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Effect of rooting media and IBA treatments on root production and survival of terminal cuttings in guava (*Psidium guajava*) cv. Taiwan pink under mist house

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Abstract
The effect of Rooting media, Indole-3-Butyric Acid treatments as well as their interactions was found significant on the root and survival percentage parameters in guava terminal cuttings. Among the three different Rooting media i.e., coco peat, vermiculite and saw dust, coco peat registered highest values regarding percentage of rooted cuttings, number of roots per cutting, length of longest root per cutting, fresh weight of roots, dry weight of roots and survival percentage of rooted cuttings of terminal cuttings in guava cv. Taiwan Pink. Among IBA treatments i.e., 250, 500, 750 ppm in solution form for 5 minutes and 1500, 3000, 6000 ppm in powder form, 3000 ppm of IBA performed the best.

Keywords: rooting media, IBA, terminal cuttings, guava

Introduction

Guava (*Psidium guajava* L.), the "Poor man's fruit" or "Apple of the tropics" belongs to tropical and subtropical climate. It is native to the Tropical America stretching from Mexico to Peru. It has attained a respectable place and popularity amongst the dietary list of common people in our country owing to nutritious, deliciousness, pleasing flavour and availability for a longer period of time during the year at moderate price. It has great demand as a table fruit and as a raw material for the processing industries, leads to earn good foreign exchange (Purseglove, 1977) [31].

Guava is propagated commercially by means of both vegetative and direct seedling methods, but the fruits of commercial grade can be obtained only when plants are propagated through vegetative progeny. Vegetative propagation of guava can be done by budding (Gupta and Malhotra, 1985; Kaundal *et al*., 1987) [13, 20], air layering (Manna *et al*., 2004) [25], stooling (Pathak and Saroj, 1988) [30] and inarching (Mukherjee and Majumdar, 1983) [28]. In direct seedling method, progeny are not uniform due to segregation and recombination of different characters. Moreover, the plants propagated through seeds come to bearing much later than the plants propagated through cuttings. Clonal propagation of guava is the possible approach to ascertain uniformity among the progeny and to maintain good quality fruits (Giri *et al*., 2004) [11].

Propagation through air layering in guava is a time consuming and hence necessitated a search for alternate but effective means of vegetative propagation. Of late, several woody perennials are successfully and rapidly propagated through use of terminal cuttings. In this context, rapid methods of propagation become very important when planting material is limited due to scarcity of a clone or varieties or due to sudden expansion in acreage. Thus it leads to an idea about the utilization of terminal cuttings, rapid propagation method in guava.

Material and Methods

An experiment was conducted on the effect of rooting media and IBA treatments on the root and shoot parameters of guava cv. Taiwan Pink at Kadiyaddha village, under the supervision of College of Horticulture, Dr. Y.S.R. Horticultural University, Venkataramannagudem, West Godavari District, Andhra Pradesh. The experiment was laid out in factorial completely randomized design with two factors *viz.*, Rooting media (3 levels) and IBA treatments (6 levels), making eighteen treatment combinations which were replicated twice. Terminal cuttings were planted in protrays consisting of rooting media *viz.*, coco peat, vermiculite and saw dust after treating with IBA at 250, 500, 750 ppm in solution form for 5 minutes and 1500, 3000, 6000 ppm in powder form. The terminal cuttings were kept under mist chamber for 35 days, under shade net for 10 days and after that, the observations on various parameters at 45 DAP were recorded as presented below.

Results and Discussion

Percentage of rooted cuttings (%)

Significant differences were observed among the rooting media, IBA treatments as well as their interactions on percentage of rooted cuttings in terminal cuttings of guava cv. Taiwan Pink at 45 days after planting were presented in Table 1. At 45 DAP the terminal cuttings planted in coco peat were found to record maximum percentage of rooting (73.98%), followed by the vermiculite (70.51%) and minimum percentage of rooting was observed in the terminal cuttings planted in saw dust medium (65.98%).

