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Effect of plant growing media on soft- wood cutting of guava cv. Sardar (L-49)

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Abstract

The present investigation, titled "Studies on propagation guava through cutting" was conducted under shadenet condition during September 2021 to January 2022 at Research cum Demonstration Farm, college of Agriculture, Dhule, Maharashtra. The experiment was set in a Factorial randomized block design (FRBD) which comprised of two factors viz. different rooting media (7 treatments) and growth regulators (5 treatments) making 35 treatment combination and were replicated three times. The results revealed that the with respect to rooting medias were complementary and the treatment M₆ (Soil + potting mixture) was found to be ideal as it recorded promising performance for the characters studied except the characters days required to rooting. It recorded least days required for rooting (19.07 days). Treatment M₄ (Soil + Perlite-1:1) recorded highest percent success at 30 Days (58.63%), number of leaves per cutting at 30, 60, 90 and 120 DAP (2.74, 7.29, 12.47, 20.62), number of shoots at 30, 60, 90 and 120 DAP (0.89, 0.99, 1.53, 2.42) and at 120 DAP it showed maximum number of primary roots per cutting (2.73), maximum number of secondary roots (5.48), highest fresh weight of roots (2.97 g), highest length of root (3.34 cm), highest dry weight of roots (0.66 g) and highest survival percentage (35.36%).

Keywords: IBA, plant growth regulator, rooting media

Introduction

Guava *Psidium guajava* L., is evergreen dicotyledonous plants that are a member of the Myrtaceae family. It is native to the Central America. Though common, guava is a significant commercial fruit crop in India and is referred to as the "Apple of the tropics" and "Poor Man's Apple." Because of huge amount of ascorbic acid in it. After oranges, guavas are a major source of vitamin C. It is a good source of Pectin and mineral namely Calcium and Phosphorus. Guava also used as a traditionally medicinal plant for treatment of diarrhoea, gastroenteritis and analgesic properties.

Due to its delightful flavour, aroma, and perfect ratio of pectin, sugar, and acid, it has a large market potential. In addition to having a high nutritional content, it is robust, heavy bearing, and produces good yields. (Singh *et al.* 2000) [25]. Even it thrives well in saline and poorly drained soil also. It is commercially important fruit crop of India and 4th important fruit crop after mango, banana and citrus. It is prolific bearer and highly remunerative crop. Due to its versatility, area under guava production is expanding. As such, the demand for quality planting is increasing rapidly. Guava is propagated by both sexually through seed and asexually methods like budding, grafting, layering and cutting (Zamir *et al.*, 2003, Chandra *et al.*, 2004) [29, 5]. Use of sexual method of propagation is restricted to breeding programme only as genetic purity is not maintained due to segregation and recombination of characters. Means, unique characteristics of certain variety cannot be multiplied or preserved through seed propagation. Vegetative propagation of guava is the possible approach to ascertain uniformity among the progeny and to maintain good quality fruits (Giri *et al.*, 2004) [8].

To avoid segregation and to get true to types of plants of the particular variety, clonal propagation is widely used in guava (Giri *et al.*, 2004; Singh *et al.*, 2007) [8, 24]. It has been reported that by applying root promoting hormones enhanced the root initiation and growth performance of soft wood grafting in guava (Hafeez *et al.*, 1988) [10]. However, assessing the potential of these methods under particular climatic conditions is very essential.

