Effects of Rate and Repeat Application of Flurprimidol on the Growth of *Photinia* × *fraseri* and *Ilex crenata* 'Compacta'[1]

Adolph J. Laiche, Jr.[2]
South Mississippi Branch Experiment Station
Mississippi State University
Poplarville, MS 39470

Abstract

Flurprimidol, α-(1-Methylethyl)-α-[4-(trifluoromethoxy)phenyl]-5-pyrimidine-methanol, was applied to three month plants of *Photinia* × *fraseri* in 5.6 L (6 qt) containers and *Ilex crenata* 'Compacta' in 2.8 L (3 qt) containers as foliar sprays at 0, 33, 66, 132, 264, 528, 1056, 2112, 4224, and 8448 ppm. Growth-medium drench applications with flurprimidol were applied at 0, 2, 4, 8, 16, 32, 64, 128, 256, and 512 ppm solution, 0.5 L (17 oz) per 5.6 L (6 qt) container to *Photinia*. The initial foliar spray treatments and the growth medium drench treatments were applied on July 14, 1983. All test plants were planted in soil on December 9, 1983. Foliar spray treatments were repeated on July 19, 1985.

Flurprimidol at low concentrations as a spray and drench substantially reduced plant size with little or no phytotoxicity. Duration of growth suppression increased as rate increased. Flurprimidol at low rates reduced growth for the remainder of the growing season in which it was applied. At higher rates growth was also reduced in the following growing season. Minor leaf distortion of smaller leaves was obtained at low rates and leaf distortion appeared to increase slightly at higher rates. Shoot growth after the effects of flurprimidol were no longer apparent appeared normal. Results indicate that flurprimidol alone and in conjunction with pruning can be helpful in maintaining woody landscape plants to a desirable size.

Index words. Growth substances, woody plants

Introduction

Container-grown woody landscape plants generally require pruning to improve quality and maintain shoot growth proportional to container size. In the landscape, pruning is needed to maintain plants in the desired shape and size for maximum utilization and beauty. Mechanical pruning is expensive. Growth retardants offer a promising solution to reduce costs by replacing all or part of the required pruning to maintain woody landscape plants.

Flurprimidol ("Cutless" trademark registered by Elanco Products Co., a division of Eli Lilly and Co., Indianapolis, IN 46285), α-(1-Methylethyl)-α-[4(trifluoromethoxy)phenyl]-5-pyrimidine-methanol, is a foliar and root active plant growth regulator that reduces internode elongation (1). Flurprimidol as a media drench of 1.5 and 3 mg/pot reduced shoot growth and increased green pigmentation of *Ilex* × *meserveae* 'Blue Princess' (3). Media drench applications of flurprimidol have reduced the growth of peach (5) and pecan seedlings (6), poinsettia (2), and chrysanthemum (8). Reduced growth has also been obtained with flurprimidol as a foliar spray on peach seedlings (5) and *Hisbiscus coccineus* Walt (4). Stem height, plant quality, inflorescence width and leaf area of *Asclepias Tuberosa* were not affected by foliar sprays of flurprimidol at 0, 5, 10, and 15 mg ai/L. Plant dry weight decreased as flurprimidol concentration increased (7).

Little information is available on the duration of growth suppression and the effects of repeat application of growth suppression agents on woody landscape plants. The objectives of this study were to determine the degree and duration of the growth retardation, and the effects of a repeat application of flurprimidol on commonly grown southern landscape plants.

Materials and Methods

Liners of *Photinia* × *fraseri* and *Ilex crenata* 'Compacta' were planted in 5.6 and 2.8 L (6 and 3 qt) containers, resp., on April 14, 1983. The growth medium of 4 pinebark : 1 sand (v/v) was amended with 4.4 kg/m^3 (7.5 lbs/yd^3) of dolomitic lime, 0.6 kg/m^3 (1 lb/yd^3) of ON-8.6P-0K (0-20-0), 0.6 kg/m^3 (1 lb/yd^3) of 8N-3.4P-6.6K (8-8-8), 74 g/m^3 (2 oz/yd^3) of Peters fritted trace elements 555, and 2.2 kg/m^3 (3.7 lbs/yd^3) of 18N-2.6P-10K (18-6-12) slow release fertilizer (Osmocote). A 12N-2.6P-5K (12-6-6) fertilizer was surface applied at the rate of 4.6 g (0.2 oz) per container on June 6 and 20. Slow release 18N-2.6P-10K (18-6-12) was surface applied on July 18, 1983, at the rate of 19 g (0.67 oz) per 5.6 L (6 qt) container and 10 g (0.36 oz) per 2.8 L (3 qt) container, resp.

