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Influence of Maturity of Stem cuttings and Plant Growth Regulators in Propagation of Orange Jasmine (*Murraya paniculata* L. Jack)

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***Abstract*:** *Murraya paniculata* (orange jasmine), is a versatile evergreen shrub belonging to family Rutaceae. It is widely used as cut foliage in floral arrangements and bouquet owing to its visual appeal. The current research was undertaken to determine the most efficient hormonal concentration for rooting of softwood and semi hardwood stem cuttings of *M. paniculata* at Kerala Agricultural University, Thrissur, Kerala, during the rainy season (July 2024). Sprouting (70 %), shoot length (6.44 cm), rooting (68.89 %), number of roots (13), root length (20.50 cm), and fresh weight of roots (1.07 g) were highest in softwood cuttings treated with IBA (1000 ppm). Early sprouting (8.67 days) was observed in softwood cuttings treated with IBA (2000 ppm). Total phenolic and flavonoid contents were lowest in softwood cuttings treated with IBA (1000 ppm) at 30 (phenol: 4.13 mg/g FW, flavonoid: 2.16 mg/g FW) and 45 (phenol: 3.45 mg/g FW, flavonoid: 1.73 mg/g FW) days after planting, while higher levels of phenols and flavonoids were observed in other treatments. Histological analysis showed that the adventitious roots of orange jasmine developed from cambial and xylem parenchyma cells, growing outward through the phloem, sclerenchyma, cortex, and epidermis, eventually emerging on the outer surface of the cutting at 45 days after planting. Softwood cuttings treated with 1000 ppm IBA proved to be the most effective for propagating *M. paniculata*.

***Keywords*:** Orange jasmine, *Murraya*, Plant growth regulators, Softwood cuttings.

1. INTRODUCTION

Orange jasmine is extensively used as cut foliage and fillers in floral arrangements, bouquets, wreaths, and interior decorations. Fully bloomed trees, adorned with white flowers, are highly ornamental and often recommended as specimen trees in gardens. Almost all parts of the plant serve various purposes, including ethnomedicinal uses, cosmetics, essential oil extraction, and insecticidal agents. Its leaves are oval-shaped, distinguished by their brownish-green colouring, bitter and spicy flavour, and aromatic fragrance. The leaf surface is smooth and glossy (Wardani et al., 2019). The flowers are pentamerous, bisexual, and have a delightful fragrance. Flowering occurs throughout the year, beginning in June during the rainy season. Orange jasmine can be grown from seeds, but seed propagated plants have long juvenile period before flowering and seeds are not available throughout the year. *M. paniculata* exhibits limited rooting ability which discourages its vegetative propagation. Due to the challenges in rooting of cuttings, it is necessary to standardize vegetative propagation methods to ensure multiplication of true-to-type progenies for the conservation and better exploitation of the diversity. Currently, planting materials are sourced from different centers, especially from Rajahmundry in Andhra Pradesh to different states including Kerala. To address these challenges, the current study was conducted to standardize vegetative propagation in orange jasmine using stem cuttings.

2. MATERIALS AND METHODS

Cuttings for the experiments were collected from mother plants of orange jasmine maintained at the shrubbery of the College of Agriculture, Vellanikkara (10^0 54'N latitude and 76^0 28'E longitude, with an elevation of 22.25 m above MSL), Thrissur during the monsoon season (June-August). Cuttings with two nodes were taken from the softwood and semi-hardwood portions of shoots which were collected from both the terminal and middle sections of the branches respectively. The chemicals used for this study were Indole-3-butyric acid (IBA), naphthalene acetic acid (NAA), gallic acid, quercetin, sodium carbonate, folin-ciocalteu reagent, sodium hydroxide, aluminum chloride and sodium nitrate, which were of analytical grade purchased from Nice Chemicals Pvt. Ltd. Edappally, Kochi, Kerala.

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Softwood and semi-hardwood cuttings of length (7-8 cm) and width (2.30-2.80 mm) were treated with different treatments such as distilled water (control), various concentrations of IBA and NAA alone and combinations of IBA and NAA (1:1) at concentrations ranging from 1000 to 3000 ppm and also tender coconut water. In control treatment, base of cuttings was immersed in distilled water for one minute (T_1). The base of the cuttings was immersed in growth regulator solutions (T_2 to T_{10}) for one minute while treatment with tender coconut water was continued for 10 minutes (T_{11}). After the treatment with distilled water/ growth regulator solutions/ tender coconut water, the cuttings were planted in 4x5-inch polythene bags filled with potting mixture consisting of soil, coir pith, and FYM in 2:1:1 ratio and placed inside ventilated rain shelter for sprouting and rooting.

