VEGETATIVE PROPAGATION THROUGH JUVENILE SHOOT CUTTINGS OF *MELIA COMPOSITA* WILLD.

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Introduction

Melia composita commonly known as 'Burma Neem' is a fast growing tree, attaining a height of about 20 m and straight cylindrical bole of about 9 m. It is found in the Sikkim Himalayas, North Bengal, Upper Assam, Khasi Hills, hills of Orissa, North Circars, Deccan and the Western Ghats at altitudes of 1,500-1,800 m amsl. Outside India, it is found in Sri Lanka, the Malay Peninsula, Java, China and Australia (Brandis, 1906). As evidenced by its wide distribution, it is capable of withstanding wide range of climatic conditions. It is occasionally planted for ornament and makes a handsome avenue tree and shade tree in plantations. The wood is used for packing cases, cigar boxes, ceiling planks, building purposes, agricultural implements, pencils, match boxes, tea boxes, plyboard, splints and kattamarans. The tree is cultivated in the arid and semi-arid and also in the semi-moist areas. Due to its fast growth and multiple uses, it is emerging as a favourite tree for growing under agro-forestry plantations in the states of Punjab, Haryana and Uttar Pradesh.

The tree is usually leafless from December to March-April, the new leaves appearing in February-March. The whitish green flowers appear from March to May soon after replaced by bunches of ovoid drupes which keep hanging on the tree till the next flowering season. As abundant seed crops are available every year, it can be easily propagated either by direct sowing or by planting out nursery seedlings, however, the importance of vegetative propagation in tree improvement programmes can not be overlooked. Vegetative propagation ensures quick genetic gains by mass multiplication of superior genotypes and help in establishing clonal seed orchards, breeding population and afforestation programmes. Amongst various methods of vegetative prpagation, rooting of shoot cuttings is the most effective method. However, no attempt has been made to propagate this species by vegetative means. Earlier, Rawat *et al.* (1994) have classified *Melia* as a moderately difficult-to-root species. This paper gives the effect of growth hormones on the rooting ability of juvenile shoot cuttings of *Melia composita* in different seasons under intermittent mist conditions.

Material and Methods

The investigation was conducted at Research Complex, Hoshiarpur during March-September, 2005. Three to four

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weeks old juvenile branch cuttings were collected in the months of March (I), April (II), May (III), June (IV), July (V), August (VI) and September (VII) from the coppicing stumps of recently harvested trees at Hoshiarpur having 10-12 years of age. The cuttings were reduced to single node cuttings of 3-4 cm length with a single leaf which was cut to half with sterilized scissors. After trimming of leaves, cuttings were sterilized with 0.1% Bavistin for a few minutes and after washing treated immediately with water (control), 1000, 2000 and 3000 ppm of IBA (Indole Butyric Acid), IAA (Indole Acetic Acid) and NAA (Naphthalene Acetic Acid) prepared in talcum powder. The basal end of the cuttings was treated for 30 seconds (quick dip method) and subsequently planted in the trays at the same depth filled with vermiculite and kept in the mist chamber under intermittent misting at 36 2°C and RH 80 to 86%. There were thus 10 treatments and 40 cuttings in each treatment. The observations with respect to number of cuttings sprouted, number of leaves per sprouted cutting, sprout length, number of cuttings rooted, number of roots per sprouted cutting and length of roots were recorded 45-50 days after planting. The data thus obtained for 2,800 cuttings was put to statistical analysis using Genstat software package to understand the significance of difference among the treatments and the months of planting.

Results and Discussion

The results of analysis of each parameter studied are enumerated below:

Sprouting per cent : The results revealed that though various treatments do not vary significantly, different months show highly significant variation (p=0.001) with respect to sprouting per cent. The juvenile cuttings planted in April reported the highest sprouting (98.5%) and August the minimum (58.25%), however cuttings during May to July were equally good (96.5%) as planted during April. This suggests that sprouting in *Melia composita* takes place profusely in all the months except August. Results further show that among the different hormones IBA, IAA and NAA gave 90.00, 85.59 and 77.74 per cent sprouting respectively on an average against control (83.21) indicating the superiority of IBA treatments (Table 1). However, sprouting per cent declined beyond the range of optimum concentration. These results are in conformity with the results reported by Tewary *et al.* (2004) for *Vitex negundo*.

