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International Journal of Current Research
Vol. 6, Issue, 07, pp.7372-7375, July, 2014

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

CLONAL PROPAGATION TECHNIQUES IN *AILANTHUS TRIPHYSA* (DENNST.) ALSTON

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ARTICLE INFO

Article History:
Received 06th April, 2014
Received in revised form
14th May, 2014
Accepted 08th June, 2014
Published online 20th July, 2014

Key words:
Ailanthus triphysa, Clonal Propagation, Superior Trees, Coppice Shoots, Rooting.

ABSTRACT

Ailanthus triphysa is the most preferred species in the safety matches industry. Under the tree improvement programme, selections of this species are to be multiplied by vegetative means for large scale deployment in clonal plantations for productivity enhancement and to meet the industrial demand. Vegetative propagation by rooting of juvenile coppice shoots of *A. triphysa* was assessed by subjecting them into different concentrations of Indole Butyric acid (IBA). Juvenile shoots were collected from the stumps of the selected trees. IBA with different concentrations (250 ppm, 500 ppm, 750 ppm, 1000 ppm, 1500 ppm, 200 ppm, 2500 ppm, 3000 ppm, 3500 ppm, 4000 ppm and control) were tried to initiate rooting. 2000 ppm concentration was performing maximum level of rooting. This treatment may be used for mass multiplication of *A.triphysa*.

INTRODUCTION

Ailanthus triphysa, a member of the family Simaroubaceae is considered as a top priority species for safety matches industry as the major wood used for manufacturing of splints. Due to its fast growth rate, it attains harvestable girth in 6-8 years. Earlier *A. triphysa* was grown as mixed plantation along with Teak, *Bombax* and *Evodia*. However, since 1980 this species is being raised as pure plantations. In Kerala, there are about 2500 ha of mixed plantations and 533 ha of pure plantations (Anon, 1991) which could meet only 10 percent requirement of the matchwood industry of the state. On an average, wood based splints requirement is 1.6 crore kg per month. The matchstick industry requirement is about 10,000 tonnes per month whereas the matchstick wood availability was only 100 to 250 tonnes (The Hindu 2013). 92 per cent of total production of matches in the country is being produced in Tamil Nadu. Cottage match industry play a pivotal role in the life of people in places such as a large number of people, especially poor women, in the rural areas depend on match units for their livelihood. Adoption of short rotation tree farming species suitable for match wood industry such as *A.triphysa* should be promoted in South India (FAO, 2004). The suitability of *A. triphysa* for extensive use in match industry, steep hike in price in recent years for wood, fast growth, marketing potential has attracted farmer's attention for short term investment and substantial revenue. Non availability of large scale plantations and quality planting stock has forced researchers, forest research institutes to initiate systematic tree improvement programmes for enhancing productivity through production of quality planting stock for deploying selections in clonal plantations to cater the needs of the safety matches industry. Vegetative propagation is a valuable tool which facilitates basic genetic research and practical tree improvement programme (Libby 1974a). It is one the most potential and useful methods that need to be tried for those species, which are economically important and preserve their genetic characters (vashista Rajiv Kumar, 2009). It provides the possibility of for multiplication of selected superior trees to produce genetically homogenous which will grow predictably with uniformity. In addition improved efficiency in management and fished product utilization may also be achieved (Sutton, 2002). Reliable, cost effective propagation techniques are required to reap the gains of Improvement programme by making available superior planting stock of all the selections for deployment in clonal plantations using improved planting stock. Non-availability of vegetative propagation technique of mature trees by conventional as well as through tissue culture methods is a main obstacle in mass multiplication of *Ailanthus triphysa.* Therefore, it is essential to standardize vegetative propagation technique for *A. triphysa*. Plant growth regulators and other chemicals are widely used in vegetative propagation to improve rooting and subsequent growth of cuttings (Nadeem *et al*., 2000; Butola and Badola, 2007). Present study was carried out to standardize vegetative propagation technique for production of quality planting stock of the selections using juvenile shoot technique for productivity enhancement.