2.1. Observations Recorded

Various growth parameters, including the number of days to sprout, percentage of cuttings sprouted, shoot length (cm), number of cuttings rooted, root number, root length (cm), and fresh root weight (g) were recorded at 90 days after planting.

2.2. Estimation of Total Phenolic and Flavonoid Content in the Basal Section of Cuttings

Gallic acid standards (1–15 ppm) were used for calibration, and the total phenolic content was calculated using the procedure outlined by Kharbangar et al. (2015) with minor modifications. The procedure outlined by Jing et al. (2015) was used for estimation of total flavonoid content.

2.3. Histological Observation of the Adventitious Rooting Zone

Adventitious rooting zone of cuttings in the most effective treatment (softwood cuttings treated with 1000 ppm IBA) was examined histologically after 30 and 45 days of planting. Leica sliding microtome (Model number: Leica SM 2010 R) was used to take the sections of 5 to 10 µm thickness. Appropriate portions were chosen, and the other stems were saved for later use. Following two to five minutes of staining with safranin at 10%, the sections were dried out using a range of graded alcohol solutions (30 to 95 and 100 per cent) and an alcohol-xylene mixture (50:50). Sections were examined under a compound microscope (4x and 10x magnification) (Model number: Leica ATC 2000). Images were taken using image analyser software Digi Pro.7.

2.4. Statistical Analysis

Data were analysed using GRAPES software developed by Kerala Agricultural University (Gopinath et al., 2021).

3. RESULTS AND DISCUSSION

3.1. Sprouting Potential of Cuttings

Significant difference was observed between softwood and semi hardwood cuttings treated with different concentrations as well as combinations of IBA and NAA in the sprouting characteristics (Table 1). Softwood cuttings treated with IBA 1000 ppm (S_1T_2) recorded highest sprouting percentage (70%) followed by semi-hardwood cuttings and softwood cuttings treated with IBA 2000 ppm which were on par with each other. Sprouting percentage was lowest in semi hardwood cuttings treated with distilled water (S_2T_1, 17.78%). Softwood cuttings treated with IBA 2000 ppm (S_1T_3) recorded minimum duration for sprouting (8.67 days) followed by semi-hardwood cuttings treated with IBA 2000 ppm (S_2T_3) and softwood cuttings treated with NAA 2000 ppm which were on par with each other with 10.67 days for sprouting. Semi hardwood cuttings treated with distilled water recorded maximum days for sprouting (21.67 days).

Sprouting of leaves from stem cuttings is influenced by several factors, including water, root development, nutrients, auxins, cytokinins, carbohydrates and proteins (Kurepa et al., 2019). Superiority of cuttings treated with IBA compared to NAA can be due to the prolonged auxin action and delayed degradation by auxin-degrading enzymes. IBA promotes cell division, leading to rapid callus formation in the cuttings. IBA improves the use of these nutrients and stimulates sprout growth by encouraging the breakdown and flow of nitrogenous chemicals and carbohydrates at the cellular level in the basal area of the cuttings at high concentrations and activity levels (Sabharwal, 2023).

Significant variation in shoot length was observed between the cuttings treated with different concentrations of growth hormones. Softwood cuttings treated with 1000 ppm IBA (S_1T_2) showed highest shoot length (6.44cm), followed by S_1T_6 and S_2T_3 (4.79 cm). In contrast, semi-hardwood cuttings treated with distilled water (S_2T_1) recorded shortest shoot length of 1.39 cm. Juvenility of the cells (more undifferentiated high active cells) and the availability of nutrients determine the sprout growth in the stem cuttings. Furthermore, CN ratio plays an important role in the development of sprouts in stem cuttings and it decline from root initiation to root emergence.

3.2. Rooting Behavior of Cuttings

Softwood cuttings treated with 1000 ppm IBA (S_1T_2) exhibited better root characteristics recording highest percentage of rooted cuttings (68.89%), number of lateral

roots (13.00) and root length (20.50 cm) (Table 2, Figure 1). This was followed by semi hardwood cuttings treated with 2000 ppm IBA. Semi-hardwood cuttings treated with distilled water recorded the lowest percentage of rooted cuttings (17.78%), number of lateral roots (2.00) and root length (2.59 cm). Softwood cuttings taken from the upper stem develop better roots than hardwood cuttings from the basal stem (Pijut et al., 2011).

