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STANDARDIZATION OF ROOTING MEDIA AND PGR LEVELS FOR SUCCESSFUL SOFTWOOD CUTTING PROPAGATION IN GUAVA (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 interaction between rooting media and growth regulators were complementary the interaction treatment T_{17} (Soil+ Perlite + IBA-4000 ppm) was found to be ideal as it recorded promising performance for the characters studied except the characters days required to rooting and length of root. It recorded maximum values for success percentage (83.13 %), 23.34 leaves per cutting at 120 DAP, number of shoots at 120 DAP (3.87), number of primary roots per cutting (4.30), number of secondary roots (8.34), highest fresh weight of roots (4.3 g), highest dry weight of roots (0.97 g) and highest survival percentage (54.63 %). The results revealed importance of IBA at 4000 ppm concentration along with root media Soil+ Perlite (1:1) for better leaf, shoot and root characters and also survival of the soft wood cuttings in guava.

Key word: IBA, Plant growth regulator, Rooting media, Perlite

Introduction

Guava (*Psidium guajava* L.) is a dicotyledonous evergreen plant and belongs to the family Myrtaceae. It is native to Central America. Guava though common but important commercial fruit crop of India which is famous as 'Poor man's apple and 'Apple of the tropics'. Because of its richness in ascorbic acid content. In fact it is the cheap source of ascorbic acid as it contains 228.3 mg ascorbic acid/100 g edible portion (Rahman *et al*., 2004) which is 3-5 times more as compared to oranges. It is a good source of Pectin and mineral namely Calcium and Phosphorus. Guava also used as a traditionally medicinal plant for treatment of diarrhea, gastroenteritis and analgesic properties.

It has a great market potential due to its delicious taste, aroma, sweet flavor and a fine balance of acid, sugar and pectin. Besides its high nutritive value, it is hardy, heavy bearer and gives good returns (Singh *et al.* 2000). Even it thrives well in saline and poorly drained soil also. It is commercially important fruit crop of India and is 4th important fruit crop after mango, banana and citrus. It is prolific bearer and highly remunerative crop. Because of such versatility, area under guava is expanding. As such, the demand for quality planting is increasing rapidly. Guava is propagated by both sexually (Zamir *et al*., 2003) through seed and asexually methods like budding, grafting, layering and cutting (Chandra *et al*., 2004). 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. Clonal propagation of guava is the possible approach to ascertain uniformity among the progeny and to maintain good quality fruits (Giri *et al.*, 2004).

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). 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). However, assessing the potential of these methods under particular climatic conditions is very essential.

Unlike other fruit crops, rooting in guava is difficult resulting in poor multiplication rate. 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 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 Singh, 2018). However, these problems can be overcome by use of growth regulators such as auxins (Ljung 2013) 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) as well as for developing stock plants. Rooting medium directly affects quality and percentage of rooting (Loach *et al.*, 1988). 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). A use of good rooting media with rooting hormone will increase root induction (Leonardi *et al.*, 2001). Therefore, a research project was envisaged at Agriculture college, Dhule with the view: To find out the best interaction of media and growth regulator for maximum root initiation and survival percentage.

Materials and Methods

The present investigation, entitled "Studies on propagation of guava through cutting." var. Sardar (L-49) was conducted under shade net condition during September 2021 to January 2022, at Research cum Demonstration Farm, Department of Horticulture, college of Agriculture, Dhule, Maharashtra. Field is situated at 20.9 North latitude and 74.78 East longitude with an altitude of 250 m. Dhule lies in the North Maharashtra region, which form the Deccan Plateau. The climate of the district is warm and dry except during the south-west monsoon season.

Preparation of Cuttings

Soft wood cuttings of guava was taken from the 15 years old orchard of cv. Sardar (L-49) About 15-20 cm long cuttings with pencil size thickness and having 2 to 3 buds were taken from terminal portion of current seasons growth.

Preparation solutions of growth regulators

To prepare 2000 and 4000 ppm concentrations of IBA were prepared by dissolving 2 g and 4 g IBA separately in a small amount of acetone in beaker. Then volume up to 1000 ml was made by adding distilled water.

To prepare 200 ppm and 400 ppm concentrations, 2 ml and 4 ml of paclobutrazol (cultar) were dissolved in 1000 ml distilled water to make the required concentration.