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MATERIALS AND METHODS

General details of the experiment

The experiment was carried out between March to November of 2012 at the Vegetative propagation complex of the Institute of Forests Genetics and Tree Breeding, Coimbatore, (11°00' N and 77°00' E 411 m above MSL). The climate of region is tropical wet and dry climate, according to the Köppen climate classification.

Coppice trial

Ailanthus trihysa plantations were not available on larger scale. Selections assembled at the germplasm bank at Panampalli field research station, Kanjikode, Palakad District were considered for the present study for coppicing and deriving rejuvenated coppice shoots for standardizing the vegetative propagation protocol.

Coppicing of selected trees

The selected group of trees was coppiced with a cut (Fig. 1) about 15- 20 cm above ground level. The cut end was given antifungal treatment (1gm of Red lead + 1 gm of copper carbonate in 1000 ml. linseed oil or Blue copper).

Fig. 1. Coppice shoots in *Ailanthus triphysa*

Fig. 2. Treated materials inside the Polytunnel

After 35 days, coppice shoots were ready for harvest. The shoots which were green, semi hard and fleshy were selected (Fig 2). Type of junvenile coppice shoots contributes a great deal to per cent success of rooting.

Design of the experiment

Experimental design was a Completely Randomized Design (CRD) with four replications of 25 juvenile shoots per replication for each concentration of IBA. The concentrations of IBA varied for the experiment were 250 ppm, 500 ppm, 750 ppm, 1000 ppm, 1500 ppm, 2000 ppm, 2500ppm, 3000 ppm, 3500 ppm and 4000 ppm. Rooting trials were carried out during August 2012.

Rooting phase

Five cms to 12 cms shoots were severed from the mother plants, wrapped with wet gunny bag material and transported to cutting preparation area. The leaves were reduced to less than half the original leaf size to minimize transpiration. The base of the processed shoots was treated with fungicide (0.1% Emission or 0.05% Bavistin). Immediately, the lower portion of the juvenile shoots was treated with indole butyric acid ranging from a concentration of 250 ppm to 4000 ppm using talcum powder by dip smear treatment to stimulate the root formation. Following this, the juvenile shoots were planted in root trainers containing presoaked vermiculite (exfoliated vermiculite agriculture grade IV with particle size ranging from 1 to 3mm) as a rooting media and kept under suitable environmental conditions for rooting in the poly tunnels (35-38^{o}C and humidity at 90% RH).

Hardening Phase

The rooted shoots were transferred from polytunnels to single net shade house (Fig.3). Under the single net shade house they were maintained for 35 days. The polytunnel covers were loosened in phases and the rooted cuttings were exposed to shade area gradually. The rooted cuttings were watered regularly twice a day and were given a dose of NPK solution (1gm/lit). After 35days the rooted cuttings were transferred to open nursery for exposing them for further hardening in direct sunlight. The rooted cuttings were maintained in the nursery till they attain plantable height (Fig. 4 rooted cuttings in root trainers). The rooted cuttings were transplanted to polythene bags of traditional potting mixture containing red soil, sand and farm yard manure in the ratio 2:1:1.

Fig. 3. Rooted coppice shoots of *Ailanthus excelsa*

Fig. 4. View of Individual coppice shoots

RESULTS AND DISCUSSION

All the concentrations of IBA were found to be significant at both 1% and 5% level (Table 1.)