Among IBA treatments, IBA powder dip @ 3000 ppm performed the best with 79.81 percentage of rooted cuttings and was followed by IBA powder dip @ 6000 ppm (76.19%) while the minimum percentage of rooting (60.13%) was observed with solution dip of IBA @ 750 ppm.

There existed a significant interaction between rooting media and IBA treatments for percentage of rooted cuttings. Significantly highest percentage of rooting (85.19%) was recorded by the terminal cuttings planted in coco peat + dipping in IBA powder @ 3000 ppm (M_1G_5).

Among the three rooting media, terminal cuttings planted in coco peat medium recorded the maximum percentage of rooting which might be perhaps due to the release of phenolic compounds from the coir pith (Lokesha *et al.*, 1988) and also can be attributed to the beneficial physical characteristics of coir pith (Smith, 1995) like aeration and water holding capacity. Presence of leaves on cuttings also could have played an important role in the initiation of roots in many plant species. Leaves considerably influence the rooting of cuttings because of their ability to produce endogenous auxins, carbohydrates by means of photosynthesis (Newton *et al.*, 1992) [29]. Krieken *et al.* (1993) [22] reported that IBA might have enhanced the rooting by increase of internal Auxins, or synergistically modify the action of IAA or due to synthesis of endogenous IAA. Treatment of cuttings with increasing concentrations of IBA coupled with endogenous auxins already present in the cuttings could improve the percentage of rooting in cuttings as reported by Melgarejo *et al*. (2000) [27].

The present results were in harmony with the findings of Mayer *et al*. (2015) [26] who recorded higher percentage of rooted cuttings in 3000 ppm of IBA than in 6000 ppm in softwood cuttings of peach under intermittent mist system. The results are in line with Malik *et al.* (2013) in softwood cuttings of guava. Such observations were also made by Abdul *et al.* (2013) [1] in guava.

According to Habibi, (2010) [14] the increase in auxin concentrations led to increase in oleander plant rooting (*Nerium oleander* L.) up to 3000 ppm of IBA and subsequent increase in IBA was found to decrease in plant rooting. Shadparvar *et al.* (2011) [37] stated that plants should be contained a certain quantity of IBA for successful induction of rooting primordia. The application of IBA might had an indirect influence by enhancing the speed of transformation of rooting primordia and movement of sugars to the base of cuttings and consequently formation of young and active roots.

Number of roots per cutting

It is evident from the results presented in Table 2 had significant differences in the number of roots per cutting by the influence of rooting media, IBA treatments as well as their interactions at 45 DAP, the terminal cuttings planted in the coco peat medium recorded the highest number of roots (23.92) followed by vermiculite (19.49) whereas the least number of roots (16.87) was observed with the saw dust medium. Among the IBA treatments, IBA powder dip @ 3000 ppm performed the best with maximum value (25.85) in respect of number of roots per cutting followed by IBA powder dip @ 6000 ppm concentration (23.32) while the minimum number of roots (14.05) was observed with the treatment of IBA solution dip @ 750 ppm.

There existed a significant interaction between rooting media and IBA treatments for number of roots per cutting. Significantly highest number of roots per cutting (29.57) was observed in coco peat medium + dipping in IBA 3000 ppm.

The terminal cuttings planted in coco peat medium gave the maximum number of roots, which might be due to presence of cytokinins in coco peat that encouraged the induction of adventitious roots (Ellyard and Ollerenshaw, 1984) [10], along with auxin mediated cell division (Davis *et al.*, 1989) [8] resulting in more number of roots. Coco peat has a high water holding capacity which helps in absorption of water and nutrients at higher level (Rubasinghe *et al.*, 2009) [36] from the medium thereby increasing the number of roots. Cuttings treated with IBA powder dip @ 3000 ppm produced more number of roots per cutting which might be due to optimum level of hormonal effect that could accumulate essential internal substances and facilitated their downward movement. Induction of maximum number of roots in IBA treated cuttings might be due to the fact that stimulation of cambial activity involved in root initiation by growth regulators as observed in many species (Ullah *et al*., 2005) [43].