The first of two applications of flurprimidol was applied as a foliar spray on July 14, 1983 to container-grown plants. Spray application rates were 0, 33, 66, 132, 264, 528, 1056, 2112, 4224, and 8448 ppm. One application of flurprimidol as a growth-medium drench was applied on July 14, 1983. Growth-medium drench rates were 0, 2, 4, 8, 16, 32, 64, 128, 256, and 512 ppm solution applied 0.5 L (17 oz) per 5.6 L (6 qt) container. In separate experiments 'Compacta' holly and *Photinia* received spray applications replicated 5 and 4 times, resp. In a third experiment *Photinia* received growth-medium drench applications replicated 4 times. All plants were grown in randomized complete block designs with 1 container-plant as an experimental unit.

The 3 experiments were continued in the field after transplanting in soil on December 9, 1983. Three replications of each experiment were planted in rows 1.5 m (5 ft) apart and plants within the row were spaced 1.5 m (5 ft) apart.

[1]Received for publication May 5, 1988; in revised form July 25, 1988. Published with the approval of the Director of the Mississippi Agricultural and Forestry Experiment Station as Scientific Contribution No. *J-6922*.

[2]Professor of Horticulture.

Osmocote 12N-2.6P-.5K (18-6-12) at the rate of 8.8 g (0.31 oz) for *Ilex* and 17 g (0.6 oz) for *Photinia* was placed at the bottom of the planting hole prior to transplanting. A 0.9 m (3 ft) wide band of black 4 mil polyethylene was placed as a mulch on the top of each row to control weeds. All plants were fertilized with 12N-2.6P-5K (12-6-6) several times per year to maintain vigorous growth during the 1984, 1985, 1986, and 1987 growing seasons.

Photinia plants that received the initial foliar application of flurprimidol were pruned to a height of 0.6 m (24 in) on May 21, 1985. Flurprimidol foliar applications were repeated on *Photinia* and *Ilex* on July 19, 1985. Treatments were completed by 11:30 am CDT. It began to rain one hour after application with 14.4 cm (0.64 in) recorded. The 2 experiments with foliar sprays were terminated on May 21, 1987. The experiment with *Photinia* plants treated with 1 application of flurprimidol as a growth medium drench was terminated on May 21, 1985.

Plant height was measured from the rim of the container in 1983 and from the soil surface in 1984, 1985, 1986, and 1987. Plant width of *Ilex* was an average of 2 measurements taken perpendicular to each other. Visual rating of the effectiveness of flurprimidol to retard growth were taken during the 1984, 1986, and 1987 growing seasons. The fresh weight of growth of *Photinia* above 0.6 m (24 in) was obtained when plants were pruned on May 21, 1985, and on May 21, 1987. *Crenata* holly were severed at the soil surface to obtain plant fresh weight on May 21, 1987.

Results and Discussion

Flurprimidol media drench applications on July 14, 1983 severely reduced plant height of *Photinia* in containers with only a 2 ppm solution, (Table 1). The duration of growth retardatation by flurprimidol in the 1984 growing season increased as rate increased. By early fall of 1984 visible effects of flurprimidol on new growth were not apparent regardless of treatment rate. Reductions in plant height, however, after the 1984 growing season were still apparent by flurprimidol application in the range of 64 to 512 ppm. Spring growth in 1985 also was normal (data not shown). The reduction in plant size was also reflected by shoot fresh weight data taken May 21, 1985, 22 months after treatment, after all plants resumed normal visible growth. Shoot fresh weight decreased with increasingly higher rates of flurprimidol (Table 1).