Auxins, whether they are surface-applied or naturally occurring, are essential for initiation of adventitious root growth on stems. External application of auxin transforms starch into simple sugars, which are necessary for the formation of new cells and the augmentation of respiratory activity in tissue regeneration during the growth of new root primordia. It also facilitates the hydrolysis and movement of carbohydrates and nitrogenous compounds at the base of the cuttings, stimulating cell division and enhancing root formation (El-Banna et al., 2023). Exogenous treatment of stem cuttings with auxin increases the number of roots and speeds up the rooting process by encouraging the formation of root primordia. IBA is the most commonly utilized auxin for adventitious root development and a more efficient regulator of plant growth. Treatment of cuttings with IBA causes greater hydrolytic activity and encourages the movement of carbohydrates from the leaves which aids in root growth (Bhatt and Tomar, 2010). Auxins encourage growth from the cellular stage to the organ level and eventually help in the development of the entire plant (Khudhur and Omer, 2015). IBA is less harmful to plants over a wider range of concentrations compared to NAA

Table 1. Effect of type of cuttings and growth regulators on sprouting potential in *M. paniculata* cuttings

Treatments	Type of cuttings	No. of days for sprouting	Sprouting of cuttings (%)	Length of shoots (cm)
T_1 – Control	S_1	18.67^{b}	25.55^{m}	1.44^{l}
	S_2	21.67^{a}	17.78^{n}	1.39^{l}
T_2 – IBA 1000 ppm	S_1	11.67^{ij}	70.00^{a}	6.44^{a}
	S_2	12.00^{i}	47.78^{def}	2.65^{fgh}
T_3 – IBA 2000 ppm	S_1	8.67^{k}	56.67^{bc}	4.23^{cd}
	S_2	10.67^{j}	57.78^{bc}	4.79^{b}
T_4 – IBA 3000 ppm	S_1	14.33^{gh}	52.22^{cd}	4.29^{c}
	S_2	13.33^{h}	44.44^{efg}	3.02^{ef}
T_5 – NAA 1000 ppm	S_1	12.00^{i}	43.33^{efg}	3.89^{d}
	S_2	14.33^{gh}	41.11^{gh}	2.90^{ef}
T_6 – NAA 2000 ppm	S_1	10.67^{j}	60.00^{b}	4.79^{b}
	S_2	14.33^{gh}	48.89^{de}	2.75^{fg}
T_7 – NAA 3000 ppm	S_1	15.33^{fg}	42.22^{fgh}	3.29^{e}
	S_2	16.33^{def}	34.44^{ijk}	2.82^{f}
T_8 - IBA+NAA (1:1)- 1000 ppm	S_1	16.00^{ef}	38.89^{ghi}	2.99^{ef}
	S_2	17.33^{cd}	30.00^{klm}	2.39^{ghi}
T_9 - IBA+NAA (1:1)- 2000 ppm	S_1	17.00^{cde}	36.67^{hij}	2.25^{ij}
	S_2	17.67^{bc}	26.67^{lm}	2.04^{ij}
T_{10} - IBA+NAA (1:1)-3000 ppm	S_1	15.33^{fg}	34.45^{ijk}	2.30^{hij}
	S_2	17.67^{bc}	27.78^{lm}	1.92^{jk}
T_{11} - Dipping in tender coconut water	S_1	16.33^{def}	32.22^{jkl}	2.12^{ij}
	S_2	18.67^{b}	24.44^{m}	1.62^{kl}
CD (p=0.05)	S	0.37	1.76	0.12
	T	0.86	4.13	0.28
	S × T	1.22	5.85	0.39

S_1- Softwood cuttings; S_2- Semi-hardwood cuttings; S- type of cutting; T- growth regulators

(Ashwath et al., 2023). Effectiveness of IBA, when compared to other growth regulators is attributed to the slower degradation rate of the chemicals by auxin-destroying enzymes (Reshma, 2017). The slow breakdown of IBA and its limited mobility leads to greater retention near the application site, making IBA one of the most efficient root stimulators.

