutrients. It is grown in almost all parts of the world and occupies a unique place amongst the fruit crops grown in India.

Cite this article: Mahesh, S., Hipparagi, K., Goudappanavar, B., Thirupathaiah, G. and Naik. R., Influence of Different Mango Varieties and Time of Grafting on Graft Survivability (%) in Both Polyhouse and Shade Net Under Northrn Dry Zone of Karnataka, *Int. J. Pure App. Biosci.* **5(5):** 1445-1451 (2017). doi: http://dx.doi.org/10.18782/2320-7051.4025

Seedling progenies of mango exhibit lot of variation and do not breed true -to-type. Therefore, vegetative propagation is preferred, since it results in uniformity and precocity in off-springs. The softwood grafting gives an excellent response in initial success with least possibility of mortality, better and uniform orchard establishment[17].The several workers reported more success rate under polyhouse condition compared to shade net condition and July to September was best time of grafting. There is lot of demand for quality planting material of mango in the northern dry zone of Karnataka. No work on performance of different varieties on grafting has been done sofar. To takeup large scale production of grafts, it is necessary to know the performance of each variety. Keeping this in view, the present investigation was undertaken on the "Studies on the effect of time of grafting in different varieties of mango under northern dry zone of Karnataka".

MATERIALS AND METHODS

An experiment was conducted at Division of Fruit Science, Sector No.70, University of Horticultural Sciences, Bagalkot, Karnataka (India) during the year 2014-2015 in a Factorial Randomized Block Design with two replications. Local cv. Sindhur stones were collected and were sown at two different dates *i.e* on 6th June, 2014 for T_1 (August-15) and T_2 (August-30) time of grafting and next on July 7th, 2014 for T_3 (September-15) and T_4 (September-30) time of grafting and used as a rootstock. A total of 1440 healthy mango seedlings were used for this experiment. The softwood grafting of mango was done using Baneshan, Alphonso, Khadar, Mallika, Kesar and Pairi were treated as scions at an interval of fortnight four times *i.e* 15th August, 30th August, 15th September and 30th September and then half of the plants were kept in polyhouse and shade net (50%) conditions. Observations were recorded on five grafts randomly selected 30, 60, 90 and 120 days after grafting. The data were subjected to statistical analysis as per the procedure outlined by Panse and Sukhatme[16] and the treatment means were compared by critical difference values computed at 5% level of significance.

Table 1. Effect of variety and time of grafting on graft survivability (%) under polyhouse condition at 30 and 60 days after grafting.

Time of grafting / Variety	30 DAG					60 DAG				
	T_1	T_2	T_3	T_4	Mean	T_1	T_2	T_3	T_4	Mean
Baneshan	100.0 (88.56)	100.0 (88.56)	95.00 (80.06)	95.50 (80.56)	**97.63 (84.43)**	90.00 (72.44)	96.00 (81.07)	81.00 (64.35)	87.50 (69.61)	**88.62 (71.87)**
Alphonso	85.00 (67.78)	83.50 (66.04)	78.50 (62.56)	69.90 (56.79)	**79.24 (63.23)**	78.00 (62.03)	79.50 (63.15)	70.00 (56.86)	55.00 (47.88)	**70.62 (57.49)**
Khadar	76.50 (61.06)	65.40 (53.97)	74.50 (59.81)	96.70 (81.78)	**78.26 (64.15)**	56.50 (48.74)	47.50 (43.56)	66.70 (54.83)	78.50 (62.38)	**62.29 (52.38)**
Mallika	84.00 (79.15)	59.50 (50.53)	92.50 (77.89)	79.00 (63.26)	**78.75 (67.71)**	80.00 (63.55)	50.00 (45.00)	78.00 (62.03)	70.00 (56.89)	**69.50 (56.86)**
Kesar	73.00 (58.79)	69.00 (56.31)	90.00 (76.00)	80.50 (63.94)	**78.13 (63.76)**	73.00 (58.79)	65.50 (54.10)	80.50 (64.10)	57.40 (49.27)	**69.10 (56.56)**
Pairi	95.80 (80.86)	96.40 (81.50)	100.0 (88.56)	96.20 (81.22)	**97.09 (83.03)**	89.20 (70.95)	90.40 (72.09)	84.60 (66.89)	83.00 (65.73)	**86.79 (68.92)**
Mean	**85.72 (72.71)**	**78.97 (66.15)**	**88.41 (74.14)**	**86.29 (71.23)**	**84.85 (71.05)**	**77.78 (62.76)**	**71.48 (59.82)**	**76.78 (61.52)**	**71.90 (58.63)**	**74.48 (60.68)**
	SE m±		**CD at 5%**			**SE m±**		**CD at 5%**		
Variety(V)	2.40		6.99			2.12		6.22		
Time of grafting(T)	1.95		5.71			1.73		5.08		
I Interaction (VXT)	4.78		14.0			4.25		12.4		