Flurprimidol foliar spray applications on July 14, 1983 reduced plant height of *Photinia* and plant height and width of *Ilex* in 1983, (Tables 2 & 4). Extensive reductions in plant height were obtained with *Photinia*, a more vigorous species (Fig. 1). Flurprimidol concentrations greater than 132 ppm did not result in a further reduction in the height of *Photinia* or in the width of *Ilex* in 1983. Decreased plant height on November 4, 1984, 16 months after treatment, was obtained with *Photinia* with 2112 ppm or higher flurprimidol foliage spray concentration (Table 2). Sixteen months after treatment with flurprimidol, holly plants exhibited a decrease in width but not in height (Table 4). The duration of growth retardation by flurprimidol in the 1984 growing season increased as rate increased with both test plants (Tables 3 & 5). By the end of the 1984 growing season, visible growth retarding effects of flurprimidol were not observed on the new growth of *Photinia* regardless of rate and only at the highest rates used on *Ilex*. The growth of both test

Table 1. Effects of flurprimidol media drench application, applied on 07/14/83, on *Photinia* × *fraseri*.

Flurprimidol rate	Height		Growth rating[z]			Fresh weight
	11/8/83	11/4/84	6/1	8/10	10/14	5/21/1985
(ppm)	cm		1984			(kg)
0	83 a[x]	176 b	10 a	10 a	10 a	5.76 abc
2	52 b	192 a	10 a	10 a	10 a	6.85 a
4	36 c	192 a	10 a	10 a	10 a	6.20 ab
8	37 c	191 a	10 a	10 a	10 a	7.14 a
16	29 c	187 ab	9 a	10 a	10 a	5.09 bcd
32	28 c	176 b	5 b	10 a	10 a	4.85 bcd
64	29 c	154 cd	3 c	8 b	10 a	4.45 cd
128	26 c	146 cd	3 c	8 b	10 a	3.67 de
256	26 c	160 c	2 c	10 a	10 a	4.00 de
512	24 c	139 d	2 c	9 ab	10 a	2.78 e

[z]Visual growth rating: 10 = normal growth (no growth retardation), 1 = growth not normal (severe growth retarding effect, i.e., short internodes and dark green foliage).

[x]Mean separation in columns by Duncan's multiple range test, 5% level.

Table 2. Effects of flurprimidol foliar sprays applied on 07/14/83 and 07/19/85 on the height of *Photinia* × *fraseri* [plants were pruned to 0.6 m (24 in) 05/21/85].

Flurprimidol rate	Height				
	applied 07/14/83		applied 07/19/85		
	11/8/83	11/4/84	11/18/85	1/20/87	5/21/87
ppm	cm				
0	90 a[z]	179 a	185 a	254 ab	364 a
33	58 b	190 a	164 b	259 a	357 a
66	47 b	180 a	173 ab	257 a	352 ab
132	26 c	189 a	153 bc	220 abc	333 abc
264	24 c	183 a	163 b	253 ab	357 a
528	22 c	178 a	139 c	249 ab	348 ab
1056	25 c	179 a	111 d	162 de	317 bc
2112	20 c	133 b	104 d	205 bcd	307 c
4224	24 c	136 b	114 d	144 e	237 d
8448	23 c	145 b	112 d	177 cde	239 d

[z]Mean separation in columns by Duncan's multiple range test, 5% level.

Table 3. Effects of flurprimidol foliar sprays applied on 07/14/83 and 07/19/85 on the growth ratings of *Photinia* × *fraseri* [plants were pruned to 0.6 m (24 in) 05/21/85].

Flurprimidol rate	Growth ratings[z]						
	applied 07/14/83			applied 07/19/85			
	6/1	8/10	10/14	5/27	8/26	10/27	5/21
(ppm)	1984			1986			1987
0	10 a[x]	10 a	10 a	10 a	10 a	10 a	10 a
33	10 a	10 a	10 a	9 ab	10 a	10 a	10 a
66	10 a	10 a	10 a	10 a	10 a	10 a	10 a
132	10 a	10 a	10 a	7 b	9 b	9 ab	10 a
264	10 a	10 a	10 a	10 a	10 a	10 a	10 a
528	6 b	10 a	10 a	10 a	10 a	10 a	10 a
1056	8 ab	10 a	10 a	4 c	6 c	8 b	10 a
2112	3 c	10 a	10 a	3 c	6 c	6 c	10 a
4224	1 c	7 b	10 a	2 c	3 c	5 d	8 b
8448	2 c	7 b	10 a	2 c	3 c	5 d	6 c

[z]Visual growth rating: 10 = normal growth (no growth retardation), 1 = growth not normal (severe growth retarding effect, i.e., short internodes and dark green foliage).