Softwood cuttings treated with 1000 ppm IBA had more shoot length with foliage, which serves as the primary site for food production, which is then transferred to the roots for growth. Additionally, IBA promoted deeper root penetration into the soil, allowing the roots to absorb more nutrients, which ultimately resulted in increased root length. Kareem et al. (2013), also observed increased root length in softwood cuttings of guava var. Gola when treated with 0.4 g of IBA per 100 g of talc powder. Softwood cuttings treated with 1000 ppm IBA (S_1T_2) registered highest fresh root weight (1.07 g), followed by semi hardwood cuttings treated with 2000 ppm IBA (S_2T_3, 0.79 g) and softwood cuttings treated with 2000 ppm NAA (S_1T_6, 0.66 g). Alternatively, semi-hardwood cuttings treated with distilled water exhibited lowest fresh root weight (0.08 g). Early initiation of roots leads to more rapid uptake of nutrients, which may facilitate endosmosis of water and promote cell enlargement in the roots. As a result, longer roots are produced, increasing the fresh weight of roots (Sabharwal, 2023).

3.3. Effect of Auxins on Total Phenolic and Flavonoid Content

Semi-hardwood cuttings treated with IBA 2000 ppm (S_2T_3) recorded lowest total phenolic content (3.36 mg/g

Table 2. Effect oftype of cuttings and growth regulators on rooting potential in *M. paniculata* cuttings

Treatments	Type of cuttings	Cuttings rooted (%)	No. of roots	Root length (cm)	Fresh wt. of roots (g)
T_1 – Dipping in distilled water	S_1	24.44^{j}	3.00^{ijk}	3.39^{m}	0.13^{o}
	S_2	17.78^{k}	2.00^{l}	2.59^{n}	0.08^{p}
T_2 – IBA 1000 ppm	S_1	68.89^{a}	13.00^{a}	20.50^{a}	1.07^{a}
	S_2	53.33^{c}	5.66^{de}	10.69^{ef}	0.40^{ef}
T_3 – IBA 2000 ppm	S_1	53.33^{c}	5.66^{de}	11.42^{d}	0.45^{d}
	S_2	61.11^{b}	9.22^{b}	16.67^{b}	0.79^{b}
T_4 – IBA 3000 ppm	S_1	46.67^{d}	4.44^{fg}	11.01^{de}	0.43^{de}
	S_2	46.67^{d}	4.44^{fg}	10.19^{g}	0.38^{fg}
T_5–NAA 1000 ppm	S_1	40.00^{ef}	4.11^{fgh}	10.30^{fg}	0.36^{gh}
	S_2	41.11^{de}	4.78^{ef}	9.54^{h}	0.32^{hi}
T_6–NAA 2000 ppm	S_1	58.89^{bc}	7.89^{c}	13.53^{c}	0.66^{c}
	S_2	55.56^{bc}	6.33^{d}	11.45^{d}	0.43^{de}
T_7–NAA 3000 ppm	S_1	38.89^{ef}	4.44^{fg}	10.14^{g}	0.33^{h}
	S_2	36.67^{efg}	4.33^{fg}	8.45^{i}	0.28^{ij}
T_8-IBA+NAA (1:1)- 1000ppm	S_1	35.56^{efg}	3.89^{fghi}	8.67^{i}	0.29^{ij}
	S_2	34.44^{fg}	3.55^{ghijk}	7.61^{j}	0.28^{ijk}
T_9-IBA+NAA (1:1)- 2000ppm	S_1	34.45^{fg}	3.66^{ghij}	8.24^{i}	0.26^{jkl}
	S_2	31.11^{ghi}	3.33^{hijk}	7.21^{jk}	0.24^{klm}
T_{10}- BA+NAA (1:1)-3000ppm	S_1	32.22^{gh}	3.33^{hijk}	7.62^{j}	0.23^{lm}
	S_2	27.78^{hij}	2.78^{jkl}	6.92^{k}	0.19^{n}
T_{11}-Dipping in tender coconut water	S_1	27.78^{hij}	3.22^{hijk}	6.39^{l}	0.21^{mn}
	S_2	25.56^{ij}	2.66^{kl}	6.04^{l}	0.13^{o}
CD (p=0.05)	S	1.81	0.29	0.14	0.02
	T	4.24	0.68	0.32	0.03
	S × T	6.00	0.96	0.45	0.04

S_1- Softwood cuttings; S_2- Semi-hardwood cuttings; S- type of cutting; T- growth regulators

FW) which was on par with softwood cuttings treated with IBA 1000 ppm at 45 days after planting. On the contrary, semi-hardwood cuttings treated with distilled water (S_2T_1) had the highest total phenolic content (11.09 mg/g FW) (Table 3). Total phenolic content was reduced in all the treatments from 30 days after planting to 45 days after planting. Softwood cuttings treated with 1000 ppm of IBA had the lowest phenolic content at 30 days after planting (4.13 mg/g FW).

