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Effects of Wounding and Auxin Treatment on Rooting Stem Cuttings of Fraser's Photinia[1]

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Abstract

Light or heavy wounding applied to stem cuttings of Fraser's photinia *(Photinia x fraseri* Dress) had little effect on stimulating rooting. The greatest response from wounding was realized when used in combination with a 5000 or 10,000 ppm indolebutyric acid (IBA) solution. Satisfactory rooting, however, was attained by IBA treatment alone.

Index words: propagation, auxin, indolebutyric acid

Introduction

A common practice when preparing stem cuttings of Fraser's photinia *(Photinia x fraseri* Dress) for rooting is to first administer a heavy wound followed by auxin treatment (1). Recent preliminary studies at N.C. State Unversity have indicated that light wounding or no wounding at all may be satisfactory, provided proper auxin treatment is used. Therefore, the following study was undertaken to investigate the effects of various wounding treatments with and without subsequent auxin application on the rooting of Fraser's photinia stem cuttings.

Material and Methods

Hardwood, terminal stem cuttings, each 15 to 20 cm (6 to 8 in) long of Fraser's photinia were taken on February 3, 1982 from stock plants growing under uniform fertility levels at Goldsboro, North Carolina. As cuttings were harvested, they were sealed in plastic bags, placed in a cooler with ice, transported to Raleigh, and stored overnight in the dark at 4°C (39.2°F). The next day, cuttings were trimmed from the base to 10 cm (3.9 in), leaves removed from the basal 5 cm (2.0 in) and the following treatments employed: (1) nontreated, (2) 5000 ppm (0.5%) indolebutyric acid (IBA), (3) 10,000 ppm (1.0%) IBA, (4) light wound, (5) light wound + 5000 ppm IBA, (6) light wound + 10,000 ppm IBA, (7) heavy

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wound, (8) heavy wound + 5000 ppm IBA, and (9) heavy wound + 10,000 ppm IBA.

Light wounding consisted of 2 equidistant vertical incisions on the basal stem to a depth reaching secondary xylem, each about 30 mm (1.2 in) in length and parallel to the longitudinal axis. A heavy wound consisted of removing from the basal stem a 30 x 4 mm (1.2 x 0.2 in) strip of bark parallel to the longitudinal axis, thereby exposing the cambium. Following wounding, particular groups of cuttings were treated with IBA solutions which had been prepared by dissolving reagent grade IBA in 50% isopropyl alcohol. When treating cuttings with IBA, the basal 2 cm (0.8 in) was dipped into the IBA solution for 1 second followed by 15 minutes of air drying before insertion into the rooting medium. Cuttings were inserted to a 5 cm (2.0 in) depth in individual, 6 cm^2 (2.4 in^2) plastic rose pots containing a moist medium of 1 peat:1 perlite (by volume).

Individual pots were placed on a single raised bench in a greenhouse maintained at approximate day/night temperatures of 24.0°/15.5°C (75°/60°F). Intermittent mist operated 3 seconds every 3 minutes from 0700 to 1900 hours daily. A natural photoperiod with full light intensity was supplied. The experimental design was a randomized complete block using 6 cuttings per treatment and 5 replications.

Fifty-three days after the experiment was initiated, cuttings were harvested and data recorded. Data included the number and length of primary roots greater than 1 mm (0.04 in) in length. Any cutting having 1 or more roots was classified as rooted. Percentages were transformed with the angular transformation and data subjected to standard analysis of variance procedures.

Results and Discussion

In the absence of IBA, light or heavy wounding had little or no effect on stimulating rooting (Table 1). In the presence of IBA, however, wounding significantly increased percent rooting with the heavy wound + 5000 ppm IBA and the heavy wound + 10,000 ppm IBA being the best treatments. Although the heavy wound in combination with 5000 or 10,000 ppm IBA produced the highest percent rooting, there were no significant differences in percent rooting whether cuttings were treated with either concentration of IBA alone or in combination with light or heavy wounding.

The greatest response from wounding was observed in terms of increasing both the number of roots per cutting and root length (Table 1). Either light or heavy wounding + 10,000 ppm IBA stimulated a significantly greater number of roots per cutting than any of the other treatments. A somewhat similar relationship was noted for root length with the heavy wound + 5000 ppm IBA resulting in the greatest root lengths (Table 1).

Although both wounding treatments + 10,000 ppm IBA, and the heavy wound + 5000 ppm IBA produced the greatest root numbers and root lengths respectively, the number of roots per cutting and root length achieved by the auxin treatments alone were of sufficient magnitude for commercial acceptance. For example, the heavy wound + 10,000 ppm IBA resulted in 21.7 roots per cutting with a mean root length of 54.1 mm (2.1 in) while the 10,000 ppm IBA treatment resulted in 15.5 roots per cutting with a mean root length of 49.2 mm (1.9 in). The number of roots was significantly different while mean root length was not. Thus, a situation existed where wounding whether light or heavy in combination with auxin resulted in significant increases in root number and length. However, the benefits to be derived from increases in root number and length resulting from wounding are questionable since both the 5000 and 10,000 ppm IBA treatments did an adequate job in stimulating rooting.