NS: Non-Significant T_1: August 15th grafted plants T_2: August 30th grafted plants

V: Variety T_3: September 15th grafted plants T_4: September 30th grafted plants

T: Time of grafting **DAG**: Days after grafting

*Figures in parenthesis indicate transformed values (Arc sin)

Table 2. Effect of variety and time of grafting on graft survivability (%) under polyhouse condition at 90 and 120 days after grafting.

Time of grafting / Variety	90 DAG					120 DAG				
	T_1	T_2	T_3	T_4	Mean	T_1	T_2	T_3	T_4	Mean
Baneshan	90.00 (72.44)	96.00 (81.07)	80.50 (63.94)	87.50 (69.61)	**88.50 (71.76)**	90.00 (72.44)	88.00 (70.00)	76.50 (61.29)	87.50 (69.61)	**86.00 (69.60)**
Alphonso	71.00 (57.57)	76.00 (60.90)	60.80 (51.28)	39.95 (39.14)	**61.94 (52.22)**	67.50 (55.28)	72.00 (58.08)	58.30 (49.84)	36.70 (37.24)	**58.60 (50.12)**
Khadar	52.50 (46.44)	38.00 (38.05)	58.30 (49.84)	73.30 (58.88)	**55.54 (48.30)**	47.00 (43.07)	34.50 (35.96)	43.30 (41.06)	70.00 (57.45)	**48.60 (44.38)**
Mallika	78.00 (62.24)	41.00 (39.79)	71.00 (57.41)	62.00 (52.01)	**63.00 (52.86)**	64.50 (53.69)	30.00 (33.22)	64.00 (53.13)	51.00 (45.59)	**52.38 (46.41)**
Kesar	58.00 (49.63)	48.50 (44.13)	78.00 (62.40)	43.00 (40.99)	**56.89 (49.29)**	48.50 (44.13)	41.00 (39.81)	72.30 (58.83)	35.90 (36.76)	**49.40 (44.88)**
Pairi	86.15 (68.66)	72.55 (58.53)	80.45 (63.85)	56.00 (48.48)	**73.80 (59.89)**	76.90 (62.76)	61.30 (51.52)	79.40 (63.01)	48.10 (43.88)	**66.40 (55.30)**
Mean	**72.60 (59.50)**	**62.00 (53.75)**	**71.50 (58.13)**	**60.30 (51.52)**	**66.60 (55.72)**	**66.00 (56.07)**	**54.40 (48.09)**	**65.60 (54.53)**	**54.80 (48.42)**	**60.25 (51.78)**
	SE m±		**CD at 5%**			**SE m±**		**CD at 5%**		
Variety(V)	2.91		8.53			3.51		10.1		
Time of grafting(T)	2.38		6.96			2.87		8.28		
Interaction (VXT)	5.83		17.1			7.02		20.3		

NS: Non-Significant T_1: August 15th grafted plants T_2: August 30th grafted plants
V: Variety T_3: September 15th grafted plants T_4: September 30th grafted plants
T: Time of grafting **DAG**: Days after grafting
*Figures in parenthesis indicate transformed values (Arc sin)

Table 3. Effect of variety and time of grafting on graft survivability under shade net condition at 30 and 60 days after grafting.

