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IBA Induced Rooting Characteristics in Night Jasmine Plant: 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. Night jasmine plant, Nyctanthes arbor-tristisL. is an ornamental plant with medicinal properties but has poor regeneration capacity from seeds naturally. Field studies were carried out using three rooting medium at a location in Central Kerala, Peninsular India, during June 2014, and repeated at four months regular interval till February 2015. Three IBA (Indole 3-butyric acid) concentrations 100 ppm, 200 ppm and 300 ppm, have been usedand 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.

I. 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 [1], [2]. 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 [3], [4], [5]. Again, there are several mathematical expressions and explanations to measure seed germinationand viability in sexually reproducing plants [6], [7], [8], [9], [10] 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 [11].

Night jasmine plant, *Nyctanthes arbor-tristis*L. is an ornamental plant [12] with medicinal properties [13], [14] but has poor regeneration capacity from seeds naturally.The lack of technology for regeneration fromcuttings was considered for selecting the plant for the experiment trials.

II. MATERIALS AND METHODS

A.Specimen collection and conduct of field trials

For the present investigation plant samples were collected from T.C Joseph Memorial Botanical Garden, of the Department of Botany, Union Christian College, Aluva, (+10° 7' 30.65", +76° 20' 3.32") Ernakulam district, Kerala State, India.Plant was identified by literature scrutiny, herbarium. All field trials was conducted in the plant nursery of T.C Joseph Memorial Botanical Garden, of the Department of Botany, Union Christian College, Aluva, (+10° 7' 30.65", +76° 20' 3.32") Ernakulam district, Kerala State, India.

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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.

B. Experiment design

For all field trials, average of the three replicates during 2014 in the months of February (P1), and June (P2), October (P3) till February 2015, 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). Stemcuttings 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 300ppm (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.

C. Calculation of SVI

In order to develop the new idea of calculating 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 unsproutedpropagule without callus production (SUP) (was determined by vertical cut test: planting material with more than three 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.

III. RESULTS

Sprouting and rooting studies of stem cuttings were carried out in three different rooting medium during three seasons(June, October and February), and the averages of various attributes obtained are given in table 1 and 2.Stem cuttings of 7 year old*Nyctanthes arbor-tristis*tree, was used as mother plants in order to obtain stem cuttings at four months interval (Fig. 1).

Table 1gives the VP of prop root cuttings in three concentrations used against the control whereas table 2 gives SVI in different concentrations. Callus production as well as sprouting and rootingwas very poor in control. High VP was obtained with all the three concentrations of IBA used (ranging between 33% to 97%) in the rooting/sprouting medium RTCP.

Fig. 1. IBA treated stem cutting of *Nyctanthes arbor-tristis*

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Table 1. VP of IBA treated stemcuttings of *Nyctanthes arbor-tristis*

IBA Conc.	Rooting Medium	CWR	SP	SUP	VP
100ppm	RTPM	4.17	0	5.55	9.72
	RTVC	2.72	8.33	5.55	16.6
	RTCP	8.33	12.5	12.5	33.05
200ppm	RTPM	5.55	0	8.33	13.88
	RTVC	6.94	34.72	9.72	51.38
	RTCP	8.33	45.83	13.89	68.05
300ppm	RTPM	5.55	0	5.55	11.1
	RTVC	6.94	50	9.72	66.66
	RTCP	8.33	75	13.89	97.22

Table 2. SVI results of IBA 300ppm treated stem cuttings of *Nyctanthes arbor-tristis*

IBA Conc.	Rooting Medium	PV	MDS Final	SVI
100ppm	RTVC	4.17	0.12	0.50
	RTCP	4.17	0.28	1.17
200ppm	RTVC	4.17	0.93	3.88
	RTCP	8.33	0.99	8.25
300ppm	RTVC	6.94	0.99	6.87
	RTCP	9.72	1.49	14.48

With stem cuttings of *Nyctanthes arbor-tristis***,** maximum SVI was obtained in RTCP (300ppm treated cuttings). The speed of completion of sprouting/rooting in RTVC was found lower than in RTCP (Fig. 2).

The ANOVA results on callus production show significance at 1% level between concentrations of IBA and significance at 5% level between media of study. The ANOVA results on callus formation and callus with root formation show significance at 1% level between concentrations of IBA and between mediums. The results wasnon significant at 5% level between years and month of study.

The ANOVA results on callus formation and callus with root formation show significance at 1% level between concentrations of IBA and significance 5% level between media of study for callus formation root production show significance at 1% level between medium of study.

Fig. 2. Rooted stem cutting of *Nyctanthes arbor-tristis*

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IV. 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 [15], [16], [17], [18]. 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 300ppm IBA (Indole 3-butyric acid) treated cuttings also SVI was highest in RTCP (14.48). Significant differences in rooting were found between various rooting media when effect of rooting, in sheanut root cuttings were performed[19]. Sprouting percentage and speed of completion of sprouting/rooting initiation increased by the use of IBA treatment [11]. However, it is shown by other workers [19] that very high IBA concentration 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 very recent method of evaluation in vegetative propagation (Nayagam, 2015A). 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 unsproutedpropagule) 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 [19], [20].

Even though SVI for control were found zero, the VP for IBA 300ppm treated trials resulted> 90% (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 (300ppm 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 [19] and hence three concentrations of IBA were used in the present experiment.

V. CONCLUSIONS

The present study focuses on regeneration of plantlets from stem cuttings of *Nyctanthes arbor-tristis*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 follows the most modern sprouting value index proposed by Nayagam (2015). The incorporation of CWR (callus production without rooting) along with SUP (sound unsproutedpropagule) 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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