Auxins promote adventitious root formation by their ability to promote the initiation of lateral roots and also enhanced the transport of carbohydrates to basal portion of the cuttings. The maximum number of roots in IBA treated cuttings at 3000 ppm might be due to its effect on cell wall plasticity that could have accelerated cell division stimulating callus development and root growth (Weaver, 1972) [45].

Adventitious root formation is a key step for vegetative propagation comprising *root induction*, in which molecular and biochemical changes occur before any cytological event; *root initiation* that is when first anatomical modifications take place; and *protrusion*, corresponding to the emergence of root primordia (Berthon *et al.*, 1990 and Heloir *et al.*, 1996) [5, 15]. Lateral roots development in *Arabidopsis* provided a model for study of hormonal signals that regulated post embryonic organogenesis in higher plants (Zhang and Forde, 2000) [46]. Lateral roots originated from pairs of pericycle cells, in several cell files positioned opposite the xylem pole, initiated a series of asymmetric, transverse divisions to create 3 to 10 "short" daughter cells (Casimiro *et al.* 2001) [7]. These short daughter cells have undergone radial enlargement and subsequently divided periclinally to give rise to inner and outer cell layers. Further periclinal divisions resulted in formation of lateral root primordia (Bhalerao *et al.*, 2002) [6].

The root formation process on the cuttings is a complicated one which is regulated by many different internal factors like the concentration of endogenous auxins, the rooting cofactors, carbohydrate substances stored in the cuttings as well as nitrogen content, these may interact to influence the rooting percentage, root length and diameter and root weight. The formation of higher number of roots per cutting may be the fact that the cambial activity is involved in root induction (Rahman *et al*., 1991) [32]. Such observations were also made by Wahab *et al.* (2001) in guava, Riaz *et al.* (2007) in hardwood cuttings of kiwi, Ismail and Asghar (2007) [17] in *Ficus hawaii*, Malik *et al.* (2013) and Abdul *et al.* (2013) [1] in guava.

Length of longest root per cutting (cm)

Significant influence of rooting media, IBA treatments as well as their interactions was observed on length of longest root per cutting in guava at 45 DAP, the terminal cuttings planted in coco peat medium were found to show the maximum length of longest root per cutting (8.82 cm) followed by vermiculite (20.73 cm) and the minimum length of longest root (17.78 cm) was observed in saw dust. Among IBA treatments, IBA powder dip @ 3000 ppm was found to record the highest value (27.92 cm) of length of longest root per cutting, followed by (25.45 cm) IBA powder dip @ 6000 ppm while the minimum length of longest root per cutting was recorded by IBA solution at 750 ppm (14.22 cm).

The interaction effect between rooting media and IBA treatments was found significant for the length of longest root per cutting. The longest roots per cutting (31.25 cm) were found in terminal cuttings planted in coco peat + dipping in IBA powder at 3000 ppm (M_1G_5).

The possible reason for the longest root per cutting may be due to amount of food reserves in cuttings (Jain *et al*., 1999). The terminal cuttings planted in coco peat gave maximum length of root which might be due to better texture and porosity of coco peat, as it enabled the downward movement of water and nutrients (Singh *et al.* 2002) and lead to easy penetration of roots (Siddagangaiah *et al.,* 1996) in the medium and also being an well drained one promoting better rooting characters (Singh *et al.,* 2002). Coir has a low particle density indicating its high specific surface that contributes to high adsorption of water and ions by the roots resulting in more root length (Rubasinghe *et al*., 2009) [36]. Maximum root length was observed in the cuttings treated with IBA 3000 ppm which might be perhaps due to an early initiation of roots at higher concentrations of IBA and therefore more utilization of nutrients due to early formation of roots (Ajaykumar, 2007). The action of auxin *i.e.* IBA might cause the hydrolysis and translocation of carbohydrates and nitrogenous substances at the base of cuttings, and resulted in accelerating the processes of cell elongation and cell division (Singh *et al.*, 2003). Similar results were also reported by Mayer *et al.* (2015) [26] who observed maximum dry weight of roots in 3000 ppm of IBA as compared to 6000 ppm in softwood cuttings of peach under intermittent mist system. The results are in line with the findings of Abdul *et al.* (2013) [1] in guava and Ismail and Asghar (2007) [17] in *Ficus hawaii*.