[x]Means separation in columns by Duncan's multiple range test, 5% level.

Table 4. Effects of flurprimidol foliar sprays applied on 07/14/83 and 07/19/85 on the height and width of *Ilex crenata* 'Compacta'.

Flurprimidol rate	applied 07/14/83				applied 07/19/85					
	11/8/83		11/4/84		11/18/85		1/20/87		5/21/87	
	Height	Width	Height	Width	Height	Width	Height	Width	Height	Width
(ppm)					cm					
0	34 a	36 a	52 a	69 a	83 a	113 a	105 a	149 a	116 a	141 a
33	27 bc	27 b	42 a	59 ab	77 ab	94 bc	98 a	127 bc	110 ab	131 ab
66	30 ab	28 b	44 a	64 ab	70 abc	94 bc	87 b	125 bc	100 abc	129 ab
132	26 bc	28 b	42 a	59 ab	70 abc	98 b	100 a	128 bc	110 ab	132 ab
264	26 bc	26 bc	46 a	60 ab	63 bc	86 bcd	85 b	115 c	95 bc	127 b
528	25 c	25 bc	44 a	62 ab	60 c	94 bc	80 b	121 bc	90 c	127 b
1056	27 bc	25 bc	49 a	69 a	76 ab	86 bcd	102 a	135 a	110 ab	135 ab
2112	29 bc	25 bc	48 a	61 ab	60 c	82 cd	86 b	115 c	101 abc	128 ab
4224	29 bc	27 b	42 a	59 ab	61 c	82 cd	79 b	113 c	87 c	125 b
8448	25 bc	23 c	41 a	56 b	57 c	79 d	66 c	94 d	67 c	121 b

[z]Mean separation in columns by Duncan's multiple range test, 5% level.

Table 5. Effects of flurprimidol foliar sprays applied on 07/14/83 and 07/19/85 on the growth ratings of *Ilex crenata* 'Compacta'.

Flurprimidol rate	Growth Ratings[z]						
	applied 07/14/83			applied 07/19/85			
	6/1	8/10	10/14	5/27	8/26	10/27	5/21
	1984				1986		1987
0	10 a[x]	10 a	10 a	10 a	10 a	10 a	10 a
33	9 a	10 a	10 a	9 ab	10 a	10 a	10 a
66	8 a	10 a	10 a	8 ab	9 a	10 a	10 a
132	9 a	9 a	10 a	9 ab	10 a	10 a	10 a
264	5 bc	10 a	10 a	7 bc	8 a	9 ab	10 a
528	4 c	10 a	10 a	6 bc	10 a	10 a	10 a
1056	6 b	10 a	10 a	8 ab	10 a	10 a	10 a
2112	1 d	10 a	10 a	6 bc	8 a	8 b	10 a
4224	1 d	6 b	9 a	4 cd	6 b	6 c	10 a
8448	1 d	4 c	8 a	2 d	4 c	5 d	8 b

[z]Visual growth rating: 10 = normal growth (no growth retardation), 1 = growth not normal (severe growth retarding effect, i.e., short internodes and dark green foliage).

[x]Mean separation in columns by Duncan's multiple range test, 5% level.

Table 6. Effects of two flurprimidol foliar sprays applied on 07/14/83 and 07/19/85 on the fresh weight of *Photinia* × *fraseri* and *Ilex crenata* 'Compacta'. [*Photinia* severed at 0.6 m (24 in) and *Ilex* severed at soil surface.]

Flurprimidol rate	*Photinia* × *fraseri*		*Ilex crenata* 'Compacta'
	applied 07/14/83	applied 07/19/85	applied 07/14/83—07/19/85
	5/21/85	5/21/87	5/21/87
(ppm)			kg
0	6.6 a[z]	23.3 a	10.9 a
33	6.4 a	19.3 ab	8.1 bc
66	5.9 ab	21.2 ab	7.8 bc
132	6.7 a	22.5 a	9.2 b
264	5.8 ab	17.1 ab	6.7 c
528	5.5 ab	18.3 ab	7.1 c
1056	4.5 bc	15.7 b	8.1 bc
2112	3.4 cd	8.8 c	5.1 d
4224	2.7 d	5.4 c	4.3 d
8448	2.4 d	6.3 c	3.5 d

[z]Mean separation in columns by Duncan's multiple range test, 5% level.

plants in the spring of 1985 was normal (data not shown). The fresh weight of branches of *Photinia* severed 0.6 m (24 in) above the soil surface was reduced by flurprimidol foliar applications (Table 6).