Table 1. Analysis of variance for response of rooting to different concentrations of IBA

Source	Type III Sum of Squares	df	Mean Square	F	Sig
IBA concentrations	7578.182	10	757.818	25.623	0.00*

Table 2. Effect of different of different growth hormones on vegetative propagation of *A. triphysa* using juvenile shoots

S.No.	Treatment	Mean Rooting percentage	Standard deviation
1	IBA 250 ppm	32^{a}	± 3.26
2	IBA 500 ppm	33^{a}	±2.00
3	IBA 750 ppm	33^{a}	±2.00
4	IBA 1000 ppm	35^{a}	±3.82
5	IBA 1500 ppm	44^{b}	±5.65
6	IBA 2000 ppm	65^{d}	±6.0
7	IBA 2500 ppm	61^{cd}	±3.82
8	IBA 3000 ppm	59^{cd}	±8.86
9	IBA 3500 ppm	58^{cd}	±6.92
10	IBA 4000 ppm	53^{c}	±6.00
11	Control	29^{a}	±6.83

Values are mean ± SD
Values followed by same alphabets are not significantly different p = 0.05 (DMRT)

Vegetative propagation (rooting response) results of *A.triphysa* are given in Table 1 & 2, respectively. Results of the present study indicate that rooting response was between 29 percent (control) and 65 percent (2000 ppm). Variation in rooting response was significant among different IBA concentrations on the basis of ANOVA ($P<0.01$). The study indicated that rooting response for control set indicated inadequate quantity of natural auxins which were not sufficient to initiate rooting. The study also indicated that enhancement in rooting percentage was only possible by subjecting the juvenile shoots to different concentrations of IBA (2000 ppm, 2500ppm, 3000 ppm and 3500 ppm). Of all the concentration tried for rooting maximum success in rooting response was observed in 2000 ppm concentration of IBA (65.00 percentage). The study also revealed that maturity stage of the plant material, juvenile coppice shoots stage is the right stage to carryout vegetative propagation of this species (Manjkhola and Dhar, 2002).

The present findings are in confirmation with studies on rooting percentage reported in western hemlock *Tsuga hetrophylla*, (Foster *et al.,* 1984), *Pinus taeda* (Foster *et al.,* 1990), in *Pinus banksiana*, *Pinus ellottii* hybrid families, (Browne *et al.,*1997) in *Pinus banksiana,* (Sheperd *et al.,* 2005) in *Pinus elliottii* × *P.caribaea* families, (Hossain *et al.,* 2007) in *Swietenia macrophylla* and *Chukrasia velutina* Butola and Badola (2007) who have recommended IAA and IBA as promising treatments to improve rooting, growth and biomass in *Angelica glauca* and *Heracleum candicans.* Better responses under IBA were in conformity with the reports of its effectiveness as compared to several naturally occurring auxins in promotion of adventitious roots (Hartmann and Kester, 1983). The result of the present study is in accordance with the study carried out by Palanisamy *et al.* (1998) which revealed that IBA 2000ppm showed maximum rooting of 65%. IBA was found to be one of the best auxins for rooting in Neem, Pongmia and Teak. Further, the present study has also revealed that rooting response in *A. triphysa* can be achieved to a maximum of 65 percent which is nearer to 70 percent threshold value of economic convenience of mass multiplication of *Eucalyptus* (Wilson, 1992) and 50 percent as in medicinal plants (Pignatti, 2005). In *A. triphysa* this is first time the rooting of coppice shoot cuttings were standardized. This technique will be useful for large scale multiplication of selected trees of *A.triphysa* and establishment of clonal plantations. Generally *A.triphysa* plantations are raised through seed sources with high variations among the individuals. This technique can be used to multiply the selections to produce quality planting stock for productivity enhancement.

Conclusion

The study stressed relevance of juvenile coppice shoots for rooting success in propagation of *A. triphysa*. The interesting point of nursery business in *A. triphysa* was not possible to propagate by vegetative means, but it can be overcome by usage of juvenile coppice shoots, 2000 ppm IBA and cost effective polytunnel technique, to tap immediate gains of tree improvement programme. Therefore, improved quality planting stock of *A.triphysa* can be produced using the juvenile shoots derived selections and can be deployed in clonal plantations for productivity enhancement. Considering the marketing potential of this species, this technique has tremendous scope for easy adoption by farmers, propagators, wood based industries and has significant value in conservation and sustainable utilization in safety matches industry.

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