Time of grafting / Variety	30 DAG					60 DAG				
	T_1	T_2	T_3	T_4	Mean	T_1	T_2	T_3	T_4	Mean
Baneshan	88.50 (70.29)	87.00 (69.40)	72.00 (58.18)	100.0 (88.56)	**86.88 (71.61)**	87.50 (69.48)	87.00 (69.40)	70.50 (57.17)	100.0 (88.56)	**86.30 (71.16)**
Alphonso	90.00 (71.65)	79.00 (62.88)	66.50 (54.66)	66.00 (54.41)	**75.40 (60.90)**	70.50 (57.73)	71.00 (58.02	52.30 (46.30)	48.00 (43.84)	**60.40 (51.47)**
Khadar	86.40 (68.93)	69.50 (56.60)	50.00 (44.97)	83.30 (65.93)	**72.28 (59.11)**	55.40 (48.15)	50.20 (45.12)	36.70 (37.24)	63.30 (52.74)	**51.40 (45.81)**
Mallika	79.50 (63.36)	79.00 (63.03)	93.00 (78.29)	85.00 (67.22)	**84.13 (67.98)**	49.00 (44.42)	63.00 (52.71)	90.00 (76.00)	74.50 (60.28)	**69.10 (58.35)**
Kesar	56.50 (48.74)	84.50 (68.57)	100.0 (88.56)	96.40 (81.50)	**84.40 (71.85)**	49.50 (44.72)	82.50 (66.14)	100.0 (88.56)	66.70 (54.77)	**74.70 (63.54)**
Pairi	96.20 (81.22)	98.00 (83.51)	96.20 (81.22)	100.0 (88.56)	**97.60 (83.64)**	71.30 (57.58)	91.70 (77.22)	89.00 (70.83)	93.10 (74.72)	**86.20 (70.09)**
Mean	**82.80 (67.36)**	**82.80 (67.34)**	**79.60 (67.65)**	**88.50 (74.36)**	**83.45 (69.18)**	**63.90 (53.67)**	**74.20 (61.44)**	**73.70 (62.68)**	**74.30 (62.48)**	**71.43 (60.06)**
	SE m±		**CD at 5%**			**SE m±**		**CD at 5%**		
Variety(V)	2.35		6.89			3.45		10.1		
Time of grafting(T)	1.92		5.62			2.82		8.25		
Interaction (VXT)	4.71		13.8			6.91		20.2		

NS: Non-Significant T_1: August 15th grafted plants T_2: August 30th grafted plants
V: Variety T_3: September 15th grafted plants T_4: September 30th grafted plants
T: Time of grafting **DAG**: Days after grafting
*Figures in parenthesis indicate transformed values (Arc sin)

Table 4. Effect of variety and time of grafting on graft survivability under shade net condition at 90 and 120 days after grafting.

Time of grafting / Variety	90 DAG					120 DAG				
	T_1	T_2	T_3	T_4	Mean	T_1	T_2	T_3	T_4	Mean
Baneshan	83.50 (66.04)	82.50 (66.35)	62.00 (52.73)	96.00 (81.07)	**81.00 (66.54)**	79.50 (63.15)	71.50 (54.55)	49.50 (44.71)	88.00 (70.00)	**74.13 (58.11)**
Alphonso	68.00 (56.28)	71.00 (58.02)	42.70 (40.79)	39.40 (38.80)	**55.30 (48.48)**	58.50 (49.92)	58.50 (49.92)	42.70 (40.83)	34.80 (36.14)	**48.63 (42.21)**
Khadar	45.00 (42.12)	50.00 (45.12)	33.30 (35.24)	63.30 (52.74)	**48.00 (43.81)**	38.05 (38.05)	49.75 (44.85)	33.30 (35.24)	53.30 (46.90)	**43.60 (41.27)**
Mallika	45.00 (41.99)	46.00 (42.71)	72.50 (60.15)	63.50 (52.85)	**56.80 (49.43)**	41.50 (40.06)	39.00 (38.64)	55.00 (47.92)	49.50 (44.72)	**46.30 (42.83)**
Kesar	46.50 (42.98)	56.50 (48.74)	94.00 (80.51)	48.30 (44.02)	**61.30 (54.06)**	39.50 (38.89)	56.50 (48.74)	88.00 (70.35)	44.55 (41.82)	**57.11 (49.94)**
Pairi	60.80 (51.20)	87.50 (74.29)	85.40 (68.13)	63.00 (52.72)	**74.20 (61.58)**	60.75 (51.21)	71.75 (57.98)	81.55 (64.64)	45.50 (42.23)	**64.81 (54.02)**
Mean	**58.10 (50.10)**	**65.60 (55.86)**	**65.00 (56.25)**	**62.20 (53.69)**	**62.74 (53.98)**	**52.97 (46.87)**	**57.83 (49.11)**	**58.34 (50.61)**	**52.54 (46.96)**	**55.59 (48.22)**
	SE m±		**CD at 5%**			**SE m±**		**CD at 5%**		
Variety(V)	1.88		5.49			1.94		5.67		
Time of grafting(T)	1.53		4.48			1.59		4.64		
Interaction (VXT)	3.75		11.0			3.89		11.4		