Keradix powder is the herbal extract available in powder form. It is manufactured by West Coat Rasayan international Pvt. Ltd, Khed, Dist. Ratnagiri used by nurserymen for enhancing rooting of cuttings of different plants.

Experimental details

The experiments were laid out in Factorial Randomized Block Design (FRBD) consisting of 35 treatments which are combinations of different growth regulators (Factor A) and rooting media (Factor B) and were replicated three times. Each treatment comprised of 50 plants.

Result And Discussion

Days required for rooting.

Substantial effects of interaction between rooting media and growth regulators on days required for rooting were observed in Table 1. Among the various treatment combinations, the treatment T_{19} (Soil + Perlite + Paclobutrazol-400 ppm) showed that this treatment required least days *i.e*. 29.23 days for rooting in softwood cutting. On the other side, late rooting of cutting recorded in the treatment T_{13} (Soil + Coco-peat + Paclobutrazol-200 ppm) which required 35.77 days for rooting. The combination of Soil, Perlite and Paclobutrazol-400 ppm (T_{19}) might have created suitable physical situations, including the availability of adequate moisture essential for initiation of enzymatic and biochemical processes by

Table 1: Interaction effect of rooting media and growth regulator on days required for rooting and per cent success of guava soft-wood cuttings at 30 Days.

Tr. No.	Interactions (M×G)	Treatment Combinations	Days required for rooting	Per cent success at 30 days (%)
1	M_1G_1	Soil + IBA-2000 ppm	34.33	70.87
2	M_1G_2	Soil + IBA-4000 ppm	32.67	64.43
3	M_1G_3	Soil + Paclobutrazol-200 ppm	0.00	0.00
4	M_1G_4	Soil + Paclobutrazol-400 ppm	31.37	58.31
5	M_1G_5	Soil + Keradix	0.00	0.00
6	M_2G_1	Coco-peat + IBA-2000 ppm	0.00	0.00
7	M_2G_2	Coco-peat +IBA-4000 ppm	34.47	45.3
8	M_2G_3	Coco-peat +Paclobutrazol-200 ppm	31.9	38.7
9	M_2G_4	Coco-peat +Paclobutrazol-400 ppm	32.33	38.4
10	M_2G_5	Coco-peat +Keradix	0.00	0.00
11	M_3G_1	Soil + Coco-peat + IBA-2000 ppm	35.0	35.73
12	M_3G_2	Soil + Coco-peat + IBA-4000 ppm	33.17	39.1
13	M_3G_3	Soil + Coco-peat + Paclobutrazol-200 ppm	35.77	25.67
14	M_3G_4	Soil + Coco-peat + Paclobutrazol-400 ppm	35.5	33.53
15	M_3G_5	Soil + Coco-peat + Keradix	0.00	0.00
16	M_4G_1	Soil + Perlite +IBA-2000 ppm	30.6	76.07
17	M_4G_2	Soil + Perlite +IBA-4000 ppm	29.57	83.13
18	M_4G_3	Soil + Perlite +Paclobutrazol-200 ppm	32.07	64.47
19	M_4G_4	Soil + Perlite + Paclobutrazol-400 ppm	29.23	69.5
20	M_4G_5	Soil + Perlite + Keradix	0.00	0.00
21	M_5G_1	Soil + Peat-moss + IBA-2000 ppm	33.83	55.2
22	M_5G_2	Soil + Peat-moss + IBA-4000 ppm	31.50	59.33
23	M_5G_3	Soil + Peat-moss + Paclobutrazol-200 ppm	33.10	48.17
24	M_5G_4	Soil + Peat-moss + Paclobutrazol-400 ppm	33.13	50.97
25	M_5G_5	Soil + Peat-moss + Keradix	0.00	0.00
26	M_6G_1	Soil + Potting mixture + IBA-2000 ppm	32.04	49.17
27	M_6G_2	Soil + Potting mixture + IBA-4000 ppm	31.29	40.37
28	M_6G_3	Soil + Potting mixture + Paclobutrazol-200 ppm	0.00	0.00
29	M_6G_4	Soil + Potting mixture + Paclobutrazol-400 ppm	32.0	28.57
30	M_6G_5	Soil + Potting mixture + Keradix	0.00	0.00
31	M_7G_1	Soil + Vermi-compost + IBA-2000 ppm	32.83	33.87
32	M_7G_2	Soil + Vermi-compost + IBA-4000 ppm	34.42	36.6
33	M_7G_3	Soil + Vermi-compost + Paclobutrazol-200 ppm	0.00	0.00
34	M_7G_4	Soil + Vermi-compost + Paclobutrazol-400 ppm	30.53	30.4
35	M_7G_5	Soil + Vermi-compost + Keradix	0.00	0.00
	SEm±		**1.21**	**1.96**
	CD at 5%		**3.43**	**5.59**