Repeat applications of flurprimidol on July 19, 1985 resulted in reductions in the height of *Photinia* and height and width of *Ilex* at rates similar to the initial application (data taken November 18, 1985; January 20, 1987; and May 21, 1987) (Tables 2 & 4). The pattern of the duration of the growth retarding effect increasing in time as flurprimidol rate increased was also similar (data taken in 1986 and 1987) (Tables 3 & 5). The fresh weight of regrowth of *Photinia* severed 0.6 m (24 in) from the soil surface receiving the second application of flurprimidol and of the shoot growth of *Ilex* severed at the soil surface and receiving 2 applications of flurprimidol was severely reduced as rate increased (Table 6).

Flurprimidol effectively reduced internode length and shoot fresh weight of *Photinia* and *Ilex*. Increased leaf red and green pigmentation of *Photinia* and green pigmentation of *Ilex* were observed by flurprimidol application. Minor leaf distortion of smaller leaves was obtained at the lower rates used in this study. Leaf distortion appeared to increase slightly at higher rates. Little phytotoxicity was also observed after the second flurprimidol application. Shoot growth after the effects of flurprimidol were no longer apparent appeared normal with both test plants after the first and second foliar spray applications (Fig. 2 & 3), and with *Photinia* after one

Fig. 1. Effects of flurprimidol foliar spray application on *Photinia* × *fraseri*. Flurprimidol applied on July 14, 1983, picture taken on November 3, 1983. Left to right, rates of flurprimidol were 0 (control) 33, 66, 264, 528, 1056, 2112, 4224, and 8448 ppm.

