EFFICIENCY OF HORMONAL TREATMENTS FOR THE PROPAGATION OF VIRGINIA PINE BY CUTTINGS

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Abstract. This study was undertaken to evaluate the efficiency of growth regulator treatments to promote adventitious roots on cuttings of Virginia pine (Pinus virginiana, Mill.) under favorable environmental conditions. Our long-term goal is to use conventional clonal propagation and micropropagation techniques to reduce the time required for producing greatly improved planting stock of Virginia pine for Christmas trees.

Cuttings of average diameter with a tip bud were randomly taken from current season's growth of superior second-generation Virginia pines and trimmed to a uniform length of 3 inches. The cuttings from 2-3 year old trees were inserted in a 2:l (v/v) sphagnum peat moss and perlite rooting medium. Eight hormonal treatments were evaluated, which consisted of three IBA and/or DMS0 combinations, two commercial rooting compounds, the fungicide Captan, Hare's Powder which is frequently used for rooting pines, and an untreated control. Data from two setting dates were used to verify results and to determine possible seasonal effects on rooting. The cuttings were set in a large open greenhouse rooting facility. The time of year in which the two rounds of cuttings were set allowed comparative determinations to be made on the better time of year for rooting Virginia pine cuttings. Each setting date consisted of eight treatments x four replications x six cutting plots giving a total of 192 treated cuttings per round.

After four months, cuttings were carefully removed from the media allowing a complete evaluation of the treatments and the developing root system. The results indicate that the summer months support poor root growth and development of cuttings of Virginia pine in Alabama and that Hare's powder appears to be one of the better hormonal treatments for rooting.

Keywords: Pinus virginiana, rooted cuttings.

INTRODUCTION

Virginia pine (Pinus viroiniana Mill.) provides the southeastern United States with a renewable source of fiber, chemicals, and energy as well as aesthetic value to the landscape, watershed to farmlands, and natural habitats for wildlife. Its chief economic value is in timber and pulp paper production. The production of Virginia pine for Christmas trees has become a substantial industry throughout the southern states with approximately 300,000-400,000 seedlings being planting annually in the state of Alabama (pers. comm. 0. F. Brown). Commercial growers are currently limited to using planting stock that was originally selected for its pulpwood characteristics. Growers desire planting improved genotypes of

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higher quality stock material - more uniform trees that increase profitability. One strategy to improve the genetic qualities of Virginia pine for usage as Christmas trees is through the selection of genetically superior clones and their subsequent multiplication through vegetative propagation methods. Clonal propagation utilizes the total genetic variation that comprises a much larger effect (Foster and Shaw, 1987). In addition to the potential larger genetic gain, genetically improved plants could be delivered for large-scale planting several years before the availability of improved plants derived from seeds from the same tree source (Matheson and Lindgren, 1985). Since clonal trees will respond in a uniform manner under similar cultural treatments, this will aid the Christmas tree grower by simplifying crop maintenence and enhancing the quality of the trees produced.

The development of rooted cuttings from conifers is often a slow and difficult process. It has been demonstrated that hormone treatments are necessary for root initiation. The application of dimethyl sulfoxide (DMSO) has been used to promote a rooting reponse in several horticultural species (Edwards, 1979). DMSO increases the permeability of plant tissues to exogenously applied auxins (McKinniss, 1969). The hormone treatment that has given the better results in the rooting of pine species is the rooting powder developed by Hare (1971), of which the active ingredient is indolebutyric acid (IBA). To date, only one study (Snow and May, 1962) exits in the literature on the propagation of Virginia pine from cuttings, with time of year and hormone treatment affecting the degree of success in rooting.

The objective of this study was to evaluate the efficiency of various growth regulator treatments to promote the production of adventitious roots on stem cuttings of Virginia pine.

MATERIALS AND METHODS

Cuttings were randomly taken from second-generation select Virginia pine trees that were two-three years old from seed. The cuttings were three inches in length and of average diameter (3-4 mm) with an intact tip bud. The first group of cuttings was taken in March 1990 and the second group of cuttings was taken in June 1990. A randomized complete block design was used with eight treatments x four replications x six cuttings per plot giving a total of 192 treated cuttings per setting date. The treatments were as followed:

(1) Hare's powder 1
(2) 4000 ppm IBA + 1% DMS0
(3) 4000 ppm IBA + 0% DMSO
(4) 0 ppm IBA + 1% DMS0
(5) 10% Captan powder
(6) 16.5% Dip 'N GrowTM
(7) Hormodin 3TM
(8) Untreated control

Cuttings were treated with the potassium salt of indolebutyric acid (K- IBA) with the IBA and DMS0 treatments prepared using a 50% ethyl alcohol base. The Captan treatment was talc-based, similarly was Hormodin 3 containing 0.8% IBA. The Dip 'N Grow solution was mixed in distilled water.