Early rooting in certain plants can be linked to the abundance of carbohydrates along with increased levels of phenolic compounds. During root initiation, these compounds are reduced, which promotes rooting in cuttings. De Klerk et al. (2011), observed that certain phenolic compounds can prevent the formation of roots by causing IAA to oxidize or decarboxylate, or by acting as precursors for the synthesis of lignin. In *Campomanesia phaea*, histochemical analysis revealed the presence of phenolic compounds in sclerenchyma tissue, which may negatively influence the adventitious root development (Santoro et al., 2022). Individual phenolic compounds may either stimulate or inhibit root formation (Izadi et al., 2016). Meta and ortho-diphenols, along with polyphenols, have the potential to inhibit auxin decarboxylation, thereby promoting rooting in cuttings. Sharma (2012) reported that etiolated plants with low total phenol levels have better root development, while woody plants with higher total phenolic content have slower root development.

Softwood cuttings treated with 1000 ppm IBA recorded lowest total flavonoid content (1.73 mg/g) at 45 days after

Table 3. Effect of type of cuttings and growth regulators on total phenol and flavonoid content in *M. paniculata*

Treatments	Type of cuttings	Total phenol content (mg/g FW)		Total flavonoid content (mg/g FW)	
		30 DAP	45 DAP	30 DAP	45 DAP
T_1 – Dipping in distilled water	S_1	11.96^{b}	10.61^{b}	5.21^{b}	3.74^{d}
	S_2	13.47^{a}	11.09^{a}	5.61^{a}	5.24^{a}
T_2–IBA 1000 ppm	S_1	4.13^{n}	3.45^{m}	2.16^{o}	1.73^{m}
	S_2	7.29^{j}	6.97^{i}	3.26^{jk}	3.00^{gh}
T_3–IBA 2000 ppm	S_1	5.91^{l}	5.61^{k}	$3.18k^{l}$	2.21^{kl}
	S_2	5.17^{m}	3.36^{m}	2.54^{n}	2.24^{kl}
T_4–IBA 3000 ppm	S_1	6.86^{k}	6.32^{j}	3.45^{ij}	2.35^{jkl}
	S_2	8.80^{i}	8.02^{g}	3.24^{jk}	2.78^{hi}
T_5–NAA 1000 ppm	S_1	7.62^{j}	7.53^{h}	3.66^{hi}	2.48^{ijk}
	S_2	9.47^{gh}	8.93^{f}	4.01^{g}	3.66^{de}
T_6–NAA 2000 ppm	S_1	5.26^{m}	4.78^{l}	2.78^{mn}	2.05^{l}
	S_2	6.54^{k}	5.36^{k}	2.94^{lm}	2.56^{ij}
T_7–NAA 3000 ppm	S_1	8.64^{i}	7.83^{g}	3.85^{gh}	2.65^{ij}
	S_2	9.82^{fg}	9.35^{e}	4.06^{fg}	3.58^{def}
T_8-IBA+NAA (1:1)- 1000 ppm	S_1	9.21^{h}	8.79^{f}	4.06^{fg}	2.73^{hi}
	S_2	10.11^{f}	9.43^{e}	4.33^{e}	3.77^{d}
T_9-IBA+NAA (1:1)- 2000 ppm	S_1	10.07^{f}	9.58^{e}	4.28^{ef}	2.97^{h}
	S_2	10.67^{de}	10.27^{cd}	4.46^{de}	4.20^{c}
T_{10}-BA+NAA (1:1)-3000 ppm	S_1	10.57^{e}	10.07^{d}	4.41^{de}	3.29^{fg}
	S_2	10.99^{cd}	10.51^{bc}	4.73^{c}	4.46^{bc}
T_{11}-Dipping in tender coconut water	S_1	11.22^{c}	10.35^{bcd}	4.62^{cd}	3.42^{ef}
	S_2	11.28^{c}	10.22^{cd}	4.78^{c}	4.65^{b}
CD (p=0.05)	S	0.11	0.09	0.08	0.09
	T	0.26	0.22	0.18	0.22
	S × T	0.36	0.30	0.25	0.31

S_1- Softwood cuttings; S_2- Semi-hardwood cuttings; S- type of cutting; T- growth regulators; FW- fresh weight

planting followed by softwood cuttings treated with 2000 ppm NAA (S_1T_6, 2.05 mg/g FW). Semi-hardwood cuttings treated with distilled water (S_2T_1) recorded higher total flavonoid content (5.24 mg/g FW). Softwood cuttings treated with 1000 ppm IBA had the lowest flavonoid concentration at 30 days after planting (2.16 mg/g FW). The total flavonoid content in all the treatments also decreased at 45 days after planting compared to 30 days similar to the trend observed in the phenol content.