rooting media and inhibition of gibberellin synthesis by Paclobutrazole which would have brought about certain anatomical and physiological changes in the cuttings leading to early root initiation (Bhusari *et al.,* 2023).

Per cent success at 30 Days (%)

Data on the per cent success on 30 days of soft-wood cutting affected by interactions of various growing media and plant growth regulator is shows in Table 1. Interaction of growing media and plant growth regulator had significant effect on per cent success of cuttings at 30 days. Significantly the highest success at 30 days recorded in the treatments T_{17} (Soil + Perlite +IBA-4000 ppm) which was 83.13 per cent. The next best treatments were T_{16} (Soil + Perlite +IBA-2000 ppm) and T_1 (Soil + IBA-2000 ppm) which recorded 76.07 and 70. 87 per cent success, respectively. Highest significant per cent success in T_{17} (Soil + Perlite +IBA-4000 ppm) might be due to higher concentration of IBA. The results are in close agreement with Kareem *et al.,* 2016 who obtained maximum success at 4000 ppm IBA concentration. Because of favorable biological and physico-chemical

Table 2: Interaction effect of rooting media and growth regulator on number of leaves of guava Softwood cuttings.

Tr. No.	Interactions (M×G)	Treatment Combinations	Average number of Shoots			
			30 DAP	60 DAP	90 DAP	120 DAP
1	M_1G_1	Soil + IBA-2000 ppm	2.23	6.2	10.13	16.4
2	M_1G_2	Soil + IBA-4000 ppm	3.3	7.2	12.3	19.1
3	M_1G_3	Soil + Paclobutrazol-200 ppm	0.00	0.00	0.00	0.00
4	M_1G_4	Soil + Paclobutrazol-400 ppm	3	5	6	0.00
5	M_1G_5	Soil + Keradix	0.00	0.00	0.00	0.00
6	M_2G_1	Coco-peat + IBA-2000 ppm	0.00	2.03	6.23	0.00
7	M_2G_2	Coco-peat +IBA-4000 ppm	1.0	3.63	6.93	13.53
8	M_2G_3	Coco-peat +Paclobutrazol-200 ppm	1.9	4.0	4.83	0.00
9	M_2G_4	Coco-peat +Paclobutrazol-400 ppm	1.4	2.96	6	7.07
10	M_2G_5	Coco-peat +Keradix	0.00	0.00	0.00	0.00
11	M_3G_1	Soil + Coco-peat + IBA-2000 ppm	2	4.2	8.27	10.93
12	M_3G_2	Soil + Coco-peat + IBA-4000 ppm	2.6	3.9	8	12.1
13	M_3G_3	Soil + Coco-peat + Paclobutrazol-200 ppm	1.2	3	0.30	0.00
14	M_3G_4	Soil + Coco-peat + Paclobutrazol-400 ppm	2.23	2.96	8.23	0.00
15	M_3G_5	Soil + Coco-peat + Keradix	0.00	0.00	0.00	0.00
16	M_4G_1	Soil + Perlite +IBA-2000 ppm	4.4	9.93	15.2	21.11
17	M_4G_2	Soil + Perlite +IBA-4000 ppm	3.9	8.8	17.67	23.34
18	M_4G_3	Soil + Perlite +Paclobutrazol-200 ppm	2.2	8.4	13.33	18.5
19	M_4G_4	Soil + Perlite + Paclobutrazol-400pm	3.2	9.3	16.17	19.54
20	M_4G_5	Soil + Perlite + Keradix	0.00	0.00	0.00	0.00
21	M_5G_1	Soil + Peat-moss + IBA-2000 ppm	2.46	6.23	11.43	8.1
22	M_5G_2	Soil + Peat-moss + IBA-4000 ppm	3.03	7.5	10.23	15.93
23	M_5G_3	Soil + Peat-moss + Paclobutrazol-200 ppm	1.63	4.2	9.4	0.00
24	M_5G_4	Soil + Peat-moss + Paclobutrazol-400 ppm	1.7	6.23	14.23	13.55
25	M_5G_5	Soil + Peat-moss + Keradix	0.00	0.00	0.00	0.00
26	M_6G_1	Soil + Potting mixture + IBA-2000ppm	1.3	2.9	2.3	0.00
27	M_6G_2	Soil + Potting mixture + IBA-4000ppm	1.2	2	9.03	4.43
28	M_6G_3	Soil + Potting mixture + Paclobutrazol-200 ppm	0.00	0.00	0.00	0.00
29	M_6G_4	Soil + Potting mixture + Paclobutrazol-400 ppm	0.9	0.9	0.9	0.00
30	M_6G_5	Soil + Potting mixture + Keradix	0.00	0.00	0.00	0.00
31	M_7G_1	Soil + Vermi-compost + IBA-2000 ppm	1.5	2.03	1.47	0.00
32	M_7G_2	Soil + Vermi-compost + IBA-4000 ppm	1.5	1.6	1.97	0.00
33	M_7G_3	Soil + Vermi-compost + Paclobutrazol-200 ppm	0.00	0.00	0.00	0.00
34	M_7G_4	Soil + Vermi-compost + Paclobutrazol-400 ppm	0.4	0.2	0.83	1.3
35	M_7G_5	Soil + Vermi-compost + Keradix	0.00	0.00	0.00	0.00
	SE ±		**0.15**	**0.32**	**0.49**	**0.98**
	CD at 5%		**0.42**	**0.92**	**1.39**	**2.85**