NS: Non-Significant T_1: August 15th grafted plants T_2: August 30th grafted plants
V: Variety T_3: September 15th grafted plants T_4: September 30th grafted plants
T: Time of grafting **DAG**: Days after grafting
*Figures in parenthesis indicate transformed values (Arc sin)

RESULTS AND DISCUSSION

The differences in percentage of survival of grafts due to different varieties, different time of grafting and their interaction were found to be significant at 30, 60, 90 and 120 days after grafting (Table 1 and 2).The varieties showed significant variation in graft success under polyhouse condition. The significantly highest percentage of survival of grafts was recorded in Baneshan (97.63% and 88.62%) and which was at par with the Pairi (97.09% and 86.79%) at 30 and 60 days after grafting respectively whereas, the lowest was recorded in Kesar at 30 days after grafting (78.13%) and Khadar (62.29%) at 60 days after grafting. The highest graft survivability (88.5% and 86%) was noticed in Baneshan and which was at par with the Pairi (73.80 and 66.40) at 90 and 120 days after grafting respectively whereas, the lowest graft survivability (55.54% and 48.6%) in Khadar at 90 and 120 days after grafting respectively. The graft union success also depends on temperature and humidity to the greater extent. The temperature affects the graft union by influencing callus formation. In general, callus formation is optimum at about 26-29°C. This might be due to the congenial climate prevailed during the study. The similar results were reported by Desai and Patil[5], Jinturkar and Narwadkar[11], Baghel *et al*[2]., and Sivudu *et al*[22]. The different time of grafting was significantly influenced on graft success under polyhouse condition. The highest percentage of survival of grafts was recorded by grafting on 15th September (88.41) and which was at par with the 30th September (86.29%) and 15th August (85.72%) whereas, the lowest percentage of survival of grafts was recorded by grafting on 30th August (78.97) at 30 days after grafting. At 60 days after grafting, significantly highest graft survival was noticed by 15th August (77.78%) and which was at par with 15th September (76.78%) whereas, the lowest was noticed in 30th August (71.43%). The highest graft survivability (72.60% and 66%) noticed in 15th August grafted plants and which was at par with the (71.50% and 65.60%) of 15th September at 90 and 120 days after grafting respectively whereas, the lowest graft survivability (60.30%) noticed in (S4) 30th September grafted plants at 90 days after grafting and 54.40% was noticed in 30th August grafted plants at 120 days after grafting under poly house conditions. This may be due to optimum temperature followed by higher relative humidity under polyhouse condition. The maturity of scion is also another important key factor in deciding the success of grafting in any fruit crops. More success in a shorter period could be recorded with softwood scion than hardwood scion[3]. Higher grafting success and also survival of the grafts was obtained between the periods from July to September; the months of rainy season by Kadam *et al*[12].The same trends of graft survivability were reported by Kulwal and Tayde[13], Shailendra and Sinha[19], Upadhyay and Prasad[24] in Mango, Gadekar *et al*[6]., and Mulla *et al*[15]., in jamun.The interaction effect between varieties and time of grafting was significantly influenced on graft survivability. The highest graft survival was noticed by Baneshan (100%) grafted on 15th August and 30th August and also noticed by Pairi (100%) grafted on 15th September and which were at par with the Khadar (96.70%) and Pairi (96.20%) grafted on 30th September whereas, the lowest was noticed by Mallika in 30th August (59.40%) grafted plants at 30 days after grafting. Similarly, the highest graft survivability was noticed in Baneshan grafted in 30th August (96%) which was at par with the Baneshan (90%) grafted on 15th August and Pairi (89.40% and 90.40%) 15th August and 30th August whereas, the lowest (47.50%) was noticed in Khadar grafted in 30th August at 60 days after grafting. The significantly highest graft survivability was noticed in Baneshan grafted in 30th August (96%) whereas, the lowest graft survivability was noticed in Khadar grafted in 30th August (38.50%) at 90 days after grafting and the highest graft survivability was noticed in Baneshan when grafts made on 15th August (90%) whereas, the lowest graft survivability was noticed in Mallika grafted in 30th August (30%) at 120 days after grafting under

polyhouse conditions. The reason for best results in sprouting and success of softwood grafting might be due to optimum temperature and relative humidity prevailing during this period resulting in early contact of cambium layers of stock and scion, early callus formation and initiation of subsequent growth. Similar results were reported by Singh and Singh[21], 2006, Amin[1] (1978b) in jack fruit, Brahmachari *et al*[4]., in mango *cv*. Amrapali and Harshavardhan[8].