Length of sprouts : The analysis of data reveal that treatments and months vary highly significantly (p=0.001) in respect of mean length of sprouts. It is seen that IBA 3000 ppm and IBA 2000 ppm out perform other treatments, producing sprout length 4.14 cm and 3.90 cm per cutting respectively. The sprout length is reported minimum due to control (1.46 cm). Among the months, like number of leaves per cutting, July planted cuttings registered the maximum sprout length (3.80 cm). All treated cuttings showed positive effect on mean length of sprouts produced (Table 2). Several authors have reported that growth regulators have stimulatory affect on various shoot parameters (Khosla *et al.,* 1982; Singh and Paliwal, 1987; Sharma and Badoni, 1989). Chawla (1991) reported that in *Vitis vinifera,* IBA treatment was most affective in increasing the average number of bud sprouts, however, higher concentrations of these auxins have been reported to have detrimental effects on shoot growth (Bhatt and Badoni, 1993).

Table 1

Effect of growth regulators on sprouting percentage of juvenile cuttings of Melia composita

Treatments	Months									
	I	II	III	IV	V	VI	VII	Mean	Sig.	CD
IBA 1000 ppm	90.00	100.00	92.50	100.00	100.00	57.50	62.50	86.07		
IBA 2000 ppm	85.00	90.00	95.00	100.00	100.00	87.50	87.50	92.14		
IBA 3000 ppm	67.50	97.50	100.00	100.00	100.00	77.50	100.00	91.79		
IAA 1000 ppm	92.50	100.00	97.50	100.00	100.00	50.00	87.50	89.64		
IAA 2000 ppm	62.50	100.00	92.50	100.00	100.00	55.00	92.50	86.07	NS	-
IAA 3000 ppm	72.50	97.50	92.50	100.00	100.00	65.00	40.00	81.07		
NAA 1000 ppm	92.50	100.00	82.50	80.00	80.00	50.00	80.00	80.71		
NAA 2000 ppm	75.00	100.00	85.00	97.50	97.50	30.00	50.00	76.43		
NAA 3000 ppm	72.50	100.00	85.00	87.50	87.50	42.50	57.50	76.07		
0 ppm	77.50	100.00	77.50	100.00	100.00	67.50	60.00	83.21		
Mean	78.75	98.50	90.00	96.50	96.50	58.25	71.75			
Sig.				***						
CD				9.86						

NS = Not significant *** Significant at $p \leq 0.001$

Table 2

Effect of growth regulators on sprout length (cm) of juvenile cuttings of Melia composita

Treatments	Months									
	I	II	III	IV	V	VI	VII	Mean	Sig.	CD
IBA 1000 ppm	2.30	1.52	1.28	1.88	4.34	4.10	2.29	2.53		
IBA 2000 ppm	3.20	7.54	1.94	3.01	4.90	4.13	2.56	3.90		
IBA 3000 ppm	2.49	6.80	2.88	4.30	5.26	4.45	2.78	4.14		
IAA 1000 ppm	1.86	3.21	1.30	1.62	3.76	1.56	1.65	2.14		
IAA 2000 ppm	1.48	1.59	1.31	2.32	3.41	3.31	1.44	2.12	***	0.91
IAA 3000 ppm	1.28	1.20	1.09	2.49	3.12	1.98	0.53	1.67		
NAA 1000 ppm	2.16	4.08	1.08	2.21	3.39	1.03	1.50	2.20		
NAA 2000 ppm	1.83	1.61	1.20	2.18	3.64	1.24	0.94	1.80		
NAA 3000 ppm	2.01	1.09	1.08	2.30	3.14	1.20	0.89	1.67		
0 ppm	1.68	1.34	1.04	1.20	3.06	1.31	0.60	1.46		
Mean	2.03	3.00	1.42	2.35	3.80	2.43	1.51			
Sig.				***						
CD				0.76						

*** Significant at $p \leq 0.001$

Number of leaves : The average number of leaves per cutting has been found to vary highly significantly among treatments (p=0.01) and months (p=0.001). Maximum number of leaves (4.82) were found in IAA 2000ppm treated cuttings, followed by IBA 2000ppm (4.60). Among the seven months for which this parameter was studied, August planted cuttings gave the poorest and the July the highest number of leaves per cutting (Table 3).