characteristics of combination of soil and perlite (rooting medium) would have resulted in better rooting. Secondly, good cell division and callusing (Hartmann *et al.*, 2002) which are associated with potential rooting.

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

There existed a significant interaction between rooting media and growth regulator treatments for the number of leaves per cutting (Table 2). At 30 DAP, the treatment combination T_{16} (Soil + Perlite +IBA-2000 ppm) had significantly highest leaves (4.4) followed by T_{17} (Soil + Perlite +IBA-4000 ppm) which had 3.9 leaves. The same trend was observed at 60 DAP also where T_{16} recorded 9.93 leaves which was significantly highest than all other treatments followed by T_{17} which recorded 8.8 leaves. However, at 90 days and 120 DAP, the treatment T_{17} excelled the treatment T_{16} which recorded 17.67 and 23.34 leaves per cutting which was significantly highest than other treatments. The maximum number of leaves per cutting produced in soft wood cuttings of guava cuttings planted in Soil + Perlite rooting medium might be due to better root development in this medium. It could be in turn attributed to the appropriate retention capacity,

Table 3: Interaction of effect of rooting media and plant growth regulators on number of Shoots of guava softwood cuttings.

Tr. No.	Interactions (M×G)	Treatment Combinations	Average number of Shoots			
			30 DAP	60 DAP	90 DAP	120 DAP
1	M_1G_1	Soil + IBA-2000 ppm	1.4	1.4	2	2.93
2	M_1G_2	Soil + IBA-4000 ppm	1.1	1.2	1.6	2.97
3	M_1G_3	Soil + Paclobutrazol-200 ppm	0.00	0.00	0.00	0.00
4	M_1G_4	Soil + Paclobutrazol-400 ppm	0.97	1.1	1.3	0.00
5	M_1G_5	Soil + Keradix	0.00	0.00	0.00	0.00
6	M_2G_1	Coco-peat + IBA-2000 ppm	0.00	1	1.2	0.00
7	M_2G_2	Coco-peat +IBA-4000 ppm	0.8	0.93	1.4	2
8	M_2G_3	Coco-peat +Paclobutrazol-200 ppm	1	1.3	0.9	0.00
9	M_2G_4	Coco-peat +Paclobutrazol-400 ppm	1.4	1.17	1.4	1.7
10	M_2G_5	Coco-peat +Keradix	0.00	0.00	0.00	0.00
11	M_3G_1	Soil + Coco-peat + IBA-2000 ppm	1	1	1.43	2.17
12	M_3G_2	Soil + Coco-peat + IBA-4000 ppm	1.2	1.07	1.4	2.17
13	M_3G_3	Soil + Coco-peat + Paclobutrazol-200 ppm	0.6	0.7	0.9	0.00
14	M_3G_4	Soil + Coco-peat + Paclobutrazol-400 ppm	0.83	1	1.4	0.00
15	M_3G_5	Soil + Coco-peat + Keradix	0.00	0.00	0.00	0.00
16	M_4G_1	Soil + Perlite +IBA-2000 ppm	1.4	1.42	2.1	3.3
17	M_4G_2	Soil + Perlite +IBA-4000 ppm	1.17	1.5	2.37	3.87
18	M_4G_3	Soil + Perlite +Paclobutrazol-200 ppm	1	1.07	1.6	2.24