Fresh weight of roots per cutting (g)

Fresh weight of roots varied significantly due to rooting medium, IBA treatments as well as their interactions at 45 DAP in guava were presented in Table 4. The terminal cuttings planted in the coco peat medium had the maximum fresh weight of roots (1.18 g) followed by vermiculite medium (0.89 g) whereas, the minimum fresh weight of roots was observed in the saw dust medium (0.70 g). Dipping in IBA powder @ 3000 ppm strength resulted in the maximum fresh weight of roots (1.26 g) followed by IBA powder dip @ 6000 ppm (1.03 g) while the minimum fresh weight of roots (0.68 g) was registered by the solution dip with IBA @ 750 ppm.

The interaction between rooting media and IBA treatments for fresh weight of roots was tested significant. Maximum fresh weight of roots (1.37 g) was found in the terminal cuttings planted in coco peat + dipping in IBA powder at 3000 ppm (M_1G_5).

The maximum fresh weight of roots was recorded by the terminal cuttings planted in coco peat which might be due to better aeration and drainage conditions and water maintenance capability (Khayyat *et al.,* 2007). IBA 3000 ppm recorded the maximum fresh weight of roots due to production of more number of roots as seen with the result on number of roots in the present study. The results are in line with Wahab *et al*. (2001) in guava and Riaz *et al*. (2007) in kiwi.

Dry weight of roots per cutting (g)

Significant variations were observed in dry weight of roots at 45 by the influence of rooting media, IBA treatments as well as their interactions were presented in Table 5. The cuttings planted in the coco peat medium recorded a higher dry weight of roots (0.15 g), followed by vermiculite medium (0.12 g) and minimum dry weight of roots (0.07 g) observed in terminal cuttings planted in saw dust medium. Treatment with powder dip of IBA @ 3000 ppm recorded the maximum (0.17 g) dry weight of roots per cutting and followed by (0.15 g) powder dip of IBA @ 6000 ppm and minimum (0.07 g) dry weight of roots per cutting observed with solution dip of IBA @ 750 ppm.

There was significant interaction between rooting media and IBA treatments for dry weight of roots. The highest dry weight of roots (0.20 g) was recorded by the terminal cuttings planted in coco peat + dipping in IBA powder @ 3000 ppm (M_1G_5).

The studies made by Mayer *et al*. (2015) also confirmed the same since they recorded maximum dry weight of roots in 3000 ppm of IBA treatment better than in 6000 ppm IBA with softwood cuttings of peach under intermittent mist system.

A high dry weight of roots (Table 5) might be due to a high value of corresponding fresh weight (Table 4) which might in turn due to a large number of sprouted roots that survived and grew longer up to 45 days after planting. Terminal cuttings planted in coco peat media recorded the maximum dry weight of roots which could be attributed to more number and length of roots. Terminal cuttings treated with IBA 3000 ppm recorded the highest dry weight of roots; which might be due to a higher number of primary and secondary roots through cell division (Debnath and Maiti, 1990).

