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Response of guava (*Psidium guajava*) genotypes to air-layering under sub-humid southern Rajasthan

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ABSTRACT

The evaluation of guava genotypes (*Psidium guajava* L.) for air layering under sub-humid conditions in the southern plains of Rajasthan was conducted from 5th to 15th July 2015-16. The genotypes were used: L-49, Allahabad Safeda, Lalit, Red Fleshed, Pant Prabhat, Safed Jam, Arka Amulya, Arka Mridula, MPUAT S-1, MPUAT S-2, Shweta, Burfkhan, Sarbati, RCGH-1, and One-Kg. Among genotypes, Lalit exhibited highest early root initiation, percentage of rooted air layers, survival percentage, and vigor index. The number of secondary roots was highest in L-49, and root-to-shoot ratio was highest in Shweta. One-Kg showed a poor response to rooting.

Key Words: Chinese layering performance, Sub-humid condition, Red and white fleshed genotypes, Air layering.

Guava (*Psidium guajava* L.) can be propagated by seeds and vegetative means. Seed-propagated plants start bearing fruits in 6-8 years with variation in fruit yield and quality, whereas vegetatively propagated ones are precocious in bearing (3-4 years after planting) and produce uniform fruits (Bose *et al.*, 1986). Vegetative propagation in guava is done by layering, grafting, and budding in different parts of India (Chadha, 2001). Under Rajasthan conditions, true-to-type saplings are produced through air and mound layering, as well as inarching methods of propagation. The success of air-layering depends on the variety, types of plant material, and time of operation (Sharma *et al.*, 1975; Dod *et al.*, 1998; Tomar, 2016). Since multiplication of desired genotype through air layering under sub-humid conditions in the southern plains of Rajasthan is not carried out to meet the demand, an experiment was conducted.

MATERIALS AND METHODS

The experiment was conducted at Rajasthan College of Agriculture, Udaipur, Rajasthan, from June to December. Fifteen genotypes, namely Allahabad Safeda, Arka Amulya, Arka Mridula, Burfkhan, L-49, Lalit, MPUAT S-1, MPUAT S-2, One-Kg, Pant Prabhat, RCGH-1, Red Fleshed, Safed Jam, Sarbati, and Shweta, were utilized.

In July, a total of 100 air-layerings were performed on each mother plant of 5-6 years old, resulting in a total of 1500 layers. Healthy shoots, approximately one year old, were selected for the process. A ring of bark, about 1.5-2 cm wide between two nodes, was carefully removed from each selected shoot using two circular cuts with a sharp knife. The exposed portion was then covered with a handful of moistened sphagnum moss, previously soaked in water for 2-3 hours. A piece of polyethylene sheet (150 gauges) was used to wrap around the operated portion, holding the moss in place. Plastic strips were firmly tied at both ends to secure the wrapping.

The layers were separated from the plant when roots became visible through the polythene sheet. After detachment, the polythene sheet was unwrapped, and the layers were treated with copper oxychloride (COC) at a rate of 3 g per liter. Following shoot pruning, the layers were planted in polythene bags (10 cm x 15 cm).

Observations were recorded on the following parameters:

1. Days taken for root initiation
2. Percentage of air layers rooted
3. Root characteristics (number of secondary roots, length of the longest root, diameter of the longest root, fresh weight, and dry weight of roots)

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4. Root/shoot ratio (calculated as averaged root length (cm) divided by averaged shoot length (cm))
5. Vigour index (calculated as averaged root length (cm) + averaged shoot length (cm) multiplied by survival percentage)
6. Survival percentage after shifting to poly bags at 15 days and one month after shifting
7. Survival percentage recorded again at 15 days after shifting in poly bags.

RESULTS AND DISCUSSION

The genotypes had a significant effect on days taken to rooting, percent of rooting, root characters (number, length, diameter, fresh weight, and dry weight of secondary roots), root: shoot ratio, survival percentage of rooted air layers, and vigor index.

Minimum days taken for root initiation were observed in Lalit (39 days), followed by Red Fleshed (40.60 days), while the maximum days taken for root initiation were in One-Kg (50 days). The probable reason might be due to the genetic makeup of varieties (vigorous, dwarf, and intermediate) and interaction with environmental factors. These findings are supported by Manna *et al.* (2001).