19	M_4G_4	Soil + Perlite + Paclobutrazol-400pm	0.9	0.98	1.57	2.7
20	M_4G_5	Soil + Perlite + Keradix	0.00	0.00	0.00	0.00
21	M_5G_1	Soil + Peat-moss + IBA-2000 ppm	1	1	1.53	2.03
22	M_5G_2	Soil + Peat-moss + IBA-4000 ppm	1.1	1.1	1.87	1.9
23	M_5G_3	Soil + Peat-moss + Paclobutrazol-200 ppm	0.7	0.83	1.1	0.00
24	M_5G_4	Soil + Peat-moss + Paclobutrazol-400 ppm	0.8	0.83	1	1.97
25	M_5G_5	Soil + Peat-moss + Keradix	0.00	0.00	0.00	0.00
26	M_6G_1	Soil + Potting mixture + IBA-2000ppm	0.7	0.8	0.8	0.00
27	M_6G_2	Soil + Potting mixture + IBA-4000ppm	0.8	1	1.87	2.17
28	M_6G_3	Soil + Potting mixture + Paclobutrazol-200 ppm	0.00	0.00	0.00	0.00
29	M_6G_4	Soil + Potting mixture + Paclobutrazol-400 ppm	0.87	0.93	1.07	0.00
30	M_6G_5	Soil + Potting mixture + Keradix	0.00	0.00	0.00	0.00
31	M_7G_1	Soil + Vermi-compost + IBA-2000 ppm	0.7	0.8	0.63	0.00
32	M_7G_2	Soil + Vermi-compost + IBA-4000 ppm	0.8	0.8	0.73	0.00
33	M_7G_3	Soil + Vermi-compost + Paclobutrazol-200 ppm	0.00	0.00	0.00	0.00
34	M_7G_4	Soil + Vermi-compost + Paclobutrazol-400 ppm	0.5	0.63	0.15	0.22
35	M_7G_5	Soil + Vermi-compost + Keradix	0.00	0.00	0.00	0.00
	SE ±		**0.07**	**0.06**	**0.09**	**0.08**
	CD at 5%		**0.19**	**0.17**	**0.25**	**0.23**

porosity and nutrient status of this combination as proven by Nagarajan *et al.*, (1985) and Dhatrikarani (2019) in guava and better development of roots would supply more nutrients from the media as suggested by Ullah *et al.*, (2005) in guava

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

As illustrated in the Table 3, the treatment T_{17} (Soil + Perlite +IBA-4000 ppm) produced significantly the highest number of shoots at all growth stages of observations *i.e.* at 30, 60, 90 ad 120 days which respectively registered 1.17, 1.5, 2.37 and 3.87 shoots. Interaction also exhibited linear increase in number of shoots was observed with the advancement of age of the cutting. Sardoei (2014) also reported significant effect of rooting media shoot number and he obtained maximum number of shoot in soil loam and perlite medium.

Number of Primary roots

Combination of different rooting media and growth regulator had a significant impact on the number of primary roots, presented in Table 4. the interaction effect revealed significant variation and significantly the highest numbers of primary roots were recorded in the treatment

Table 4: Interaction effect of rooting media and plant growth regulator on number of Primary, Secondary roots and length of roots guava softwood cuttings.

