Branching of *Photinia* x *fraseri* in Response to Growth Regulators and Fertilizer[1]

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Abstract

Container grown photinia plants treated with 6-benzylamino purine (BA) or dikegulac (Atrinal) had 3 to 4 times as many branches as untreated plants. Branching was greatly increased by applying 10 to 15 gm (2-3 tsp) of Osmocote 18N-2.6P-10K (18-6-12) to supplement the fertilizer in the container mix. Application of Atrinal increased branching an additional 100% at the highest fertilizer level. Hand pinching the day before the first Atrinal application increased branching in one experiment, but hand pinching 11 days before the first Atrinal application had no effect on the response to Atrinal in another experiment. BA and N-(phenylmethyl)-9-(tetrahydro-2H-pyran-2-yl)-9H-purin-6-amine (Accel) increased branching when applied with Off-Shoot-O (OSO), and had less effect or no effect without OSO. Adding a phosphate buffer (Buffer-X) to prevent precipitation of BA further increased the response to the BA plus OSO treatment.

Index words: Atrinal, BA, Accel, Off-Shoot-O, chemical pinching

Introduction

Chemical pruning or pinching has been an accepted nursery and greenhouse practice with a few kinds of plants ever since the fatty acid derivatives became available for this purpose in the 1960's (2, 5, 8), Dikegulac (Atrinal) is now used for chemical pruning of greenhouse and nursery azaleas (*Rhododendron*) (3, 4). It has been shown to increase branching of other nursery plants including Japanese holly (*Ilex crenata* 'Compacta') (15), euonymus (*Euonymus fortunei* 'Colorata') (7), photinia (*Photinia* X *fraseri*) (9, 13), camellia (*Camellia* X) (14), and various other ornamentals (10).

Cytokinins promote branching by stimulating growth of axillary buds. A combination of the cytokinin Accel and OSO resulted in increased branching of photinia and Exbury azaleas (12). BA induced bottom breaks in roses (*Rosa*) (11) and promoted axillary shoots in Japanese holly (17) and in photinia, especially when applied with OSO (13).

The research reported here is a continuation of studies on the response of photinia to Atrinal and to the cytokinins, with emphasis on nutritional status of the plants, timing in relation to stage of growth, and treatments to enhance the growth regulator activity.

Materials and Methods

Except in Experiment 2, 1-yr-old photinia plants were transplanted from 7.6 cm (3 in) square peat pots into 3.8 liter (#1) containers in a mix of sphagnum peat, bark (Douglas fir and hemlock), and sand (6:1:1 by vol.) with 10N-2.6P-3.3K (10-6-4) fertilizer added at 5.9 kg/m^3 (10 lb/yd^3). The plants in Experiment 2 were growing in a predominantly sawdust mix in 3.8 liter (#1) containers in which they were rooted at a commercial nursery.

A randomized complete block design was used in all experiments. Ten single-plant replications were treated in all except the first experiment, where 4 replications of 6 plants per treatment were used. Plants were growing outdoors in all experiments. Growth regulators were applied with a 1-liter (1.06 qt) compressed air sprayer. Where hand pinching was one of the treatments, this was accomplished by removing approximately 2.5 cm (1 in) of soft shoot tip.

Experiment 1. In this experiment the plants were treated while still growing in the peat pots. The treatments were 2 or 3 applications of Atrinal at 3000 ppm, 1 application at 6000 ppm, or a combination of OSO at 4.2% with BA at 3000 or 6000 ppm. Treatments were started on May 8, with repeat applications of Atrinal on June 1 and June 15. These treatments were compared with untreated controls, plants hand pinched once, or sprayed once with OSO at 4.2%. The plants were transplanted June 8 into 3.8 liter (#1) containers.

Experiment 2. Immediately before growth regulator treatments were applied, the plants were divided into 3 groups for differential fertilizer application. One group received 5 gm (1 tsp) of Osmocote 18N-2.6P-10K (18-6-12), the second received 10 gm (2 tsp), and the third received no supplemental fertilizer besides what was in the mix when the plants were received from the nursery. Growth regulator treatments were BA with OSO, Atrinal, hand pinch, and hand pinch followed by Atrinal. The Atrinal treatments consisted of 2 applications, August 21 and 31.

Experiments 3 and 4. Differential fertilizer treatments applied immediately after transplanting were 0, 5, and 15 gm (0, 1, and 3 tsp) of Osmocote 18N-2.6P-10K (18-6-12) per plant. In Experiment 3, growth regulator treatments were OSO at 3% on July 12, 1982, followed by Atrinal at 3000 ppm on July 19 and 26. These treatments were compared with Atrinal without the OSO pre-treatment, OSO alone, and an untreated control.