The rooting of guava cuttings is influenced by several internal and external factors, such as age, health, nutritional status (carbohydrate reserves and nitrogen compounds), hormonal

balance (auxin and cytokinin) of the mother tree, cutting age, type of cutting, presence or absence of leaves at cutting, cuttings time, environment conditions such as temperature and humidity, phenolic compound oxidation and treatment of cuttings with growth regulators (Evans, 1992; Hartmann, *et al.*, 2002; Sardoei, 2014; Sohnika *et al.*, 2015; Abdul *et al.*, 2016; Mitra and Pathak, 2018) [7, 11, 22, 27, 1, 20]. However, these problems can be overcome by use of growth regulators such as auxins (Ljung 2013) [15] which are known to enhance rooting as evident from the literature. However, use of appropriate growth regulator alone is not enough. Therefore, there is need to use proper media along with growth regulator. Because, propagation media is considered as essential part of propagation because rooting competency depends upon type of medium used (Ingram, *et al.*, 1993; Chadha, 2007; Mehmood *et al.*, 2013) [12, 4, 19] as well as for developing stock plants. Rooting medium directly affects quality and percentage of rooting (Loach *et al.*, 1988) [16]. The suitability of the rooting medium depends on the species, type of cuttings, growing conditions, season of the year and the cost effectiveness of the medium components (Macdonald, 1986; Hartmann *et al.*, 2002) [18, 11]. A use of good rooting media with rooting hormone will increase root induction (Leonardi *et al.*, 2001) [14]. Therefore, a research project was envisaged at Agriculture college, Dhule with the view of objective: To study different combination of media for maximum root initiation and to find best combination of rooting media.

Materials and Methods

At a height of 250 meter above mean sea level. Field is located at latitude 20.9 North and longitude 74.78 East. Dhule is situated in the Deccan Plateau region of North Maharashtra. Apart from the south-west monsoon season, the district has a warm, dry climate.

Preparation of Cuttings

Guava soft wood cuttings have been collected from the 15-year-old cv. Sardar orchard (L-49). Cuttings from the terminal portion of this season's growth, measuring around 15-20 cm in length and containing two to three buds, were taken with a pencil size thickness. The lower section quickly takes into 1.1% Carbedizim solution to avoid fungal an infestation.

Preparation solutions of growth regulators

IBA was dissolved into separate solutions of 2 g and 4 g in a little amount of acetone in a beaker to create concentrations of 2000 and 4000 ppm. Thereafter, distilled water was added to create a volume of up to 1000 ml.

The necessary concentration was made by dissolving 2 and 4 ml of paclobutrazol (cultural) in 1000 ml of distilled water to get the 200 ppm and 400 ppm concentrations.

Keradix powder is the herbal extract available in powder form. It is used by nurserymen for enhancing rooting of cuttings of different plants. (Bhusari *et al.*, 2023) [3]

Experimental details

The research studies were set up using a Factorial Randomized Block Design (FRBD) and were replicated three times. The study consisted of 35 treatments total, which were combinations of various growth regulators (Factor A) and rooting media (Factor B). There were fifty plants in each treatment.

Growth regulators and growth media used

I. Factor-A

Sr. No.	PGR	Concentration
1	IBA	2000 ppm
2	IBA	4000 ppm
3	Paclobutrazol	200 ppm
4	Paclobutrazol	400 ppm
5	Keradix	-

II. Factor B

Sr. No.	Types of Media	Proportion
1	Soil	Sole
2	Cocopeat	Sole
3	Soil + Cocopeat	1:1
4	Soil + Perlite	1:1
5	Soil + Peat-moss	1:1
6	Soil + Potting Mixture	1:1
7	Soil + Vermicompost	1:1

Result and Discussion

Days required for rooting.

The perusal of data depicted in Table 1. Significant variation was observed in time taken to root initiation in cuttings. Least days of 19.07 was noted in the treatment M₆ (Soil + potting mixture). This treatment i.e. M₆ (Soil + potting mixture) was on par with the treatments M₇ (Soil + Vermicompost), M₁ (Soil -Sole) which required 19.56 days, 19.67 days, respectively for rooting of soft wood cuttings of guava. Longest period (27.89 days) for rooting were registered in the treatment M₃ (Soil + Coco peat). In the present study the maximum percentage of rooting which might be perhaps due to the release of phenolic compounds from the coir pith (Lokesha *et al.*, 1988) [17] and also can be attributed to the beneficial physical characteristics of coir pith (Smith, 1995) [26] like aeration and water holding capacity.