Tr. No.	Interactions (M×G)	Treatment Combinations	Numbr of Primary roots	Number of Secondary roots	Length of roots (cm)
1	M_1G_1	Soil + IBA-2000 ppm	1.4	2.87	3.2
2	M_1G_2	Soil + IBA-4000 ppm	2.03	3.93	3.03
3	M_1G_3	Soil + Paclobutrazol-200 ppm	0.00	0.00	0.00
4	M_1G_4	Soil + Paclobutrazol-400 ppm	0.00	0.00	0.00
5	M_1G_5	Soil + Keradix	0.00	0.00	0.00
6	M_2G_1	Coco-peat + IBA-2000 ppm	0.00	0.00	0.00
7	M_2G_2	Coco-peat +IBA-4000 ppm	1.9	3.83	3.13
8	M_2G_3	Coco-peat +Paclobutrazol-200 ppm	0.00	0.00	0.00
9	M_2G_4	Coco-peat +Paclobutrazol-400 ppm	1.9	3.17	3.4
10	M_2G_5	Coco-peat +Keradix	0.00	0.00	0.00
11	M_3G_1	Soil + Coco-peat + IBA-2000 ppm	2.12	4.43	2.6
12	M_3G_2	Soil + Coco-peat + IBA-4000 ppm	2.04	4.07	2.9
13	M_3G_3	Soil + Coco-peat + Paclobutrazol-200 ppm	0.00	0.00	0.00
14	M_3G_4	Soil + Coco-peat + Paclobutrazol-400 ppm	0.00	0.00	0.00
15	M_3G_5	Soil + Coco-peat + Keradix	0.00	0.00	0.00
16	M_4G_1	Soil + Perlite +IBA-2000 ppm	3.97	8.03	3.9
17	M_4G_2	Soil + Perlite +IBA-4000 ppm	4.30	8.34	4.6
18	M_4G_3	Soil + Perlite +Paclobutrazol-200 ppm	2.57	5.07	3.1
19	M_4G_4	Soil + Perlite + Paclobutrazol-400 ppm	2.83	5.97	5.1
20	M_4G_5	Soil + Perlite + Keradix	0.00	0.00	0.00
21	M_5G_1	Soil + Peat-moss + IBA-2000 ppm	2.2	4.2	2.4
22	M_5G_2	Soil + Peat-moss + IBA-4000 ppm	2.27	4.03	2
23	M_5G_3	Soil + Peat-moss + Paclobutrazol-200 ppm	0.00	0.00	0.00
24	M_5G_4	Soil + Peat-moss + Paclobutrazol-400 ppm	1.8	3.43	2.8
25	M_5G_5	Soil + Peat-moss + Keradix	0.00	0.00	0.00
26	M_6G_1	Soil + Potting mixture + IBA-2000 ppm	0.00	0.00	0.00
27	M_6G_2	Soil + Potting mixture + IBA-4000 ppm	1.63	3.47	2.2
28	M_6G_3	Soil + Potting mixture + Paclobutrazol-200 ppm	0.00	0.00	0.00
29	M_6G_4	Soil + Potting mixture + Paclobutrazol-400 ppm	0.00	0.00	0.00
30	M_6G_5	Soil + Potting mixture + Keradix	0.00	0.00	0.00
31	M_7G_1	Soil + Vermi-compost + IBA-2000 ppm	0.00	0.00	0.00
32	M_7G_2	Soil + Vermi-compost + IBA-4000 ppm	0.00	0.00	0.00
33	M_7G_3	Soil + Vermi-compost + Paclobutrazol-200 ppm	0.00	0.00	0.00
34	M_7G_4	Soil + Vermi-compost + Paclobutrazol-400 ppm	1.10	1.50	1.2
35	M_7G_5	Soil + Vermi-compost + Keradix	0.00	0.00	0.00
	SEm±		**0.08**	**0.15**	**0.18**
	CD at 5%		**0.24**	**0.44**	**0.51**

combination Soil + Perlite +IBA-4000 ppm (T_{17}) which recorded 4.3 primary roots which was followed by Soil + Perlite +IBA-2000 ppm (T_{16}) recorded 3.97 roots. Wahab *et al.,* (2001) also recorded maximum number of roots per cutting with 3000 ppm IBA. Hartman *et al.,* (2002) reported that application of IBA is more effective to increase the rooting ability of guava cuttings.