In Experiment 4, Atrinal at 3000 ppm was applied July 19, 11 days after hand pinching, with a second application 1 week later. Atrinal was also applied on plants that were not pinched, and these 2 treatments were compared with untreated controls and plants pinched only.

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Experiment 5. Treatments applied August 6 were BA, BA plus OSO, and Accel plus OSO. The BA sprays were applied with or without the addition of a phosphate buffer (Buffer-X) at 0.3% to determine its effect in increasing activity by preventing precipitation of BA.

Results and Discussion

Experiment 1. Plants treated with OSO plus BA at 3000 or 6000 ppm, 2 or 3 applications of Atrinal at 3000 ppm, or 1 application of Atrinal at 6000 ppm, had 3 to 4 times as many branches as untreated plants (Table 1).

Plant height was reduced 14 to 30% by the OSO plus BA treatments, and 41-50% by the Atrinal treatments.

Experiment 2. Unsprayed plants treated with the higher rate of Osmocote (10 gm, 2 tsp) had nearly 4 times as many branches as plants with no supplemental fertilizer (Table 2). The number of branches was nearly doubled again by application of Atrinal. Hand pinching the day before Atrinal application increased response to Atrinal on plants with no supplemental fertilizer, and decreased the response at the high level of Osmocote. BA with OSO had no significant effect on branching, possibly because a lower concentration of OSO (2%) was used than in other experiments.

Experiments 3 and 4. As in the previous experiment, fertilizer applications greatly incrased branching (Table 3). Two applications of Atrinal further increased branching, to at least 4 times as many branches as on unsprayed plants at the low Osmocote level, and twice as many at the higher level. OSO did not affect branching, and a pretreatment with OSO did not affect the response to Atrinal. Plants fertilized with Osmocote tended to be up to 30% taller than without supplemental fertilizer. Atrinal significantly reduced height in plants that received the high rate of Osmocote (Table 3).

In Experiment 4, Atrinal application greatly increased branching regardless of nutritional status, but the highest number of branches was on plants that also received Osmocote (Table 4).

Hand pinching reduced plant height and greatly increased branching, especially in the plants with no supplemental fertilizer or 5 gm (1 tsp) Osmocote per plant (Table 4). This is contrary to most previous experiments, where branching was not significantly increased by hand pinching (Tables 1 and 2, and ref. 11 and 12).

Plants treated with Atrinal had nearly twice as many branches as hand pinched plants, and hand pinching 11 days before the first application did not affect the response to Atrinal (Table 4). It did have an effect in an earlier experiment (Table 2). Hand pinching before Atrinal application has been suggested for uniform shaping of greenhouse azaleas and as an alternative procedure for other plants (1).

Experiment 5. As in most previous experiments, BA applied with OSO greatly increased branching (Table 5). When Buffer-X was added, the number of branches was nearly twice as many as from the BA plus OSO treatment without added buffer. BA had a much smaller effect when applied with Buffer-X, but without OSO.

Table 1. Effects of growth regulators on branching and height of photinia. Experiment 1, 1981.

Treatment	Rate (ppm)	Number of branches[z]	Plant height (cm)
Untreated	—	1.8 a	86 a
Hand pinch	—	2.3 a	67 cd
Off-Shoot-O[y]	—	1.9 a	81 ab
Off-Shoot-O[y] + BA	3000	6.8 bc	74 bc
Off-Shoot-O[y] + BA	6000	7.9 c	60 de
Atrinal — 3 applications	3000	7.3 bc	43 f
Atrinal — 2 applications	3000	5.6 b	50 f
Atrinal — 1 application	6000	5.6 b	51 ef

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

[y]Off-Shoot-O was applied at 4.2% (v/v).

Table 2. Effect of fertilizer and growth regulator treatments on branching, Experiment 2, 1981.

		Number of branches[z]		
		Amount of Osmocote (gm)		
Treatment	Rate (ppm)	0	5	10
Untreated	—	1.1 a	3.0 a-d	4.3 c-f
Off-Shoot-O (2%)	—	1.8 a-c	2.5 a-d	3.5 a-e
Off-Shoot-O (2%) + BA	2000	3.3 a-e	3.1 a-e	3.9 b-f
Atrinal[y]	3000	1.6 ab	5.1 d-f	8.5 g
Hand Pinch	—	3.2 a-e	2.8 a-d	2.9 a-d
Hand Pinch + Atrinal[y]	3000	5.0 d-f	5.7 ef	6.1 f

[z]Means followed by the same letter or letters are not significantly different at the 5% level as determined by Duncan's Multiple Range Test.

[y]Two applications, 10 days apart.

Table 3. Effect of supplemental fertilizer application on response to Atrinal, Experiment 3, 1982.