The treated cuttings were set one inch deep in 10 inch ^{3} Leach Super Cells^{TM} containing a 2:1 mixture of shredded sphagnum peat moss and perlite. They were subsequently placed in a temperature and humidity controlled greenhouse at International Forest Seed Company (Odenville, Alabama) with intermittent fogging and irrigation (Hughes, 1987).

[1] A talc formulation containing 1% each of the auxins IBA and 1-phenyl-3-methyl-5-pyrazolone (PPZ), 10% powdered sugar, 20% captan fungicide, and 1% of the growth retardant n-dimethylaminosuccinamic acid (B-Nine) (I-I-10-20-I).

After four months, percentage rooted cuttings per plot (RC) was assesses on a plot basis. A Chi-square (X^2) test using a 2 x 8 contingency table was conducted with data from each trial to assess treatment differences.

RESULTS AND DISCUSSION

A large difference in overall rooting was attributed to the seasonal and cultural environment effects. Differences among treatments were seen in the percent rooting of the March (Table l) and June (Table 2) cuttings.

Table 1. Rooting percentages for March setting of Virginia pine cuttings.

	Replication				
Treatment	1	2	3	4	x%
Hare's powder	16.7	66.7	50.0	50.0	45.8
4000 ppm IBA + 1% DMS0	0.0	0.0	0.0	16.7	4.2
4000 ppm IBA + 0% DMS0	40.8	0.0	0.0	0.0	10.2
0 ppm IBA + 1% DMS0	0.0	16.7	16.7	0.0	8.3
10% Captan	0.0	0.0	0.0	0.0	0.0
16.5% Dip 'N Grow ™	0.0	16.7	16.7	33.3	16.7
Hormodin 3™	0.0	16.7	16.7	16.7	12.5
Untreated control	0.0	0.0	16.7	0.0	4.2

Overall x = **11.97%**

Table 2. Rooting percentages for June setting of Virginia pine cuttings.

	Replication				
Treatment	1	2	3	4	x%
Hare's powder	0.0	16.7	16.7	0.0	8.3
4000 ppm IBA + 1% DMS0	0.0	16.7	0.0	0.0	4.2
4000 ppm IBA + 0% DMS0	0.0	0.0	0.0	0.0	0.0
0 ppm IBA + 1% DMSO	0.0	0.0	0.0	16.7	4.2
10% Captan	0.0	0.0	0.0	0.0	0.0
16.5% Dip 'N Grow ™	0.0	0.0	50.0	0.0	12.5
Hormodin 3 ™	0.0	16.7	0.0	16.7	8.3
Untreated control	0.0	0.0	0.0	0.0	0.0

Overall x = **3.8%**

Although treatment differences were statistically non-significant ($X^2 = 7.04^{NS}$) for the March cuttings, the Hare's powder treatment proved to be the most effective with 45.8% of the cuttings rooted. The other treatments ranged from 0-16.7% rooting, which is more or less ineffective. The average rooting percentage for the March cuttings was 11.97% (Table 1).

The June cuttings gave a very poor result with non-significant treatment differences. The setting date for these cuttings *was* June 22, 1990. The average rooting percentage for the June cuttings was 3.8% (Table 2). The only conclusion that could be reached was, when using our system, Virginia pine cuttings should not be set for rooting during the hot summer months when cuttings are prone to dessicate and die.

As in many tree species, season of the year is an important factor in the rooting of cuttin gs. Snow and May (1962) achieved far greater rooting of IBA treated cuttings taken in December (72%) and March (18.6%) than we did for March and June cuttings. Their higher rooting percentage in March might be attributed to the use of past season's growth of much older material (eight or nine year old trees) versus the current **season's** growth from two-three year old trees in our study. Also, they may have set cuttings earlier in March, indicating that March may be too late to take cuttings from Virginia pine trees ready to flush, which may inhibit rooting.

Given our better results in March, we intend to repeat the study at various times during the November to March time period. DMSO with and without IBA needs to be further investigated along with other concentrations of IBA. The study by Mahalovich et al. (1987) showed that in the absence of auxin, DMSO treatments may increase permeability, possibly mobilizing endogenous auxins to produce high rooting percentages.

This study provides us with preliminary, yet very useful information on the rooting of Virginia pine. Requirements for optimum rooting need to be defined requiring further experimentation with the various parameters that effect rooting, pertaining to both donor and environment. Continuation of this effort will provide genetically improved Virginia pine trees to Christmas tree producers in the southeast.

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