Percent success at 30 Days (%)

As per the data represented in Table 1. At 30 DAP, significantly highest success of 58.63 percent was registered in the treatment M₄ (Soil + Perlite-1:1). This was followed by the treatment M₅ (Soil + Peat moss-1:1) recording 42.77 percent success at 30 DAP. On the other side treatment M₇ recorded lowest rooting percentage (20.17%) at 30 days after planting. Sohnika *et al.* (2015) [27] emphasised importance of rooting media and observed highest success in vermiculite + sand + FYM (1:1:1) during which was at par with (77.02%) in vermiculite + sand (1:1) and (76.01%) in perlite + sand + FYM (1:1:1). Similar observations were also made by Abdul *et al.*, (2013) [1] in guava.

Numbers of leaves (30, 60, 90, 120 Days)

Obvious influence growing media on number of leaves per cutting as evident from the (Table 2). The treatment M₄ (Soil + Perlite-1:1) recorded significantly the highest number of leaves at 30, 60, 90 and 120 DAP and exhibited linear increase in number of leaves. This treatment produced 2.74, 7.29, 12.47 and 20.62 leaves at 30, 60, 90 and 120 DAP, respectively. The treatment M₇ (Soil + Vermi-compost-1:1) was found to be poor and recorded 0.68, 0.77, 0.85 and 0.26 number of leaves at 30, 60, 90 and 120 DAP. At 120 days there decrease in number of leaves because of high phenolic

compound present in cuttings. (Arafat *et al.* 2020) ^[2] Dhatrikarani *et al.* (2019) ^[6] also observed significant influence of rooting media on number leaves in guava in guava cv. Tainwan Pink.

Numbers of shoots (30, 60, 90, 120 Days)

Types of rooting media had significant influence on number of shoots per cutting 30, 60, 90, 120 days. As data represented in table 3, the rooting medium treatment M₄ (Soil + Perlite-1:1) exhibited superior performance that it recorded significantly the highest number of shoots at all growth stages of observations i.e. at 30, 60, 90 and 120 days which respectively recorded 0.89, 0.99, 1.53 and 2.42 shoots and linear increase in numbers of shoots with advancement of age of cutting. Sardoei (2014) ^[22] also reported significant effect of rooting media shoot number and he obtained maximum number of shoot in soil loam and perlite medium. However, relatively poor root formation recorded during extremely hot and cold conditions was due to low activity of cambium to proliferate in unfavorable and adverse environmental conditions (Goel and Behl, 1994) ^[9].

Number of Primary roots

Different rooting media had a significant impact on the number of primary roots. Perusal of data in table 4. showed at 120 DAP, soft wood cuttings planted in the treatment M₄ (Soil + Perlite-1:1) produced significantly highest number of primary roots per cutting (2.73), followed by M₅ (Soil + Peat-moss-1:1) which had 1.25 primary roots per cutting and the least number of primary roots was recorded in the rooting media Soil + Vermi-compost-1:1 (M₇) which had 0.22 number of primary roots per cutting. Results are in similar line with Sohnika *et al.* (2015) ^[27] they obtained good results with Vermiculite + Sand+ FYM (1:1:1). No rooting in the cuttings treated with Keradix indicating that it is not useful in the guava propagation.

Number of secondary roots

In case of rooting media (Table 4.), treatment M₄ (Soil + Perlite-1:1) registered significantly highest number of secondary roots i.e. 5.48 roots, whereas on the other hand treatment M₇ (Soil + Vermi-compost-1:1) recorded least number of secondary roots (0.30). Sohnika *et al.* (2015) ^[27] who observed significant impact of rooting media on number of secondary roots reported significant results with Vermiculite + Sand+ FYM (1:1:1) followed by Perlite + Sand+ FYM (1:1:1).