A problem observed with the use of 10,000 ppm IBA was basal stem necrosis. Although the degree of necrosis varied from cutting to cutting, all cuttings treated with the higher IBA concentration with or without wounding showed auxin injury. Injury ranged from 1 to 2 cm (0.4 to 0.8 in) on the basal stem. This might have been avoided by using a slightly lower IBA concentration such as 7500 ppm since the 5000 ppm concentration caused no observable injury.

The results reported herein demonstrate that the critical factor in stimulating rooting of Fraser's photinia stem cuttings is treatment with a proper IBA concentration applied as a concentrated liquid. This is consistent with previous work on this species (1). Although

Table 1. Effects of wounding with and without subsequent IBA treatment on the rooting of Fraser's photinia stem cuttings.

Treatment	Rooting Percentage[z]	Mean no. roots/ cutting[y]	Mean root length (mm)[y]
Nontreated	3.3bc[x]	1.0d	7.0c
5000 ppm IBA	90.0a	8.8c	43.3b
10,000 ppm IBA	96.6a	15.5b	49.2ab
Light wound	0.0c	——	——
Light wound + 5000 ppm IBA	96.6a	10.5c	48.5ab
Light wound + 10,000 ppm IBA	96.6a	20.1a	54.6ab
Heavy wound	13.3b	0.2d	14.8c
Heavy wound + 5000 ppm IBA	100.0a	10.1c	62.7a
Heavy wound + 10,000 ppm IBA	100.0a	21.7a	54.1ab

[z]Each value is based on 30 cuttings.

[y]Values are based on the number of cuttings which rooted for a particular treatment.

[x]Means within columns followed by the same letter or letters are not significantly different using Duncan's Multiple Range Test at the 5% level.

wounding in combination with auxin may further stimulate rooting, the additional benefits to be gained from wounding are questionable and could be eliminated, thus reducing labor costs during preparation of cuttings.

Significance to the Nursery Industry

The results of this study indicate that light or heavy wounding in combination with IBA treatment need not be applied to Fraser's photinia stem cuttings to achieve satisfactory rooting. Adequate rooting can be attained simply by treatment with a concentrated IBA solution within a range of 5000 to 10,000 ppm. Elimination of wounding during preparation of cuttings will reduce labor costs.

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Soilless Mixes for Nursery Production

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I've had the opportunity to travel quite extensively up and down the East coast and into the Mid-West to visit nurserymen and had an opportunity to look at some of the soilless mixes that they are using for their production. Many have developed their mixes on a "by guess and by golly" approach, while others have proceeded to take a more scientific approach. The one mix that we find most often is the UC mix or 50% peat and 50% sand. That one seems to have stood the test of time and is used by many growers throughout the East coast. Other more adventuresome souls have experimented with such additives as perlite, vermiculite, hardwood and softwood bark, sewage sludge, styrofoam, sawdust, corn stalks, ground up rubber tires and other materials. It seems as if a company has a product that is of no value to anyone in the U.S. they always try to sell it to a nurseryman. This becomes very irritating, I would think, to you folks and to me personally because when I was with Extension work we were constantly questioned and queried and would we try this and would we try that. It just gets to be a hassle.

The first thing I'd like to look at is, "What do we really expect a mix to do? What do you as a nurseryman want the mix to do?" Well, first of all, the mix has to provide an anchor for the plant. It has to keep the plants in an upright position, hopefully hold them in place during strong winds, rains and other adverse weather conditions you might have. We want to provide an ideal environment for the roots, for the oxygen and the carbon dioxide exchange. And finally, we want it to last for long periods of time—up to 2-3-4 years, depending upon how quickly you can sell the crop.

Now, what do we look for in a mix? First of all, it has to be free from insects, diseases and weeds. It should also be free from harmful chemicals, such as herbicides, industrial pollutants, and other things. I have had the misforture of being called in three different times this year on chemical problems with container-grown nursery crops. They all involved herbicides of one type of another, mostly soil sterilants that had gotten into the mix either through the injector system, through run off into the irrigating ponds or, in one particular instance, it seemed to be that the nurseryman had a "friend" that didn't like him and put a few herbicides in his mix. And that happens, it really does, unfortunately.

What other things do we look for in a mix? We need good drainage and aeration. The roots cannot absorb water or nutrients except in the presence of oxygen. As the roots grow, they give off carbon dioxide which if it's not allowed to be taken from the mix, can become toxic to the roots themselves. The mix must drain well, but it should not shrink away from the side of the pot; so that when you irrigate, the water simply runs down the edge of the pot and out the bottom and does not wet the root system thoroughly. The soil mix should have about 30% air space in order to develop a root system such as you see here. It must be able to hold fertilizer, for short periods of time anyway, while the plants grow and develop.

The nutrient capacity of mixes varies quite extensively depending upon the material that is put into the mix. However, this is an area that is being worked on more and more by university people and we're finding that we actually know very little about the nutrient requirements for many of these plants. Soil tests are being developed to test for specific elements: nitrogen, phosphorus and potash. But we're finding that nitrogen, especially in the nitrate form, if it's not taken up fairly quickly by the plants, simply passes through the media and out the bottom of the pot. If bark is incorporated in the mix, we're finding that the ammonium is tied up very rapidly by the bark particles. And phosphorus, if you were growing in a soil mix, would become tied up in a soil, but in a

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