Rooting per cent: Though treatments have been found to be homogenous in effect, all IBA treatments gave better rooting (54.76%) than IAA and NAA. However, all treatments except NAA 1000 ppm were better than control. Rooting per cent varied highly significantly (p=0.001) among various months. June planted cuttings registered the highest per cent of rooting (88.75) and the May the least (20.75), as it is the flowering period for the species (Table 4). This is contrary to the findings of Palanisamy and Kumar (1996) for Neem, where auxins (IAA and IBA) and B-Vitamin induced significant rooting (40 to 80%) only in leaf fall or bud breaking stage (February) and in other seasons the adventitious root formation was very poor (0 to 20%). However, young Neem seedlings (1 to 3 years) showed significant rooting (60 to 80%) in most of the months (Palanisamy and Kumar, 2001). The rooting potential of juvenile cuttings varies with season. The best season for rooting varies with plant species. Seasons of cutting, collection and planting play an

Table 3

Effect of growth regulators on number of leaves per cutting of juvenile cuttings of Melia composita

Treatments	Months									
	I	II	III	IV	V	VI	VII	Mean	Sig.	CD
IBA 1000 ppm	4.16	5.05	3.76	4.53	5.90	2.28	2.73	4.06		
IBA 2000 ppm	4.40	5.45	3.90	5.15	5.80	3.33	4.20	4.60		
IBA 3000 ppm	5.83	5.90	4.25	5.73	5.05	3.03	3.80	4.31		
IAA 1000 ppm	5.25	3.00	3.83	6.50	6.28	1.98	3.20	4.29		
IAA 2000 ppm	5.50	3.80	4.00	6.48	7.25	2.30	4.43	4.82	**	0.77
IAA 3000 ppm	4.05	4.58	3.51	6.55	6.98	3.40	1.20	4.32		
NAA 1000 ppm	3.33	3.65	3.28	4.08	5.30	1.20	2.15	3.28		
NAA 2000 ppm	3.50	3.50	3.50	5.20	5.98	1.10	1.58	3.48		
NAA 3000 ppm	3.05	3.00	3.50	4.30	4.30	1.63	1.53	3.04		
0 ppm	3.00	2.90	3.05	5.00	5.68	2.30	1.43	3.34		
Mean	4.21	4.08	3.66	5.35	5.85	2.26	2.63			
Sig.				***						
CD				0.48						

** Significant at p = 0.01, *** Significant at p ≤ 0.001

Table 4

Effect of growth regulators on rooting percentage of juvenile cuttings of Melia composita

Treatments	Months									
	I	II	III	IV	V	VI	VII	Mean	Sig.	CD
IBA 1000 ppm	42.50	32.50	25.00	97.50	70.00	47.50	65.00	54.29		
IBA 2000 ppm	35.00	25.00	22.50	97.50	52.50	70.00	67.50	52.86		
IBA 3000 ppm	42.50	37.50	27.50	100.00	47.50	60.00	85.00	57.14		
IAA 1000 ppm	42.50	35.00	15.00	100.00	60.00	42.50	75.00	52.86		
IAA 2000 ppm	15.00	22.50	32.50	100.00	57.50	50.00	65.00	48.93	NS	-
IAA 3000 ppm	12.50	15.00	22.50	95.00	67.50	55.00	42.50	44.29		
NAA 1000 ppm	0.00	62.50	15.00	57.50	52.50	5.00	77.50	38.57		
NAA 2000 ppm	35.00	87.50	15.00	80.00	55.00	25.00	30.00	46.79		
NAA 3000 ppm	35.00	92.50	17.50	62.50	57.50	32.50	45.00	48.93		
0 ppm	52.50	40.00	15.00	97.50	47.50	40.00	10.00	43.21		
Mean	31.25	45.00	20.75	88.75	56.75	42.75	56.25			
Sig.				***						
CD				16.48						

