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RESEARCH ARTICLE

IBA INDUCED ROOTING CHARACTERISTICS IN CORAL BUSH: EVALUATION USING SVI CONCEPT

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ABSTRACT

Rooting ability in IBA induced rooting experiments largely depends on the medium used for rooting this has been established using SVI (sprouting value index), which, is a mathematical approach. Coral bush, *Ardesia littoralisis* a medicinal and avenue plant species of India, Sri Lanka, Myanmar and Malesia. Field studies were carried out using three rooting medium at a location in Central Kerala, Peninsular India, for three times at four months regular interval. Three IBA (Indole3-butyric acid) concentrations 100 ppm, 200 ppm and 500 ppm IBA, have been used and the data obtained was evaluated with SVI (sprouting value index) method in order to evaluate the suitable medium, which gives maximum results. The control cuttings do not recorded rooting. The results obtained indicate high SVI (sprouting value index), when stem root cuttings planted in root trainers with coir pith compost (RTCP) for all the three concentration of IBA applied. Sprouting percentage was increased and the delay in completion of sprouting/rooting initiation decreased by the use of IBA treatment.

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INTRODUCTION

Plant propagation has a global effect, as it is a fundamental occupation of human kind and its discovery dates back to the origin of civilization and ornamental gardening attained high level during the period between 500 B.C to A.D. 1000 (Harlan, 1992; Solbrig and Solbrig, 1994). The vegetative propagation of herbaceous plants can be performed easily as many of them produces bulbs, rhizomes, corms, tubers, offsets, suckers and stolons, which are natural vegetative propagating structures. But vegetative propagation in tree species is a difficult process and it is attained through hormone application mostly in stem cuttings, which eventually initiates adventitious root and shoots (Davies *et al.,* 1994; Macdonald, 1986; Ritchie, 1994).

Again, there are several mathematical expressions and explanations to measure seed germination and viability in sexually reproducing plants (Czabator, 1962; Nicols and Heydecker, 1968; Brown and Mayer, 1998; Bewley and Black, 1994; Santana and Ranal, 2004) but mathematical expressions for determining efficiency of vegetative planting material or for clonal propagation is scanty. The data obtained through the present investigation are being interpreted using sprouting value index (SVI) proposed by Nayagam (2015A).

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Ardesia littoralis is thrives well in mangrove swamps and backwaters in India, Sri Lanka, Myanmar and Malaysia (Sasidharan, 2004). The technology for regeneration from cuttings is promising for future cultivation practices as is it is often preferred as a garden species and also has medicinal value.

MATERIALS AND METHODS

Specimen collection and conduct of field trials

For the present investigation seeds were procured from the mother plants in T.C Joseph Memorial Botanical Garden, Department of Botany, Union Christian College, Aluva, (+10° 7' 30.65", +76° 20' 3.32") Ernakulam district, Kerala State, India and the stem cuttings were obtained from one year old saplings raised in the green house. All field trials were conducted in the plant nursery of T.C Joseph Memorial Botanical Garden. For the sake of large scale planting material production in mechanized gardens, trials were conducted in 100cc root-trainer blocks (24 celled) using potting mixture (RTPM), root trainers with vermicompost (RTVC) and root trainers with coir pith (RTCP) as rooting medium.

Experiment design

For all field trials, average of the three replicates during the months of February (P1), and June (P2), October (P3) during

2014were conducted in three different rooting medium such as root-trainers with potting mixture (RTPM), root trainers with vermi compost mixture (RTVC) and root-trainers with coir pith (RTCP). Stem cuttings with an average size of 7.5 to 10 cm were used. The sample size was kept twenty-four for each trials separately as the 100cc root-trainer block contains 24 cells. A non-auxin control and three Indole 3-butyric acid (IBA) concentrations were designed in this experiment with 100ppm, 200ppm and 500ppm (parts per million) in order to detect the rooting/sprouting ability by quick dip method. A randomized complete block design was employed. After 45 days, the cuttings were evaluated for rooting/sprouting percentages, mortality percentage and viability percentage. The data obtained were subjected to one factor analysis, employing analysis of variance (ANOVA) and two-way ANOVA.

Calculation of SVI

In order to calculate sprouting value index (SVI), data regarding sprouting and successful rooting percentages (SP – sprouting percentages), percentage of planting material with callus production but without rooting (CWR – callus without rooting), percentage of sound unsprouted propagule without callus production (SUP) (was determined by vertical cut test: planting material with more than two nodes living tissues was considered viable) was prepared. Viability percentage can be prepared using the formula (VP = SP + CWR + SUP), peak value (PV = maximum mean sprouting recorded at any time during the test), final mean sprouting (final MDS = cumulative percentage of full sprouting at the end of the test divided by number of days to finish sprouting) were calculated. SVI index method developed through the present study is calculated by the equation, SVI = PV * MDS.

RESULTS

Sprouting and rooting studies of stem cuttings were carried out in (2014 -June, October and February), and the various attributes obtained are given in table 1 and table 2. Table 1 gives the VP of stem cuttings in three concentrations used against the non-auxin control whereas table 2 gives SVI in different concentrations (Fig. 1).