The differences in percentage of survival of grafts due to varieties, time of grafting and their interactions were found to be significant under shade net conditions (Table 3 and 4).The varieties showed significant variation on graft survivability under shade net condition. The significantly highest graft survivability was noticed in Pairi at 30 days after grafting (97.60%) and 86.30% in Baneshan and which was at par with the Pairi (86.20%) at 60 days after grafting whereas, the lowest graft survivability (72.28% and 51.40%) was noticed in Khadar at 30 and 60 days after grafting respectively. The highest graft survivability (81% and 74.13%) was noticed in Baneshan whereas, the lowest graft survivability (48% and 43.60%) noticed in Khadar at 90 and 120 days after grafting respectively under shade net condition.The time of grafting significantly influenced on the graft survivability under shade net condition. The highest graft survivability was noticed in 30th September (88.50%) and which was at par with the 15th August (82.80) whereas, the lowest graft survivability was noticed in 15th September (79.60%) at 30 days after grafting and the highest graft survivability was noticed in 30th September (74.30%) which was at par with the (74.20%) whereas, lowest graft survivability was noticed in 15th August (63.90%) grafted plants at 60 days after grafting. The significantly highest graft survivability was noticed in 30th August (65.60%) and which was at par with the 15th September (65%) and 30th September (62.20%) whereas, the lowest graft survivability noticed in 15th August (58.10%) grafted plants at 90 days after grafting. Similarly the highest graft survivability found in 15th September (58.34%) and which is at par with the 30th August (57.83%) whereas, the lowest graft survivability was noticed in 30th September (52.54%) grafted plants at 120 days after grafting. These observations are conformity with the fact that shade, humid and warm conditions after grafting might have resulted in increasing the survival percentage of grafts as reported by Singh *et al*[20]., Islam *et al*[10]., in mango and Ghosh *et al*[7]., in sapota.The interaction effect between varieties and time of grafting were significantly influenced on graft survivability. The significantly highest graft survivability of 100 percent was noticed in Kesar grafted in 15th September, Baneshan and Pairi in 30th September grafted plants and followed by Pairi (98.00%) in 30th August whereas, the lowest graft survivability was noticed in Khadar grafted in 15th September (50.00%) grafted plants at 30 days after grafting. Similarly, the highest graft survivability noticed Kesar grafted in 15th September (100%) and Baneshan grafted in 30th September (100%) whereas, the lowest graft survivability was noticed in Khadar (36.70%) grafted in 15th September grafted plants at 60 days after grafting. The highest graft survivability was noticed in Baneshan grafted in 30th September (96%) whereas, the lowest graft survivability was noticed in Khadar in 15th September (33.30%) grafted plants at 90 days after grafting. And the highest graft survivability was noticed in Baneshan in 30th September (88%) grafted plants and also in Kesar grafted in 15th September (90.90%) whereas, the lowest graft survivability was noticed in Khadar in 15th September (33.30%) grafted plants at 120 days after grafting under shade net condition.The higher percentage of graft success was noticed under 50 per cent shade when compared to open conditions[9], Venkata Reddy and Melanta[25] in mango, Lingaiah *et al*[14]., Sundari and Reddy[23] in cashew and Selvi *et al*[18]., in jack fruit.The variation in grafting success may be attributed due to the differences in the quantity of endogenous phenolic compounds and / due to the

differential capacity of rootstocks in the production of undifferentiated mass of parenchyma cells when grafting performed.