The maximum percentage of air layers rooted was recorded in Lalit (74.76%), followed by Allahabad Safeda (71.19%) and One-Kg (50.19%). Lalit responded better to air layering due to genetic and physiological behavior. Better rooting occurs in layers when the shoot is physiologically mature and in the active sap flow stage, which varies with genotypes (Table 1). These results are analogous to the findings reported by Sarkar and Ghosh (2006).

Maximum number of secondary roots was recorded in L-49 (11.20), length of the longest root in Lalit (7.12 cm), diameter of the longest root in Pant Prabhat (1.11 mm), fresh weight (1508 mg) and dry weight (395 mg) in Lalit, and the minimum number of secondary roots (4.20), fresh weight (914 mg), and dry weight (196 mg) in One-Kg. Sarbati exhibited the longest root length (3.50 cm), and RCGH-1 had the smallest root diameter (0.54 mm) (Table 2, Fig. 1). The better root characteristics observed could be attributed to the genetic makeup of the genotypes, either alone or in combination with environmental factors, which may have contributed to a higher carbohydrate supply to the roots, resulting in better vegetative growth as evidenced by our study. Similar results were also reported by Ramteke *et al*. (1998) and Tripathi *et al.* (2018).

The root-to-shoot ratio showed significant differences among the varieties. The highest root-to-shoot ratio was observed in Shweta (1.24), followed by Lalit (1.19), and One-Kg (0.97). The greater root-to-shoot ratio in Shweta could be attributed to its

Table: 1 Root initiation (days), rooted layers (%), secondary roots numbers and root: shoot of air layers

Treatment	Genotypes	Days taken for root initiation	Air layers rooted (%)	Number of secondary roots	Root: shoot ratio
T_1	L-49	42.40	67.20	11.20	1.12
T_2	Allahabad Safeda	41.40	71.19	8.80	1.10
T_3	Lalit	39.00	74.76	10.60	1.19
T_4	Red Fleshed	40.60	64.05	7.60	1.07
T_5	Pant Prabhat	42.20	64.05	7.20	1.13
T_6	Safed Jam	49.80	52.50	7.00	1.00
T_7	Arka Amulya	47.20	60.69	5.80	1.03
T_8	Arka mridula	44.20	61.53	6.40	1.07
T_9	MPUAT S-1	42.20	63.00	7.00	1.06
T_{10}	MPUAT S-2	49.80	55.65	4.80	1.03
T_{11}	Shweta	40.80	64.26	10.20	1.24
T_{12}	Burfkhan	42.80	62.37	5.20	1.03
T_{13}	Sarbati	43.80	61.95	6.60	1.02
T_{14}	RCGH-1	42.00	69.93	6.40	1.01
T_{15}	One Kg	50.00	50.19	4.20	0.97
SEm±		0.590	0.815	0.097	0.014
CD (5%)		1.706	2.353	0.280	0.041

higher root growth, indirectly improving the root-to-shoot ratio. This finding is consistent with the study conducted by Vaghela and Sharma (2015).

For each genotype 100 layers were attempted during 5-15 July and root: shoot was recorded after (15 days) shifting layers in poly bags.

The survival percentage of rooted air layers was highest in Lalit (81.40%), followed by Shweta (78.40%) and One-Kg (47.80%). Lalit air layers exhibited higher survivability, which could be attributed to the production of healthy, stout, and a greater number of secondary feeder roots. These roots not only support

Table: 2 Survival of rooted air layers (%), vigour index and success of layers in poly bag (%) of air layers of guava genotypes.

Treatment	Genotypes	Survival of rooted air layers (%)	Vigour index	Success of layers in poly bag (at one month after shifting) (%)
T_1	L-49	74.00	582.13	83.55
T_2	Allahabad Safeda	71.20	581.47	82.46
T_3	Lalit	81.40	838.42	91.00
T_4	Red Fleshed	77.20	697.37	86.00
T_5	Pant Prabhat	70.40	570.24	81.00
T_6	Safed Jam	50.80	318.35	61.00
T_7	Arka Amulya	53.80	394.53	64.00
T_8	Arka mridula	62.80	412.39	73.00
T_9	MPUAT S-1	66.20	494.29	76.00
T_{10}	MPUAT S-2	53.20	393.68	63.00
T_{11}	Shweta	78.40	663.79	88.00
T_{12}	Burfkhan	55.80	344.10	66.00
T_{13}	Sarbati	57.80	321.75	67.00
T_{14}	RCGH-1	58.40	336.77	68.00
T_{15}	One Kg	47.80	262.90	58.00
SEm±		0.881	9.347	0.933
CD (5%)		2.547	26.998	2.695

Survivability was recorded after (15 days) shifting of layers in poly bags.