Number of secondary roots

Interaction between rooting media and growth regulators significantly impacted the parameter number of secondary roots. As evident from the Table 4. Significantly the highest secondary roots were produced in the interaction treatment T_{17} (M_4G_2 i.e. Soil + Perlite +IBA-4000 ppm) recorded 8.34 secondary roots which was at par with T_{16} (M_4G_1 i.e. Soil + Perlite +IBA-2000ppm) which recorded 8.03. Better rooting is also due to good cell division and callusing which is associated with potential rooting (Hartman I. 2002).

Length of roots (cm)

Significant influence of interaction between root

Table 5: Interaction effect of rooting media and plant growth regulator on fresh and dry weight of roots and Survival percentage of guava soft-wood cuttings.

Tr. No.	Interactions (M×G)	Treatment Combinations	Fresh weight of roots (g)	Dry weight of roots (g)	Survival Percentage (%)
1	M_1G_1	Soil + IBA-2000 ppm	2.13	0.41	37.6
2	M_1G_2	Soil + IBA-4000 ppm	2.07	0.4	42.27
3	M_1G_3	Soil + Paclobutrazol-200 ppm	0.00	0.00	0.00
4	M_1G_4	Soil + Paclobutrazol-400 ppm	0.00	0.00	0.00
5	M_1G_5	Soil + Keradix	0.00	0.00	0.00
6	M_2G_1	Coco-peat + IBA-2000 ppm	0.00	0.00	0.00
7	M_2G_2	Coco-peat +IBA-4000 ppm	1.8	0.31	41.23
8	M_2G_3	Coco-peat +Paclobutrazol-200 ppm	0.00	0.00	0.00
9	M_2G_4	Coco-peat +Paclobutrazol-400 ppm	2.37	0.43	37.5
10	M_2G_5	Coco-peat +Keradix	0.00	0.00	0.00
11	M_3G_1	Soil + Coco-peat + IBA-2000 ppm	2.03	0.4	33.54
12	M_3G_2	Soil + Coco-peat + IBA-4000 ppm	2.90	0.7	37.17
13	M_3G_3	Soil + Coco-peat + Paclobutrazol-200 ppm	0.00	0.00	0.00
14	M_3G_4	Soil + Coco-peat + Paclobutrazol-400 ppm	0.00	0.00	0.00
15	M_3G_5	Soil + Coco-peat + Keradix	0.00	0.00	0.00
16	M_4G_1	Soil + Perlite +IBA-2000 ppm	3.9	0.93	50.7
17	M_4G_2	Soil + Perlite +IBA-4000 ppm	4.3	0.97	54.63
18	M_4G_3	Soil + Perlite +Paclobutrazol-200 ppm	3.27	0.65	31.67
19	M_4G_4	Soil + Perlite + Paclobutrazol-400 ppm	3.37	0.73	39.8
20	M_4G_5	Soil + Perlite + Keradix	0.00	0.00	0.00
21	M_5G_1	Soil + Peat-moss + IBA-2000 ppm	2.13	0.43	39.83
22	M_5G_2	Soil + Peat-moss + IBA-4000 ppm	1.83	0.38	40.93
23	M_5G_3	Soil + Peat-moss + Paclobutrazol-200 ppm	0.00	0.00	0.00
24	M_5G_4	Soil + Peat-moss + Paclobutrazol-400 ppm	2.67	0.67	29.4
25	M_5G_5	Soil + Peat-moss + Keradix	0.00	0.00	0.00
26	M_6G_1	Soil + Potting mixture + IBA-2000 ppm	0.00	0.00	0.00
27	M_6G_2	Soil + Potting mixture + IBA-4000 ppm	2.2	0.59	28.06
28	M_6G_3	Soil + Potting mixture + Paclobutrazol-200 ppm	0.00	0.00	0.00
29	M_6G_4	Soil + Potting mixture + Paclobutrazol-400 ppm	0.00	0.00	0.00
30	M_6G_5	Soil + Potting mixture + Keradix	0.00	0.00	0.00
31	M_7G_1	Soil + Vermi-compost + IBA-2000 ppm	0.00	0.00	0.00
32	M_7G_2	Soil + Vermi-compost + IBA-4000 ppm	0.00	0.00	0.00
33	M_7G_3	Soil + Vermi-compost + Paclobutrazol-200 ppm	0.00	0.00	0.00
34	M_7G_4	Soil + Vermi-compost + Paclobutrazol-400 ppm	1.27	0.74	18.87
35	M_7G_5	Soil + Vermi-compost + Keradix	0.00	0.00	0.00
	SEm±		**0.12**	**0.05**	**1.45**
	CD at 5%		**0.34**	**0.15**	**4.20**