Fig. 1. Rooted stem cutting of *Ardesia littoralis*

Callus production as well as sprouting and rooting was very poor in control. VP obtained for IBA treated stem cuttings was high with all the three concentrations used (ranging between >29.16% to 98.55%) in the rooting/sprouting medium RTVC and RTCP. With stem cuttings of *Ardesia littoralis*, maximum SVI was obtained in 500ppm treated cuttings. Maximum PV (8.33), maximum MDS final (1.94) and maximum SVI (16.16) was resulted in 500ppm treated cuttings in RTCP.

Whereas lowest PV (4.17), lowest MDS final (0.28) and lowest SVI (1.17) was resulted in 100ppm treated cuttings in RTVC. The speed of completion of sprouting/rooting is found higher in RTCP than in RTVC. The ANOVA results on callus formation and callus with root formation show significance at 1% level between concentrations of IBA.

Table 1. VP of IBA 1BA treated stem cuttings of *Ardesia littoralis*

IBA Concentration	Rooting medium	CWR	SP	SUP	VP
100ppm	RTPM	12.5	0	4.17	16.67
	RTVC	8.33	12.5	8.33	29.16
	RTCP	6.94	37.5	8.33	52.77
200ppm	RTPM	16.67	0	8.33	25.00
	RTVC	11.11	37.5	8.33	56.94
	RTCP	8.33	50.00	9.72	68.05
500ppm	RTPM	16.67	0	12.5	29.17
	RTVC	8.33	63.89	9.72	81.94
	RTCP	8.33	87.5	2.72	98.55

Table 2. SVI results of IBA treated stem cuttings of *Ardesia littoralis*

IBA Concentration	Rooting medium	PV	MDS Final	SVI
100ppm	RTVC	4.17	0.28	1.17
	RTCP	4.17	0.83	3.46
200ppm	RTVC	5.55	0.83	4.61
	RTCP	6.94	1.11	7.70
500ppm	RTVC	6.94	1.42	8.33
	RTCP	8.33	1.94	16.16

DISCUSSION

The SVI studies worked out in the present study is a mathematical approach to determine the quality of rooting material, suitability of the medium used for rooting and the optimum concentration of IBA to be used. Production of elite genotypes of any plant species can be generated by vegetative method of propagation round the year. Successful propagation using stem cuttings has been reported by several studies in various plants, which uses stem cuttings, rhizomes or other vegetative parts (Sharma & Aier, 1989; Rosier *et al.,* 2004; Hartman *et al*., 1997; Hambrick *et al.,* 1991) but rooting of stem cuttings using tree species is very scanty and treatment of the results with mathematical approach is still few.

In field trials, all planting materials gave elite performance in RTCP planting medium. In the trials using 500ppm IBA (Indole 3-butyric acid) treated cuttings also SVI was highest in RTCP (16.16). Significant differences in rooting were found between various rooting media was used, in sheanut cuttings (Akakpo *et al.,* 2014). Sprouting percentage and speed of completion of sprouting/rooting initiation increased by the use of IBA treatment (Nayagam, 2015A). However, it is shown by other workers (Akakpo *et al.,* 2014) that very high IBA concentrations have negative effect in rooting. Comparing the CWR and SUP percentages one can also assess the defects in management practices, dormancy and the genotype of the cultivar. Sprouting index value (SVI) proposed through the present study is a modified form of Germination value (GV), proposed by Czabator (1962) for seed germination studies. It is also suitable in field and nursery trials for vegetative propagation and IBA treated rooting of cuttings. The incorporation of CWR (callus production without rooting) along with SUP (sound unsprouted propagule) in calculating VP (Viability percentage) is effective in finding the field oriented defects. SVI and VP is an integrated measure of planting material quality. The speed of sprouting/rooting ability along with the completeness of sprouting can also be determined vegetative planting materials. Suitable rooting media hold considerably high rooting ability (Nayagam, 2015B; Akakpo *et al.,* 2014).

Even though SVI for control were found zero, the VP for all the IBA treated trials are between 29.16>%to 98.55% (table 1) which indicates that by using alternate methods like pretreatments and management practices, SVI can be increased. The internal physiology of the planting material may be the reason for the same. The change in planting material and IBA treatment used affects the rooting process as in the present study; SP was increased in higher concentration (500ppm IBA). Methods for reducing CWR and SUP values can increase SP and the sample in rooting medium with least difference in SP and VP value will give maximum performance. Results of the rooting experiments showed that with very high IBA concentration in sheanut tree cuttings, rooting ability decreased (Akakpo *et al.,* 2014) and hence three concentrations of IBA were used in the present experiment.

Conclusion

The present study focuses on regeneration of plantlets from stem cuttings of *Ardesia littoralis* and the data obtained were interpreted using sprouting value index (SVI) to establish suitable vegetative planting material and suitable rooting medium through field trials. Trials conducted in different rooting medium reveal the sprouting efficiency and vigor in different medium. SVI is a statistically treated data, which is obviously a modification of germination value for seed germination proposed by Czabator (1962) the incorporation of CWR (callus production without rooting) along with SUP (sound unsprouted propagule) in calculating VP (Viability percentage) makes it suitable for vegetative cultivation practices and it interprets the quality of planting material, failure due to management practices and the selection of suitable rooting medium. This method of planting stock preparation is valuable in large-scale cultivation and much promising in producing quality clonal planting material production in economically important plants in future.

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