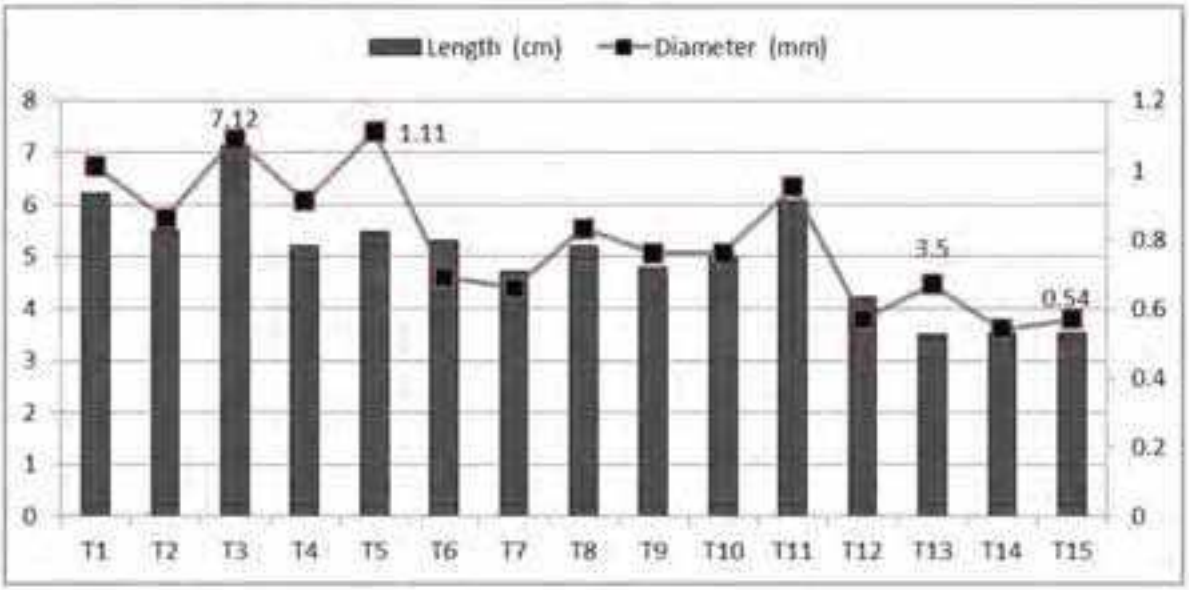

Fig. 1. Air layer's secondary root length and diameter of different guava genotypes

the uptake of water and nutrients from the media but also contribute to a higher survival percentage (Table 2). These findings are supported by Rehman *et al.* (2013) and Chand *et al*. (2018).

Lalit genotype recorded a higher vigor index (838.42), closely followed by Red Fleshed (697.37). This difference in vigor index might be due to variations in the nature of the varieties regarding growth, development, survivability, root-to-shoot ratio, and moisture uptake, which play a key role in enhancing the vigor index of polybag-shifted layers. This finding aligns with the studies conducted by Tripathi *et al*. (2018).

The maximum success rate was observed in Lalit (91.00%), followed by Shweta (88.00%) and One-Kg (58.00%). While there is no direct reference available to support these specific results, it is likely that Lalit's early root initiation, higher percentage of rooted air layers, higher root-to-shoot ratio, and vigor index contribute to the higher survival percentage of rooted air layers after shifting. These findings are in line with the studies by Chand *et al.* (2018) and Rehman *et al.* (2013).

CONCLUSION

The evaluation of guava genotypes for air layering demonstrated that Lalit genotype exhibited highest values for early root initiation, percentage of rooted air layers, survival percentage, and vigor index. The L-49 genotype had greatest number of secondary roots, while Shweta showed maximum root-to-shoot ratio. On the other hand, One-Kg genotype displayed a poor response to air layering. The response of guava genotypes to air-layering followed an overall trend as follows: Lalit (better) > Red Fleshed > Shweta > L-49 > Allahabad Safeda > Pant Prabhat > MPUAT S-1 > Arka Mridula > Sarbati > RCGH-1 > Burfkhan > Arka Amulya > MPUAT S-2 > Safed Jam > One-Kg (poor).

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