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Standardization of grafting time in different red pulp guava (*Psidium guajava* L.) by softwood grafting

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Abstract
The investigation was conducted in the Main Horticulture Research and Extension Center, University of Horticultural Sciences, Bagalkot during the year 2020 to 2021 with an objective to study the best grafting month in different red pulp guava (*Psidium guajava* L.) by softwood grafting which showed minimum number of days taken for graft take (4.58 days), maximum sprouting percentage (91.67%), highest graft success (85.83%) and survivability (96.89%) in February month. Among the varieties Arka Kiran took less number of days for graft take (7.04 days), more sprouting percentage (85.00%), highest graft success (67.50%) and survivability (90.13%). However, Interaction effect showed least number of days taken for graft take (4.24 days), highest graft survivability (99.50%) in Arka Kiran grafted on February month followed by March grafted plants.

Keywords: Sprouting percentage, highest graft success

Introduction
Guava (*Psidium guajava* L.) known as the "Apple of tropics" belongs to the family Myrtaceae which comprises of about 3,000 species under 80 genera. It is well-distributed in the tropical and subtropical regions of the world, especially in South America, Asia and Australia. The genus *Psidium* has about 150 shrubs and *P. guajava* is well-known species grown worldwide and is one of the most promising fruit crops of India (Paull and Bittenbender, 2006) [10].

Guava is one of the 50 best-known edible fruits of tropical and subtropical climate worldwide and has commercial importance in more than 50 countries (Yadava, 1996) [20]. In India, guava is the fifth most important fruit crop. The area under the crop is (265.00 thousand ha) with a production (4054.00 thousand MT) after Banana, Mango, Citrus and Papaya. It shares 4.1% of total fruit production in India. Whereas, Uttar Pradesh leads in area and production under guava cultivation (49.53 thousand ha and 928.44 thousand MT respectively) (Anon, 2018) [1].

India, Pakistan, Sudan, Brazil, Egypt, Mexico, Indonesia and Bangladesh are the world's top guava producers. The technical levels used in the production of nursery plants, orchards and post-harvest management vary greatly between nations. The shape of guava tree and floral morphology favours self-pollination, while cross-pollination is believed to be 35 percent, carried out mostly by bees and wasps. However, the amount of cross pollination varies by genotype, production area environment, and availability and effectiveness of pollinizing agents. As a result, seed propagation produces genetically diverse individuals, which may be seen in orchards and plants from the same orchard. Hence, seed propagation is not recommended in commercial orchards of high productivity (Pereira, 1990) [11]. The adoption of vegetative propagation methods for guava by nurserymen and fruit growers on a commercial scale is directly related to propagation facility, costs, technology transfer and most importantly, the organisation of the production chain at the regional level, in addition to interest in adopting new technologies.

In India, there is a huge opportunity to expand the guava cultivation to a much larger region. As the area under fruit cultivation is growing and there is a requirement to prepare quality guava planting material throughout the year as such a quick and successful propagation strategy is necessary.

Seeds have been used to grow guava plants for a long time, however propagating by seeds results in lot of variation in the plants. Although, air layering is the most cost-effective approach for vegetative multiplication, it has not shown to be particularly successful in the instance of guava due to the formation of low quality roots and hence poor field survival (Shashikumar *et al*., 2012) [15]. Softwood grafting is a simple and effective solution to these issues and grafts may be created in less than a year, lowering the cost of raising grafts significantly. Softwood grafting produces a good result, with a higher graft success and survival percentage of quality grafts and a lower risk of mortality, which aids in the creation of a better and more uniform orchard (Ram and Pathak, 2006) [13].

Material and Methods

The field experiment was conducted at MHREC, University of Horticultural Sciences, Bagalkot. It is situated in the northern dry zone of Karnataka during November 2020 to March 2021 in FCRD. Ten month old local cultivar rootstock were raised for softwood grafting. A total of 600 healthy guava seedlings were used for this experiment.

The softwood grafting of guava was done using Arka Kiran, Punjab Pink and Punjab Bold were as scions at different grafting months i.e. November, December, January, February and March. Observations were recorded on ten grafts in each replication at 30, 60 and 90 days after grafting. The data were subjected to statistical analysis as per the procedure outlined by Panse and Sukhatme (1985) and the treatment means were compared by critical difference values computed at 5% level of significance.

Results and Discussion

Number of days taken for first sprouting

In this study, minimum number of days taken for first sprouting (4.58) was recorded best when grafting was carried out on February, while, Arka Kiran took minimum number of days for sprouting (7.04) among different varieties. With reference to interaction effect Arka Kiran grafted on February month (4.24) took less number of days for sprouting. The less number of days required for sprouting might be owing to the optimal temperature and relative humidity. This could be because, better and earlier sprouting is encouraged by establishment of intimate contact of a significant portion of the cambial region, early callus formation, production of storage food material and interlocking of parenchymatous cells in both stock and scion under favourable environmental conditions. Similar findings were reported by Syamal *et al.* (2012) [19], Sweeti *et al.* (2016) [18], Gotur *et al.* (2017) [4] in guava, Ratan *et al.* (1987) [14], Prasanth *et al.* (2007) [12] in mango, Madalageri *et al.* (1991) [8] in jamun, Barathkumar (2017) [2] in anola and Patil *et al.* (2017) [9] in custard apple.