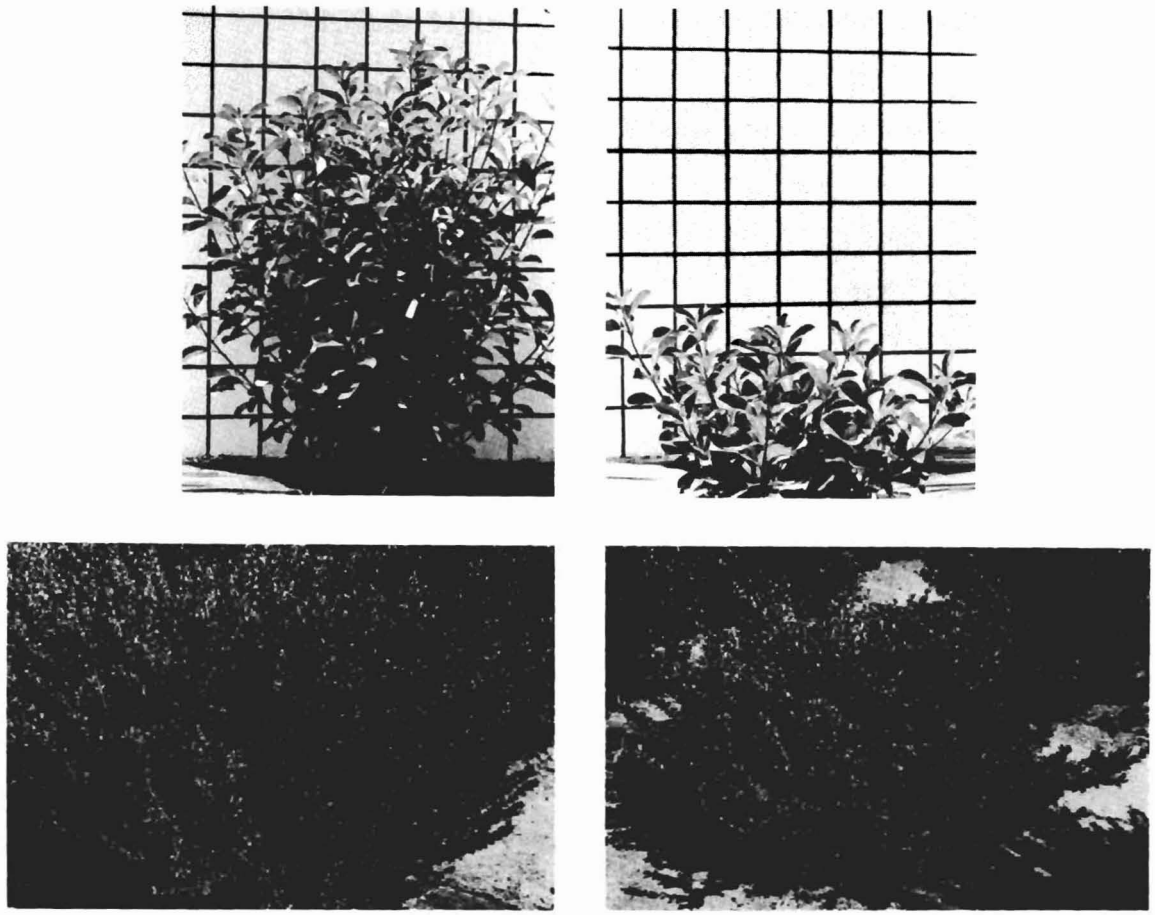

Fig. 2. Effects of flurprimidol foliar spray application on *Photinia* × *fraseri* (upper) and *Ilex crenata* 'Compacta' (lower), left-0 ppm (control), right-4224 ppm flurprimidol. *Photinia* × *fraseri* one application, flurprimidol applied on July 14, 1983, picture taken August 10, 1984. *Ilex crenata* 'Compacta' 2 applications, flurprimidol applied on July 14, 1983 and July 19, 1985, picture taken October 20, 1986.

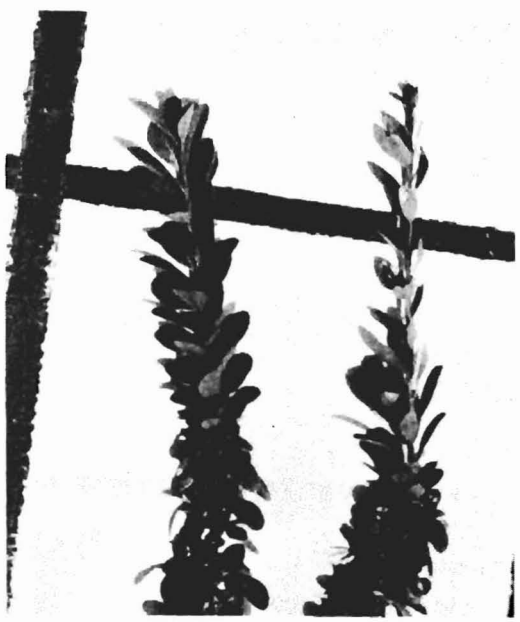

Fig. 3. Typical growth suppression on *Ilex crenata* 'Compacta' caused by flurprimidol spray application, basal half of each stem, left; and normal non-compressed growth of each stem, right. Flurprimidol applied on July 14, 1983, picture taken August 10, 1984.

media drench application. The effects of midseason applications of flurprimidol at low concentrations was short-term, suppressing growth only for the remainder of the growing season in which it was applied. Growth suppression was extended into the following year only at very high concentrations.

Results in this study indicate that flurprimidol alone and in conjunction with pruning can be helpful in maintaining landscape plants to a desirable size. However, a disadvantage of using a long-term effective growth suppressant is that in the event treated plants become disfigured through mechanical injury, insect and disease infestation, herbicide damage, etc., recovery will not be possible until the growth retarding effect has diminished and growth can resume.

Significance to the Nursery Industry

This growth suppression agent offers potential in reducing plant maintenance cost in situations where plant size must be controlled (usually by pruning). Growth suppression agents such as flurprimidol may prove to be a more valuable tool for use by landscape maintenance enterprises than for wholesale production nurseries.

Editorial Note: This paper reports the results of research only, and does not imply registration of a pesticide under FIFRA. Before using any of the products mentioned in this

research paper, be certain of their registration by appropriate state and/or federal authorities.

Literature Cited

1. Anonymous. 1983. Technical report on EL-500. Eli Lilly & Co., Indianapolis, IN 46285.

2. Barrett, J.E. and C.A. Bartuska. 1981. Comparison of growth retardant activities of EL-500 with ancymidol, chlormequat, and daminozide. HortScience 16:443. (absts).