media and growth regulators were noticed (4.) significantly the highest length of roots was observed in the interaction treatment T_{19} (Soil + Perlite + Paclobutrazol-400 ppm) which recorded 5.1 cm length of root. The treatment T_{17} (Soil + Perlite +IBA-4000 ppm). The results are in harmony with those reported by Haq (1992), Trujillo (2002), Rymbai and Gayathiri and Vijayakuamr (2020). A good rooting medium serves as a nutrient and water reservoir, its porosity and allowing oxygen diffusion to roots and permits gaseous exchange between roots and atmosphere would have resulted in development of roots (Agro, 1998).

Fresh weight of roots (g)

Perusal of data presented in the Table 5, revealed significant impact of interaction between rooting media and growth regulator treatments. The interaction treatment T_{17} (Soil + Perlite + IBA-4000 ppm) registered significantly the highest fresh weight of roots at 120 DAP which was 4.3 g. This treatment was followed by T_{16} (Soil + Perlite + IBA-2000 ppm), T_{18} (Soil + Perlite + Paclobutrazole-200 ppm) and T_{19} (Soil + Perlite +

Paclobutrazole-400 ppm) which recorded 3,9 g, 3.37 g and 3.27 g fresh weight of roots, respectively. Results are in close agreement with Anamika *et al.,* (2022) and Sujin *et al.,* (2020). Jaleta *et al.,* (2019) reported highest fresh and dry weight of roots in Soil+Sand (75:25 v/v) in grapes and similar result incorporated in Bhusari *et al.,* (2025) in guava softwood cutting.

Dry weight of roots (g)

Considerable influence of rooting media and growth regulator on dry weight of roots was observed in Table 5. The interaction treatment T_{17} (Soil + Perlite + IBA-4000 ppm) had significantly the highest fresh weight of roots at 120 DAP which was 0.97 g. This treatment was on par with T_{16} (Soil + Perlite + IBA-2000 ppm) which recorded 0.93 fresh weights of roots, respectively. The application of IBA, favorable conditions provided by rooting media and their harmonizing effect led to abundant induction of roots and better root growth and also production of more number of shoots per cutting and leaves would have increased fresh and dry weight of roots.

Survival percentage (%)

Interaction effect also significantly influenced the survival percentage. Significantly the highest survival of softwood cuttings of guava was observed in the interaction treatment T_{17} (Soil + Perlite +IBA-4000 ppm) which was 54.63 per cent. However, T_{16} (Soil + Perlite +IBA-2000 ppm) which recorded 50.7 per cent was on par with T_{17} (Soil + Perlite +IBA-4000 ppm) which was 54.63 per cent.

This might be because the plant transferred the largest assimilate amounts to the leaf buds which are one of the manufacturing sites of natural auxin and eventually crucial for critical functions such as including photosynthesis and respiration (Wahab *et al.,* 2001). The findings are similar to Kareem *et al.,* (2016), Soni *et al.,* (2016), Rajamanickam *et al.,* (2021), Reddy *et al.,* (2022).

Conclusion

The combination of rooting media Soil + Perlite (1:1) and growth regulator IBA (4000 ppm) was found ideal for improving leaf, shoot, and root characteristics, as well as the survival of softwood cuttings in guava, except for percent success at 30 DAP. These results clearly indicate that in crops like guava, where rooting is difficult the selection of an appropriate rooting medium is as important as the use of growth regulators for achieving better propagation success. The combination of soil and perlite provides an ideal balance of moisture retention, aeration, and nutrient availability, which supports rapid root growth and enhances the establishment of cuttings.

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