Sprouting percentage (%)

In this study, maximum sprouting percentage (91.67%) was recorded in plants grafted on February, where as Arka Kiran (85.00%) recorded more percentage sprout. The genetic composition of Arka Kiran scion may impact the histology and metabolic processes during graft union, resulting in quicker development of physiological and meristamatic activities in the tissues leading in earlier scion sprouting with higher per cent of sprout. This finding was supported by Sweeti *et al.* (2016) [18], Gotur *et al.* (2017) [4] in guava, Shraddha *et al.* (2018) [16] and Singh *et al.* (2014) [17] in mango.

Graft success and survivability

At 30 and 90 DAG, significantly highest graft success and graft survivability (85.83% and 96.89%, respectively) was noticed in February grafted plants and in different varieties Arka Kiran (67.50% and 90.13%, respectively) had highest. In interaction maximum graft survivability was recorded when grafting was carried out on February with the variety Arka Kiran (99.50%). The availability of favourable climatic conditions during the month of February may account for the highest proportion of graft survival. Early sprouting, high sprouting percentage, more leaves and sprout length in combination increased the graft success percentage. Present findings are duly supported by Syamal *et al.* (2012) [19], Sweeti *et al.* (2016) [18], Gotur *et al.* (2017) [4], Kukshal *et al.* (2017) [7] in guava, Kaur *et al.* (2019) [6], Shraddha *et al.*(2018) [16], Karna *et al.* (2018) in mango, Deshmukh *et al.* (2018) [3] in tamarind and Barathkumar (2017) [2] in anola.

Table 1: Performance of different red pulped guava varieties for number of days taken for first sprouting

Grafting time	Number of days taken for first sprouting			
	Scion varieties			
	V_1	V_2	V_3	Mean
M_1	9.22	9.33	9.78	9.44
M_2	8.64	8.75	8.89	8.76
M_3	7.21	7.42	7.55	7.40
M_4	4.24	4.65	4.84	4.58
M_5	5.89	6.21	6.55	6.22
Mean	7.04	7.27	7.52	
	S.Em.±		C.D at 5%	
M	0.03		0.10	
V	0.03		0.10	
M×V	0.06		0.18	

M_1- November M_2- December M_3- January M_4- February M_5- March V_1 -Arka Kiran V_2 –Punjab Pink V_3 –Punjab Bold

Table 2: Performance of different red pulped guava varieties for sprouting percentage

Grafting time	Sprouting percentage			
	Scion varieties			
	V_1	V_2	V_3	Mean
M_1	70.00	65.00	62.50	65.83
M_2	75.00	70.00	67.50	70.83
M_3	95.00	87.50	87.50	90.00
M_4	95.00	90.00	90.00	91.67
M_5	90.00	87.50	82.50	86.67
Mean	85.00	80.00	78.00	
	S.Em.±		C.D at 5%	
M	1.20		3.70	
V	1.50		4.80	
M×V	2.70		NS	

Table 3: Performance of different red pulped guava varieties for graft success and survivability

Grafting time	Scion varieties							
	Graft success (%) 30 DAG				Graft survivability (%) 90 DAG			
	V_1	V_2	V_3	Mean	V_1	V_2	V_3	Mean
M_1	45.00	37.50	35.00	39.17	82.66	86.25	82.00	83.64
M_2	47.50	40.00	37.50	41.67	89.44	81.12	87.50	86.02
M_3	72.50	70.00	70.00	70.83	87.88	89.20	89.20	88.76
M_4	87.50	85.00	85.00	85.83	99.50	97.05	94.11	96.89
M_5	85.00	82.50	80.00	82.50	91.17	91.58	90.62	91.13
Mean	67.50	63.00	61.50		90.13	89.04	88.69	
	S.Em.±		C.D at 5%		S.Em.±		C.D at 5%	
M	0.71		2.17		0.37		1.12	
V	0.92		2.80		0.47		1.45	
M×V	1.59		NS		0.82		2.51	

M_1- November M_2- December M_3- January M_4- February M_5- March V_1 -Arka Kiran V_2 –Punjab Pink V_3 –Punjab Bold DAG – Days after grafting NS -Non significant

Conclusion

On the basis of summarized results obtained from the present investigation, it can be concluded that February grafted plants performed better in all observation recorded and in case of variety Arka Kiran performed best compared to remaining varieties.

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