3. Borden, P. and R.W. Campbell. 1984. Response of *Ilex* × *meserveae* 'Blue Princess' to hand shearing and three growth retardants. HortScience 19:285–287.

4. Fielek, J. 1984. Effects of EL-500 on height and lateral shoot development of *Hibiscus coccineus* Walt. HortScience 19:600. (absts).

5. Marini, R. and E.L. Wefelmeyer. 1985. Growth of peach seedlings as affected by paclobutrazol & flurprimidol. HortScience 20:526. (absts).

6. Marquad, R.D. 1985. Chemical growth control of pecan seedlings. HortScience 20:529. (absts).

7. Newman, S.E. and M.W. Follett. 1987. Effects of four chemical growth retardants on *Asclepias tuberosa* L. MAFES Research Report. 12(8):1–4.

8. Robson, J.M., J.E. Barrett, and D.A. Gilbertz. 1981. Timing of chrysanthemum stem elongation response to ancymidol and EL-500. HortScience 16:464. (absts).

Influence of High Salt Levels on the Germination and Growth of Five Potentially Utilizable Plants for Median Turfing in Northern Climates[1]

M. St-Arnaud and G. Vincent[2]
Jardin botanique de Montréal,
4101 Sherbrooke Street E.,
Montreal, Quebec, Canada H1X 2B2

Abstract

We evaluated the germination and growth of *Coronilla varia* (crown vetch), *Lotus corniculatus* (birdsfoot trefoil), *Medicago lupulina* (black medic), *Kochia scoparia* (kochia) and *Polygonum aviculare* (prostrate knotweed) at different NaCl concentrations. No reduction of germination was observed in the five species studied for all concentrations of NaCl. High concentrations of NaCl in the soil adversely affected the growth of *L. corniculatus* and *M. lupulina*, but not of the other species. For *P. aviculare*, germination and growth was better with higher salt concentrations.

Index words: Salinity, plant growth, turf

Species used in this study: *Coronilla varia, Lotus corniculatus, Medicago lupulina, Kochia scoparia, Polygonum aviculare,* crown vetch, birdsfoot trefoil, black medic, kochia, prostrate knotweed.

Introduction

Numerous studies have been conducted on the effects of de-icing salt on road side vegetation (3, 4, 6). However, growth problems associated with salinity in plants used on road medians in northern climates have not been well studied.

During winter months, medians regularly receive surface water from adjacent streets, which increase the NaCl level of the soil and often results in levels that are injurious to plants. Electrical conductivity (EC) values in excess of 100 mS/m (soil/water ratio, 1:2) are considered restrictive to the germination and growth of most plant species (7). Table I lists EC values measured on various road medians in Montreal during spring of 1984. Although salinity can be very high in winter, usually a gradual decrease is observed during spring because of leaching, without any cumulative accumulation over the years. However, in some cases salinity remains high enough to injure the vegetation during the growing season. There are more than 110 km (68 miles) of medians covering an area of approximately 34 ha (84 ac) in Montreal; the areas involved are therefore considerable. When built, these medians were turfed with grasses, which are known for their tolerance to high salinity, gradually disappear and are replaced by forbs, such as *Ambrosia artemisiifolia* (common ragweed), *Chenopodium album* (lamb's quarters), *Kochia scoparia* (kochia), *Lepidium densiflorum* (common peppergrass), *Polygonum aviculare* (prostrate knotweed), *Taraxacum officinale* (dandelion) and others. However, the medians where these species have become dominant rarely show a vegetation cover exceeding 70%.

We evaluated the germination and growth of *Kochia scoparia*, *Medicago lupulina* (black medic) and *Polygonum aviculare*, three species which are sometimes found on median, and two species commonly used as ground covers, *Coronilla varia* (crown vetch) and *Lotus corniculatus* (birdsfoot trefoil). All those species have a decumbent stem, a factor to consider in the maintenance of medians except for *K. scoparia* which tends to have the same growth habit after mowing.

[1]Received for publication December 3, 1987; in revised form August 16, 1988. We thank Ms J. Bruneau and L. Dumont for their technical work and Ms H. Levert for typing the manuscript.

[2]Botanists, Montreal Botanical Garden, Montreal, Canada.