Similarly the promoting effect of IBA can be attributed to the reason that the exogenous application of auxin could have triggered the initiation of root primordial in a better way (Ratnakumari, 2014). Such well-developed root primordial could have helped in establishment of better vascular connectivity within the conductive tissue of cutting as a result of which better root development occurred. The hormones were shown to regulate different aspects of plant growth and development including cell elongation and cell differentiation. Auxins are the substances which are produced in one tissue and migrate to effect the development of another tissue. They promote cell elongation and had a variety of other growth regulating effects. The root formation process in cuttings is intensified by the IBA treatment through polysaccharide hydrolysis which provides energy for meristematic tissues and thereby encouraging the formation of root primordial. The effect of auxins is specific in the development of root (Husen and Pal, 2007) which is evident from the above mentioned works as well as the results obtained in the present study.

Survival percentage of rooted cuttings (%)

There were significant differences in respect of survival percentage of rooted terminal cuttings among the different rooting media and IBA treatments as well as their interactions at 45 DAP (Table 6). The terminal cuttings planted in coco peat medium were found to have maximum survival percentage of rooted cuttings (71.00%) followed by those planted in vermiculite (67.67%) whereas, the minimum survival percentage of terminal cuttings was noticed in saw dust (63.33%).

Among IBA treatments, the highest survival percentage (75.00%) was noticed in IBA powder dip @ 3000 ppm followed by (71.67%) those treated terminal cuttings with IBA powder dip @ 6000 ppm and the minimum survival percentage of rooted terminal cuttings was noticed in solution dip of IBA @ 750 ppm (59.33%).

There existed a significant interaction between rooting media and IBA treatments with respect to survival percentage of rooted terminal cuttings. Significantly maximum survival percentage of rooted terminal cuttings (79.00%) was found in terminal cuttings planted in coco peat medium + treatment with IBA powder dip @ 3000 ppm (M_1G_5).

The cuttings planted in coco peat medium gave highest survival percentage might be due to its corresponding merit in root and shoot growth and sustenance over a period of time. The advantages with coco peat might be due to incorporation of coarser material which would improve the aeration status of medium (Awang *et al*., 2009). Aeration is necessary for the gaseous exchange between the soil and atmosphere to remove CO_2 released by roots and microorganisms in the soil to external atmosphere and supply of O_2 from the external atmosphere to the growing roots leading to better respiration and survival of plants (Jeyaseeli and Paul, 2010).

The highest survival percentage was recorded in the cuttings treated with IBA powder dip @ 3000 ppm, which might due to development of effective root system and increase in number and length of roots per cutting as influenced by the uptake of nutrients and water (Reddy *et al*, 2008). The survival of the sprouted cuttings might be directly linked to the formation of adventitious roots on cuttings.

Auxins role in inducing roots in the cuttings as described by many researchers is in consistency with the results of the study. The possible explanation to these findings lies in better development of root system with more number of roots, greater root length, fresh and dry weight of roots which would have enabled the rooted cuttings to survive till the end in the polybag thereby recording the highest survival (Goudappa, 2016). The above results are in accordance with Abdul *et al.* (2013) [1] in guava, Abdullah *et al*, (2006) [2] in guava Sukhjit (2015) in hardwood cuttings of peach. Riaz *et al*. (2007) reported the highest survival percentage in 3000 ppm of IBA than 6000 ppm of IBA in hardwood cuttings of kiwi.

Conclusion

The study revealed that, among the three different Rooting media *i.e.*, coco peat, vermiculite and saw dust, coco peat registered highest values regarding Percentage of rooted cuttings, Number of roots per cutting, Length of longest root per cutting, fresh weight of roots, dry weight of roots, and Survival percentage of rooted cuttings in guava cv. Taiwan Pink. Among IBA treatments *i.e.*, 250, 500, 750 ppm in solution form for 5 minutes and 1500, 3000, 6000 ppm in powder form, 3000 ppm of IBA performed the best. It could be quite safe to recommend that clonal propagation of guava through Terminal cutting is reliable for nursery plants production as it is quick, easy and economical method of vegetative propagation.