REFERENCES

1. Amin, R.S., Softwood grafting A-new technique for hardwood plants. *Curr. Sci.* **47(13):** 468-469 (1978b).
2. Baghel, B.S., Hema Nair, and Nema, B.K., Response of mango (*Mangifera indica* L.) grafts to coloured poly house/light. *South Indian Hort.*, **50:** 1-6 (2002).
3. Baskaran, A., Saraswathy, S. and Prathiban, S., Standardisation of propagation methods for jack (*Artocarpus heterophyllus*, Lam.). *The Asian J. Hort.*, **3(2):** 361-363 (2008).
4. Brahmachari, V.S., Kumar, N. and Kumar, R., Seasonal effect on success of Veneer grafting in Mango cv. Amrapali. *Hortil. J.*, **10(2):** 1-5 (1997).
5. Desai, J.B. and Patil, V.K., Success of stone grafting in mango in glass house and in open. *Punjab Horti. J.*, **24:** 7-10 (1984).
6. Gadekar, Bharad, S.G., Mane, V.P. and Sarika Patil, Seasonal variation in success of softwood grafting of jamun under akola conditions. *Asian J. Hort.*, **2(5):** 266-268 (2010).
7. Ghosh, S.N., Bera, B., Roy, S. and Banik, B.C., Effect of cultivars and season on grafting success in sapota under Paschim Midnapur conditions of West Bengal. *J. Hort. Sci.*, **5(2):** 138-139 (2010).
8. Harshavardhan, A., Conducted an experiment to standardize propagation method in jackfruit. *M.Sc. (Horti.) Thesis*, Dr.Y.S.R. Horticultural University, Venkataramannagudem, Andhra Pradesh (2011).
9. Iqbal, M., Review of mango research and production in Fizi. *Fizi Agri. J.*, **44:** 22-26 (1982).
10. Islam, M.N., Rahim, M.A. and Farooque, A.M., Standardization of time and grafting techniques in Mango under Bangladesh condition. *Asian J. Pl. Sci.*, **3(3):** 378-386 (2004).
11. Jinturkar, S.P. and Narwadkar, P.R., Effect of environmental conditions on the success of epicotyl grafting in mango. *Acta Hort.* No. 231, 252-254.Second international symposium on mango, Bangalore, India, 20-24 May 1985 (1989).
12. Kadam, S.G., Nawale, R.N., Nadkarni, H.R. and Magdum, M.B., Studies on *in situ* softwood grafting in cashew (*Anacardium occidentale* Linn.). *The Cashew*. **8(4):** 8-11 (1995).
13. Kulwal, LV. and Tayde, G.S., Studies on propagation of mango varieties by soft wood grafting under Akola conditions. *Abs. Paper*. Second International Symposium on mango. Bangalore, May 20-24 (1985b).
14. Lingaiah, H.B., Vishnuvardhana, Raju, G.T.T., Janakiraman, N., Sivappa and Lakshman, M., Influence of growing conditions on the production of root stocks and grafting success in Cashew (*Anacardium occidentale* L.). *Cashew*. **14(3):** 9-13 (2000).
15. Mulla, B.R., Angadi, S.G., Mathad, J.C, Patil Andu, V.S. and Mummigatti, V., Studies on softwood grafting in jamun (*Syzygium cumini* Skeels.). *Karnataka J. Agri. Sci.*, **24(3):** 366-368 (2011).
16. Panse, V.G. and Sukhtme, P.V., *Statistical methods for Agricultural workers*. Indian Council of

Agricultural Research, New Delhi (1985).

17. Ram, R.A. and Pathak, R.K., Softwood grafting open new avenues in cultivation fruit crops. *Indian J. Hort*., **63(4):** 10-11 (2006).
18. Selvi, R., Kumar, N., Selvarajan, M. and Anbu, S., Effect of environment on grafting success in Jackfruit. *Indian J. Hort.*, **65:** 341-343 (2008).
19. Shailendra, R. and Sinha, G.C., Use of aluminium foil for increasing veneer grafting success under adverse condition. *Prog. Hort.*, 1**9(1-2):** 141-142 (1987).
20. Singh, M.P., Gill, S.S. and Khaturia, H.N., Standardization of propagation techniques in mango. *Acta Hort.*, **231:** 179-181 (1989).
21. Singh, S. and Singh, A.K., Standardization of method and time of propagation in jamun *(Syzygium cuminii)* under semi-arid environment of western India. *Indian J. Agril. Sci.*, **76(4):** 242-245 (2006).
22. Sivudu, B.V., Reddy, M.L.N., Baburatan, P. and Dorajeerao, A.V.D., Effect of structural conditions on veneer grafting success and survival of mango grafts (*mangifera indica* cv. Banganpalli). *Pl. Arch.*, **14:** 71-75 (2014).
23. Sundari, N.S.S. and Reddy, M.L.N., Influence of shade on success and growth of softwood grafts in cashew. *The Andhra Agri. J.*, **50(1&2):** 83-85 (2003).
24. Upadhyay, N.P. and Prasad, R.S., Effect of time of veneer grafting on sprouting and growth in mango cv. Dashehari. *Indian J. Hort.*, **45(1-2):** 61-62 (1988).
25. Venkata Reddy, C. and Melanta, K.R., Effect of age of root stocks on the success of soft-wood grafting of mango in containers and *in situ*. *South Indian Hort.*, **36(3):** 143-145 (1988).