NS = Not Significant, *** Significant at $p \leq 0.001$

important part in rooting response of shoot cuttings. Nanda e*t al.* (1968) have also found seasonal variation in rooting response in the shoot cuttings of some forest species. Nanda *et al.* (1969, 1970) showed the effectiveness of exogenously applied auxins changes with seasons and further governed by morpho-physiological conditions related to bud dormancy. The supply of auxins from the base of the cuttings appears to stimulate rooting in this species. The enhancement of rooting may not be due to actual auxins applied, but perhaps a transformation of that auxin after absorption. It is also reported that natural and synthetic auxins when applied to cuttings usually increase the development of existing root primordium (Haissig, 1974). Auxins play multifarious roles related to the division and elongation of meristematic cells, differentiation of cambial initials into root primordia and in the mobilization of reserve food material, thereby enhancing the activities of the hydrolyzing enzymes (Nanda, 1970, 1975; Nanda and Kochar, 1985).

Number of roots : The number of roots per cutting vary with treatments and months highly significantly (p=0.001). The IBA 3000 ppm produced maximum number of roots (3.92) whereas minimum roots were produced in control (1.45). Same trend was observed by Tchoundjeu *et al.* (2004) in juvenile cuttings of *Pausinystalia johimbe* treated with IBA, IAA and NAA. It may be seen that IBA 3000 produced 2.26 to 2.28 times more roots than the same concentration of IAA and NAA respectively and about 2.76 times than control. In Neem

Table 5

Effect of growth regulators on number of roots in juvenile cuttings of Melia composita

Treatments	Months									
	I	II	III	IV	V	VI	VII	Mean	Sig.	CD
IBA 1000 ppm	1.23	1.10	0.98	4.73	4.73	2.38	2.55	2.53		
IBA 2000 ppm	1.35	4.23	1.78	4.90	4.90	2.90	2.70	3.25		
IBA 3000 ppm	1.75	4.95	3.33	5.23	5.23	3.43	3.53	3.92		
IAA 1000 ppm	1.28	0.73	0.80	4.63	4.63	1.68	2.48	2.32		
IAA 2000 ppm	0.88	0.55	0.85	4.40	4.40	2.23	1.95	2.18	***	0.21
IAA 3000 ppm	0.30	0.33	0.63	4.23	4.23	1.65	0.58	1.71		
NAA 1000 ppm	0.88	2.13	0.35	3.38	3.38	0.25	1.85	1.75		
NAA 2000 ppm	0.88	0.83	0.53	4.43	4.43	1.08	1.30	1.93		
NAA 3000 ppm	0.73	0.50	0.70	2.83	2.83	1.63	1.75	1.57		
0 ppm	0.35	0.35	0.63	3.20	3.20	1.85	0.55	1.45		
Mean	0.96	1.57	1.06	4.20	4.20	1.91	1.92			
Sig.				***						
CD				0.18						

*** Significant at $p \leq 0.001$

seedlings, IBA (1000 ppm) could increase the number of roots by 18 fold than compared to control (Palanisamy and Kumar, 1996). All the IBA treatments produced greater number of roots as compared to control (Table 5). Among the months, best performance was recorded in June and July planted cuttings. In addition to enhancing the rate of adventitious roots development, auxin application has been found to increase the number of roots per rooted cutting in a variety of species (Palanisamy and Kumar, 1996; Chauhan, *et al.,*1994).

Root Length : The variation among treatments and months are highly significant (p=0.001). The treatments, IBA 3000 ppm showed greater root length of 4.31 cm (Table 6). The response of various concentrations of IAA and NAA is far poor as in case of number of roots per cutting. Among the months, best results are obtained in June planted cuttings, which could produce 5.15 times more root length than May planted. As in this study, auxins are well known to play a significant role in stimulating root formation in shoot cuttings of woody plants. Many authors have reported differences in rooting frequency depending on the exogenous auxins or combination of auxins used (Felker and Clarke, 1981; Klass *et al.,* 1987) with IBA often giving best results (Teklehaimanot *et al.,* 1996; Chauhan e*t al.,* 1994).