Table 1: Effect of rooting media and IBA treatments on percentage of rooted cuttings (%) of terminal cuttings in guava cv. Taiwan Pink at 45 DAP.

IBA treatments (G)	Percentage of rooted cuttings (%)			Mean
	Rooting media (M)			
	Coco peat (M_1)	Vermiculite (M_2)	Saw dust (M_3)	
250 ppm (G_1)	71.06 (57.43)	68.94 (56.11)	64.72 (53.54)	68.24 (55.69)
500 ppm (G_2)	67.52 (55.23)	65.00 (53.70)	61.30 (51.51)	64.60 (53.48)
750 ppm (G_3)	62.68 (52.32)	62.02 (51.93)	55.71 (48.26)	60.13 (50.84)
1500 ppm (G_4)	75.89 (60.57)	71.91 (57.97)	68.09 (55.58)	71.96 (58.04)
3000 ppm (G_5)	85.19 (67.35)	79.85 (63.30)	74.40 (59.58)	79.81 (63.41)
6000 ppm (G_6)	81.53 (64.53)	75.37 (60.22)	71.69 (57.83)	76.19 (60.86)
Mean	73.98 (59.57)	70.51 (57.21)	65.98 (54.38)	70.15 (57.05)
Factor	M	G	M x G	
S Em±	0.19	0.27	0.47	
CD at 5%	0.57	0.80	1.39	

G_1, G_2 and G_3 are treatments of guava terminal cuttings with IBA in solution form.
G_4, G_5 and G_6 are treatments of guava terminal cuttings with IBA in powder form.
* Figures in parenthesis indicate transformed values.

Table 2: Effect of rooting media and IBA treatments on number of roots per cutting of terminal cuttings in guava cv. Taiwan Pink at 45 DAP.

IBA treatments (G)	Number of roots per cutting			Mean
	Rooting media (M)			
	Coco peat (M_1)	Vermiculite (M_2)	Saw dust (M_3)	
250 ppm (G_1)	23.49	19.43	15.21	19.39
500 ppm (G_2)	20.27	16.35	13.12	16.58
750 ppm (G_3)	17.51	14.26	10.42	14.05
1500 ppm (G_4)	25.61	20.19	18.31	21.37
3000 ppm (G_5)	29.57	24.54	23.52	25.85

6000 ppm (G_6)	27.11	22.31	20.53	23.32
Mean	23.92	19.49	16.87	20.09
Factor	M	G	M x G	
S Em± CD at 5%	0.01 0.04	0.02 0.06	0.03 0.10	

G_1, G_2 and G_3 are treatments of guava terminal cuttings with IBA in solution form.
G_4, G_5 and G_6 are treatments of guava terminal cuttings with IBA in powder form.

Table 3: Effect of rooting media and IBA treatments on length of longest root per cutting (cm) of terminal cuttings in guava cv. Taiwan Pink at 45 DAP.

IBA treatments (G)	**Length of longest root per cutting (cm)**			**Mean**
	Rooting media (M)			
	Coco peat (M_1)	**Vermiculite (M_2)**	**Saw dust (M_3)**	
250 ppm (G_1)	7.28	8.20	7.65	7.71
500 ppm (G_2)	6.19	7.43	7.42	7.01
750 ppm (G_3)	6.18	6.34	6.46	6.33
1500 ppm (G_4)	7.54	9.52	8.40	8.49
3000 ppm (G_5)	14.74	10.04	9.10	11.29
6000 ppm (G_6)	11.02	9.38	9.05	9.82
Mean	8.82	8.48	8.01	8.44
Factor	M	G	M x G	
S Em± CD at 5%	0.055 0.166	0.079 0.234	0.136 0.407	

G_1, G_2 and G_3 are treatments of guava terminal cuttings with IBA in solution form.
G_4, G_5 and G_6 are treatments of guava terminal cuttings with IBA in powder form.