Length of roots (cm)

The significant influence of rooting media was clearly

noticed table 4. and the significantly the highest length of roots was observed in the soft wood cuttings of guava placed in the treatment M₄ (Soil + Perlite in 1:1) which recorded 3.34 cm length of root at 120 DAP. The treatments M₇ (Soil + Vermi-compost-1:1) had very poor performance recording 0.24 cm length of root. Results are in similar line with Sohnika *et al.* (2015) ^[27]

Fresh weight of roots (g)

Positive impact of rooting media on fresh weight of roots was noticed in Table 5. with respect to the treatment M₄ (Soil + Perlite-1:1 medium) exhibited significantly the highest fresh weight of roots (2.97 g) and followed by the M₅ (Soil + Peat-moss-1:1) which recorded (1.33 g) fresh weight of roots. The lowest fresh weight of roots was observed in the treatments M₇ (Soil + Vermi-compost-1:1) which recorded 0.25 g fresh weight of roots. Results are almost similar to the results of Sardoei (2014) ^[22] who found highest fresh and dry weight of roots in Perlite + Sand. Sohnika *et al.* (2015) ^[27] also reported Perlite+ Sand+ FYM as best media for guava cuttings.

Dry weight of roots (g)

Considerable influence of rooting media on dry weight of roots was observed in (table.5). Results showed that guava soft wood cuttings placed in the M₄ (Soil + Perlite-1:1) recorded the significantly the highest dry weight of roots (0.66 g) at 120 DAP. On the other hand M₆ (Soil + potting mixture 1:1) recorded lowest dry weight of softwood cuttings 0.12 g.

Results are in similar lines with those of Sardoei (2014) ^[22] who found highest fresh and dry weight of roots in Perlite + Sand. Qadri *et al.* (2018) ^[21] obtained maximum weight of dry roots in top soil rooting media in soft wood cuttings of guava.

Survival percentage (%)

Growing media treatments significantly influenced survival percentage of soft wood cuttings of guava showed in Table 5. Results represented that the highest survival of 35.36% was observed in the treatment M₄ (Soil + Perlite-1:1) followed by those planted in the treatment M₅ (Soil + Peat-moss-1:1) which was 22.03 percent, Whereas the treatment M₇ (Soil + Vermi-compost-1:1) recorded the lowest softwood cutting survival rate 3.77 percent. Significant effect of media on survival percentage of guava cutting might be due to porosity, aeration and less water holding capacity which helps to produce more number of adventitious roots and thereby increase the survival percentage

Table 1: Effect of various rooting media on days required for rooting of guava and percent success at 30 days (%) softwood cuttings.

Sr. No.	Media (M)	Media (M) with Proportion	Days required for rooting	Percent success at 30 days (%)
1	M ₁	Soil -Sole	19.67	38.72
2	M ₂	Cocopeat-Sole	19.74	24.48
3	M ₃	Soil + Cocopeat-1:1	27.89	26.81
4	M ₄	Soil + Perlite-1:1	24.29	58.63
5	M ₅	Soil + Peat-moss-1:1	26.31	42.77
6	M ₆	Soil + Potting Mixture-1:1	19.07	23.62
7	M ₇	Soil + Vermi-compost-1:1	19.56	20.17
	SEm±		0.70	1.13
	CD at 5%		1.98	3.23

Table 2: Effect of various growth media on number of leaves of guava soft wood Cuttings.