Pre-treatment[z]	Atrinal treatment[y]	Osmocote (gm/plant)	Number of branches[x]	Plant height[x] (cm)
None	—	0	0.2 a	63 abcd
	—	5	2.0 a	78 abc
	—	15	7.2 b	82 ab
Off-Shoot-O	—	0	0.6 a	62 cd
	—	5	0.7 a	83 a
	—	15	6.7 b	76 abc
Off-Shoot-O	+	0	2.3 a	54 de
	+	5	8.0 b	58 cde
	+	15	14.9 c	51 e
None	+	0	1.0 a	54 de
	+	5	7.3 b	62 bcd
	+	15	13.7 c	55 de

[z]Pre-treatment with Off-Shoot-O at 3% (v/v) was July 12.

[y]+ = Atrinal was applied at 3000 ppm on July 19 and 26.

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

Table 4. Effects of supplemental fertilizer application on response to hand pinching and Atrinal application, Experiment 4, 1982.

Pre-treatment[z]	Atrinal treatment[y]	Osmocote (gm/plant)	Number of branches[x]	Plant height[x] (cm)
None	—	0	1.0 a	54.6 b
	—	5	1.8 a	70.0 a
	—	15	5.5 bc	62.2 ab
Hand Pinch	—	0	4.8 b	36.6 cd
	—	5	4.7 b	34.6 cd
	—	15	6.7 bcd	40.1 c
Hand Pinch	+	0	8.0 cde	32.1 cd
	+	5	9.4 def	28.3 d
	+	15	11.1 f	30.8 cd
None	+	0	7.7 cde	38.8 c
	+	5	9.5 ef	37.1 cd
	+	15	11.1 f	35.0 cd

[z]Pre-treatment by removing the growing tip by hand was done July 8.

[y]+ = Atrinal was applied at 3000 ppm on July 19 and 26.

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

Accel had no effect without OSO. Applied at 1000 ppm with OSO, it resulted in approximately 3 times as many branches as on untreated plants (Table 5).

Off-Shoot-O by itself does not affect branching of photinia. Its effect in increasing branching when applied with the cytokinins may be as a surfactant, aiding the penetration of cytokinin to the meristematic region of the axillary buds. Studies on penetration and movement of methyl decanoate, the principal ingredient of OSO, indicate that it readily penetrates young epidermal cells and diffuses to inner tissues (6, 16).

Significance to the Nursery Industry

Where growth regulator applications can be used to control plant shape and size, efficiency of nursery production may be improved. Many variables enter into the successful use of any growth regulating chemical. Nutritional status of the plants affected branching and the response to chemicals that promoted branching. Hand pinching before the start of Atrinal applications did not give consistent results. More work is needed on this response. If chemical application can completely substitute for any manual pinching or pruning, the treatments will be more useful. The effects of OSO and Buffer-X on activity from the cytokinins emphasizes the importance of having the proper spray formulation to produce the desired results.

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Table 5. Branching response from two cytokinins and effects of application with Off-Shoot-O or Buffer-X. Experiment 5, 1982.

Cytokinin	Rate (ppm)	Off-Shoot-O[z]	Buffer-X[y]	Number of branches[x]
None		—	—	0.7 a
None		+	—	0.7 a
None		+	+	1.2 ab
BA	1000	—	+	1.7 bc
BA	1000	+	—	3.3 d
BA	1000	+	+	6.0 e
Accel	500	—	—	1.1 ab
Accel	1000	—	—	0.9 a
Accel	500	+	—	1.7 bc
Accel	1000	+	—	2.0 c

[z]+ = Off-Shoot-O added at 4.0% (v/v).

[y]+ = Buffer-X added at 0.3% (v/v).

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

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Occurrence of Cercospora Blight on *Cryptomeria japonica (L.f.) D. Don in the United States*[1]

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Abstract

This is the first report of the occurrence of *Cercospora sequoiae* as a pathogen of *Cryptomeria japonica* in the United States. Koch's postulates were fulfilled on rooted cuttings indoors; the fungus caused dark brown lesions on succulent needles and stems. Conidiophores were fascicled and measured 40-107 µm. Conidia were brown, 33-80 µm x 4-6 µm, echinulate and 3-8 septate.

Index words: *Cryptomeria, Cercospora* blight

Introduction

Cercospora blight of *Cryptomeria japonica* (L.f.) D. Don., caused by *Cercospora sequoiae* Ellis & Everhard (C. *cryptomeriae Shirai*), is the most destructive forest nursery disease in Japan (3). The disease is widespread in Japan where epidemics on *Cryptomeria* seedlings may occur. *Cryptomeria* seedlings may be killed within a single season, while young trees may die in a few years. Lesions that occur on young trees are perennial and may develop as sunken cankers on mature trees (4).

A blighted specimen of *Cryptomeria japonica* was received from a landscape in Lanexa, VA by the VPI & SU Plant Disease Clinic in 1982 and determined by the

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