Table 4: Effect of rooting media and IBA treatments on fresh weight of roots per cutting (g) of terminal cuttings in guava cv. Taiwan Pink at 45 DAP.

IBA treatments (G)	**Fresh weight of roots per cutting (g)**			**Mean**
	Rooting media (M)			
	Coco peat (M_1)	**Vermiculite (M_2)**	**Saw dust (M_3)**	
250 ppm (G_1)	1.30	0.83	0.63	0.92
500 ppm (G_2)	1.00	0.64	0.61	0.75
750 ppm (G_3)	1.09	0.59	0.35	0.68
1500 ppm (G_4)	1.28	0.97	0.80	1.02
3000 ppm (G_5)	1.37	1.32	1.10	1.26
6000 ppm (G_6)	1.06	1.02	1.01	1.03
Mean	1.18	0.89	0.70	0.94
Factor	M	G	M x G	
S Em± CD at 5%	0.05 0.15	0.07 0.21	0.12 0.36	

G_1, G_2 and G_3 are treatments of guava terminal cuttings with IBA in solution form.
G_4, G_5 and G_6 are treatments of guava terminal cuttings with IBA in powder form.

Table 5: Effect of rooting media and IBA treatments on dry weight of roots per cutting (g) of terminal cuttings in guava cv. Taiwan Pink at 45 DAP.

IBA treatments (G)	**Dry weight of roots per cutting (g)**			**Mean**
	Rooting media (M)			
	Coco peat (M_1)	**Vermiculite (M_2)**	**Saw dust (M_3)**	
250 ppm (G_1)	0.14	0.11	0.09	0.11
500 ppm (G_2)	0.13	0.09	0.07	0.10
750 ppm (G_3)	0.11	0.06	0.05	0.07
1500 ppm (G_4)	0.15	0.13	0.11	0.13
3000 ppm (G_5)	0.20	0.18	0.14	0.17
6000 ppm (G_6)	0.18	0.14	0.12	0.15
Mean	0.15	0.12	0.07	0.11
Factor	M	G	M x G	
S Em± CD at 5%	0.002 0.007	0.003 0.009	0.005 0.016	

G_1, G_2 and G_3 are treatments of guava terminal cuttings with IBA in solution form.
G_4, G_5 and G_6 are treatments of guava terminal cuttings with IBA in powder form.

Table 6: Effect of rooting media and IBA treatments on survival percentage of rooted cuttings (%) of terminal cuttings in guava cv. Taiwan Pink at 45 DAP.

IBA treatments (G)	Survival percentage of rooted cuttings (%)			Mean
	Rooting media (M)			
	Coco peat (M_1)	Vermiculite (M_2)	Saw dust (M_3)	
250 ppm (G_1)	69.00(56.15)	65.00(53.71)	61.00(51.33)	65.00(53.73)
500 ppm (G_2)	66.00(54.31)	63.00(52.52)	63.00(52.52)	64.00(53.11)
750 ppm (G_3)	64.00(53.11)	61.00(51.33)	53.00(46.70)	59.33(50.38)
1500 ppm (G_4)	73.00(58.67)	69.00(56.15)	65.00(53.71)	69.00(56.18)
3000 ppm (G_5)	79.00(62.71)	75.00(59.98)	71.00(57.40)	75.00(60.03)
6000 ppm (G_6)	75.00(59.98)	73.00(58.67)	67.00(54.92)	71.67(57.86)
Mean	71.00(57.49)	67.67(55.39)	63.33(52.76)	67.33(55.21)
Factor	M	G	M x G	
S Em±	0.24	0.34	0.59	
CD at 5%	0.71	1.00	1.74	

G_1, G_2 and G_3 are treatments of guava terminal cuttings with IBA in solution form.
G_4, G_5 and G_6 are treatments of guava terminal cuttings with IBA in powder form.
* Figures in parenthesis indicate transformed values.

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