Sr. No.	Media (M)	Media (M) with Proportion	Average number of leaves			
			30 DAP	60 DAP	90 DAP	120 DAP
1	M ₁	Soil -Sole	1.71	3.68	5.69	7.10
2	M ₂	Cocopeat-Sole	0.86	2.53	4.80	4.12
3	M ₃	Soil + Cocopeat-1:1	1.61	2.81	4.96	4.61
4	M ₄	Soil + Perlite-1:1	2.74	7.29	12.47	20.62
5	M ₅	Soil + Peat-moss-1:1	1.77	4.83	9.06	7.52
6	M ₆	Soil + Potting Mixture-1:1	0.68	1.16	2.45	0.89
7	M ₇	Soil + Vermi-compost-1:1	0.68	0.77	0.85	0.26
	SEm±		0.08	0.19	0.28	0.70
	CD at 5%		0.24	0.53	0.80	2.01

Table 3: Effect of various rooting media on number of shoots of guava soft wood Cuttings

Sr. No.	Media (M)	Media (M) with Proportion	Average number of Shoots			
			30 DAP	60 DAP	90 DAP	120 DAP
1	M ₁	Soil -Sole	0.69	0.74	0.98	1.18
2	M ₂	Cocopeat-Sole	0.64	0.88	1.01	0.74
3	M ₃	Soil + Cocopeat-1:1	0.73	0.75	1.03	0.87
4	M ₄	Soil + Perlite-1:1	0.89	0.99	1.53	2.42
5	M ₅	Soil + Peat-moss-1:1	0.72	0.75	1.10	1.18
6	M ₆	Soil + Potting Mixture-1:1	0.47	0.55	0.75	0.43
7	M ₇	Soil + Vermi-compost-1:1	0.40	0.45	0.30	0.04
	SEm±		0.04	0.03	0.05	0.06
	CD at 5%		0.11	0.10	0.14	0.16

Table 4: Effect of various rooting media on number of Primary roots, number of Secondary roots, Length of roots (cm), of guava softwood cuttings.

Sr. No.	Media (M)	Media (M) with Proportion	No. of Primary roots	No. of Secondary roots	Length of roots (cm)
1	M ₁	Soil -Sole	0.69	1.36	1.25
2	M ₂	Cocopeat-Sole	0.76	1.40	1.31
3	M ₃	Soil + Cocopeat-1:1	0.83	1.70	1.10
4	M ₄	Soil + Perlite-1:1	2.73	5.48	3.34
5	M ₅	Soil + Peat-moss-1:1	1.25	2.33	1.44
6	M ₆	Soil + Potting Mixture-1:1	0.33	0.69	0.44
7	M ₇	Soil + Vermi-compost-1:1	0.22	0.30	0.24
	SE m±		0.06	0.11	0.12
	CD at 5%		0.17	0.31	0.36

Table 5: Effect of various growing media on Fresh weight of roots (g), Dry weight of roots (g), Survival Percentage (%) of guava softwood cuttings.

Sr. No.	Media (M)	Media (M) with Proportion	Fresh weight of roots (g)	Dry weight of roots (g)	Survival Percentage
1	M ₁	Soil -Sole	0.84	0.16	15.97
2	M ₂	Cocopeat-Sole	0.83	0.15	15.75
3	M ₃	Soil + Cocopeat-1:1	0.99	0.22	14.14
4	M ₄	Soil + Perlite-1:1	2.97	0.66	35.36
5	M ₅	Soil + Peat-moss-1:1	1.33	0.30	22.03
6	M ₆	Soil + Potting Mixture-1:1	0.44	0.12	5.61
7	M ₇	Soil + Vermi-compost-1:1	0.25	0.15	3.77
	SE m±		0.08	0.04	1.03
	CD at 5%		0.24	0.11	2.97

Conclusion

The combination of rooting media M₄ (Soil + Perlite (1:1)) was found superior for all the characters i.e. maximum rooting, number of leaves and shoots, number of primary and secondary roots, length of roots, fresh and dry weight of roots and survival of the soft wood cutting guava cv. Sardar except percent success at 30 DAP in which M₆ (soil + potting mixture 1:1) showed superior results.

The results clearly indicates in guava that, where rooting is difficult, use of growing media is more important. Cuttings are also helpful in obtaining desired amount of vigorous plants in a shorter period of time.

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