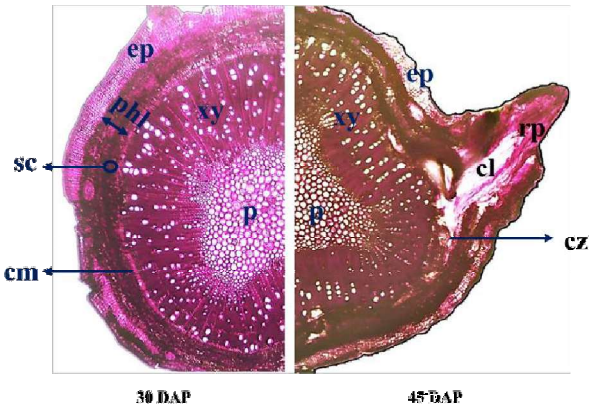
3.4. Morphological and Histological Changes in Cuttings during Rooting

Morphological and histological changes were observed at 30 and 45 days after planting in the best treatment viz., cuttings treated with IBA 1000 ppm. At 30 days after planting, the adventitious rooting zone showed a noticeable fading of green coloration and swelling and at day 45, this area faded further developing minor cracks, bursts, and small white callus tissues on the epidermis. Both woody and herbaceous plants naturally develop callus at the base of the cutting as a response of the cambium to the damage caused by cutting (Wroblewska, 2013). In contrast to this, in the present study, profuse callus formation was not observed in any of the treatments. Histological observations revealed that, adventitious roots of orange jasmine grew from cambial and xylem parenchyma cells and spread outward through the cortex, phloem, sclerenchyma, and epidermis before reaching the outer surface of the cuttings (Figure 2). Cambium layer or vascular tissues were identified as the origin of adventitious roots in many investigations. Cambium zone is the primary tissue where adventitious roots are most likely to form. However, it remains unclear which specific part of the new parenchyma belongs to the cambium, phloem, or xylem. In tetraploid *Robinia pseudoacacia*, IBA application enhanced cell divisions within the vasculature, with adventitious roots initiating specifically from the cambium layer (Uddin et al., 2024). Adventitious roots in woody plant cuttings can also develop in the phloem and pericycle. In *Rosa* species, roots developed in the cambial zone tissues near the pith rays, as well as within the phloem and pericycle (Monder et al., 2019). They observed the absence of a firm ring of sclerenchymatous cells in the adventitious rooting zone of cuttings in rose. In contrast to this, in this study, adventitious roots originated even in the presence of thick sclerenchymatous layer in the pericycle. Push of the root primordia for initiation of root resulted in rupture of cortex and epidermal cells (Figure 2).

a. Softwood cuttings

b. Semi-hardwood cuttings

Figure 1. Response of different type of cuttings and concentrations of plant growth regulators on the growth of *M. paniculata* at 90 days after planting



Abbreviations: ep- epidermis; phl- phloem; sc- sclerenchyma; cm- cambium; xy- xylem;
p- pith; cl- callus; rp- root primordia; cz- cambium zone; DAP – Days After Planting

Figure 2. Transverse sections of rooting zone of *M. paniculata* cuttings

4. CONCLUSION

The impact of several plant growth regulators on the emergence and establishment of softwood and semi-

hardwood cuttings of *M. paniculata* was assessed. Softwood cuttings treated with IBA 1000 ppm (S_1T_2) resulted in maximum sprouting of cuttings, shoot length, percentage of rooted cuttings, number of roots, root length and fresh root weight, followed by semi hardwood cuttings treated with IBA 2000 ppm. Lower doses of growth regulators yielded better outcomes compared to higher concentrations and their combinations of growth hormones.

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Conflict of Interest

Authors do not have any conflict of interests to declare.

Authors' Contributions

Resmi Paul, Vishnu Raju and Mini Sankar developed the concept of the experiment. Yarrakula Venugopal executed the trial, collected and analysed the data and prepared the manuscript.

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