Conclusions

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Table 6

Effect of growth regulators on mean root length (cm) of juvenile cuttings of Melia composita

Treatments	Months									
	I	II	III	IV	V	VI	VII	Mean	Sig.	CD
IBA 1000 ppm	1.24	4.36	0.83	4.81	1.48	2.81	3.17	2.67		
IBA 2000 ppm	1.97	6.91	2.09	5.94	1.91	2.98	3.58	3.63		
IBA 3000 ppm	2.18	7.25	3.03	6.93	3.40	3.77	3.63	4.31		
IAA 1000 ppm	1.27	1.71	0.23	3.84	1.84	2.80	2.96	2.09		
IAA 2000 ppm	1.44	0.21	0.63	5.92	1.59	2.17	3.09	2.15	***	1.07
IAA 3000 ppm	0.63	0.21	0.65	5.72	1.65	2.16	0.28	1.61		
NAA 1000 ppm	0.59	0.05	0.43	3.81	1.60	1.27	1.74	1.36		
NAA 2000 ppm	1.23	0.62	0.46	3.77	1.83	1.16	0.81	1.41		
NAA 3000 ppm	1.12	0.54	0.55	4.79	1.20	1.36	1.15	1.53		
0 ppm	0.39	0.04	0.50	2.84	1.20	0.24	0.35	0.79		
Mean	1.21	2.19	0.94	4.84	1.77	2.07	2.07			
Sig.				***						
CD				0.90						

*** Significant at $p \leq 0.001$

concentrations of auxin treatment on rooting ability show that treatment IBA 3000 ppm has out performed the other treatments and gave maximum rooting per cent, number of roots, root length and sprout length. Tewary *et al.* (2004) has also reported similar results in *Vitex negundo*.

The study indicates that *M. composita* can be successfully propagated through juvenile shoot cuttings treated with IBA 3000 ppm under mist chamber conditions in all months except during flowering period. The present work opens a new window of opportunity to planting and tree improvement using vegetative propagation.

SUMMARY

Melia composita **is a fast growing tree species popularly grown in homesteads and agro-forestry plantations. Effects of 1000, 2000 and 3000 ppm of IBA, IAA and NAA were studied on the rooting ability, sprouting percentage, sprout length, number of leaves, number of roots and length of roots in juvenile shoot cuttings of** ***Melia composita*** **from March 2005 to September 2005 under intermittent mist conditions. IBA 3000 ppm produced the best results giving 57.14% rooting, 3.92 roots per rooted cutting and 4.31 cm mean root length in 45-50 days. Among the months, July planted cuttings gave the best results. The technology can be used to multiply superior genotypes for tree improvement and mass propagation for afforestation programmes.**

बाल प्ररोह कलमों द्वारा *मेलिया कम्पोजिटा* विल्डे० का वर्धी प्रवर्धन कराना

आर०के० लूना व सुरेश कुमार

सारांष

मेलिया कम्पोजिटा तेजी से बढ़ने वाली वृक्ष जाति है जिसे घर आंगनों और कृषिवानिकी रोपवनों में बहुत उगाया जाता है। *मेलिया कम्पोजिटा* की प्ररोह कलमों में जड़ें निकालने की योग्यता, अंकुर निकलने का प्रतिशत, अंकुरों की लम्बाई, पत्तियों की संख्या, जड़ों की संख्या, और उनकी लम्बाई पर 1000, 2000, और 3000 भाग प्रति दस लाख भाग पानी में मिलाए इण्डोल ब्यूटिरिक अम्ल, इण्डोल एसेटिक अम्ल और न्यूक्लिइक एसेटिक अम्ल अनुप्रयुक्त कर उनसे पड़ते प्रभावों का अध्ययन मार्च 2005 से सितम्बर 2005 तक अंसतत धुन्ध दशाओं में किया गया। इण्डोल ब्यूटिरिक अम्ल 3000 भाग से सर्वोत्तम परिणाम मिले अर्थात 57.14 जड़ें निकलना, जड़ें निकली प्रत्येक कलम में 3.92 जड़ें, तथा 45–50 दिनों में जडों की माध्य लम्बाई 4.31 सेमी० रही। महीनों के विचार से जुलाई में लगाई कलमों से सबसे अच्छे परिणाम रहे। यह प्रौद्योगिकी वृक्ष सुधार हेतु श्रेष्ठ समपित्रैक बहुलित करने तथा वनीकरण कार्यक्रमों के पुंजीभूत प्रवर्धन के लिए उपयोग में लाई जा सकती है।

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