Chemically Induced Branching of *Vinca minor*[1]

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Abstract

Application of Pro-Shear (BA), Accel (PBA), Promalin (BA + GA_{4+7}) or Atrimmec (dikegulac) was tested for its ability to induce branching of *Vinca minor* L. 'Alba.' In the first experiment, plants receiving a single foliar spray of 62.5, 125 or 250 ppm Pro-Shear or Accel; 125, 250 or 500 ppm Promalin; or 1000, 2000 or 3000 ppm Atrimmec were compared to controls. Promalin at 250 or 500 ppm resulted in more runners throughout the experimental period. Atrimmec initially suppressed runner development, but treated plants had more runners 8 and 10 weeks after treatment. Application of Pro-Shear or Accel did not affect the development of runners. In a second experiment, foliar sprays of 250, 500 or 1000 ppm Promalin or Atrimmec applied 7 weeks apart were compared to controls. Application of Promalin increased primary and secondary runner numbers and secondary runner lengths. Atrimmec at the higher rates increased primary runner numbers 16 weeks after initial treatment but rate had no effect on numbers or lengths of secondary runners.

Index words: periwinkle, BA, Pro-Shear, dikegulac, Atrimmec, PBA, Accel, BA + GA_{4+7}, Promalin, pruning.

Species used in this study: lesser periwinkle (*Vinca minor* L. 'Alba').

Growth regulators used in this study: Pro-Shear (BA), *N*-(phenylmethyl)-1*H*-purin-6-amine; Atrimmec (dikegulac), 2, 3:4, 6-bis-*O*-(1-methylethylidene)-α-L-*xylo*-2-hexulofuranosonic acid; Accel (PBA), *N*-(phenylmethyl)-9-(tetrahydro-2*H*-pyran-2-yl)-9*H*-purine-6-amine; Promalin (BA + GA_{4+7}), *N*-(phenylmethyl)-1*H*-purin-6-amine + (1α, 2β, 4aα, 4bβ, 10β)-2, 4a, 7-trihydroxy-1-methyl-8-methylenegibb-3-ene-1, 10-dicarboxylic acid 1, 4a-lactone.

Significance to the Industry

Increased efficiency through the reduction of labor required to produce vining groundcovers can lead to greater profits. By eliminating the need for repeated pruning to induce axillary shoot development, labor costs can be lowered. This may be achieved through the application of plant growth regulators which can increase axillary shoot development. Applications of Promalin at 250 to 1000 ppm increased primary and/or secondary runner numbers and lengths when compared to control plants. A second application of 1000 ppm Promalin 7 weeks after initial treatment was especially effective in stimulating secondary runner development. Development of runners was suppressed for 6 weeks following treatment with 1000 to 3000 ppm of Atrimmec. Thereafter, numbers of primary runners increased with application. In a second test, Atrimmec at 250 to 1000 ppm had no effect on primary runners for 11 weeks and minimal effect 16 weeks after treatment. Results with Atrimmec are inconclusive.

Introduction

Vinca minor L., lesser periwinkle, a common vining, evergreen groundcover, is characterized by a prostrate, mat-forming growth habit. Flowers of white, blue or purple are

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produced on long stolons or runners with few lateral branches (6). *Vinca* is typically priced by the number of runners present, with plants having multiple runners commanding a higher price. Many herbaceous and woody landscape crops are potted several plants per pot or pruned repeatedly during production to develop well-branched, high quality plants. Using more than one cutting or plant per pot requires large amounts of plant material, while repeated pruning is labor-intensive (1,8). The development of a well-branched plant from a single cutting without the need of repeated pruning should increase efficiency of production.

Pruning increases branching by removing the auxin source and, hence, apical dominance of the terminal bud, allowing axillary growth to occur (15). The exogenous application of synthetic cytokinins, such as Pro-Shear, Promalin (BA + GA_{4+7}) and Accel, also reduces apical dominance, thereby promoting the growth of lateral buds (2,3,5,8). A foliar spray application of Pro-Shear increased the number of lateral branches on *Peperomia obtusifolia* when applied at 250, 500 or 1000 ppm (8), on *Dieffenbachia* 'Welkeri' at 500, 1000 or 2000 ppm (16) and *Cordyline terminalis* 'Celestine Queen' at 250 or 500 ppm (11). Promalin has been used to promote branching of peach at 500 ppm (7), cherry and pear at 1000 or 2000 ppm (4) and apple (13). Accel induced branching of rose when applied at 400 ppm (9) and various other floricultural crops when applied at rates from 50 to 2000 ppm (10). Atrimmec, another plant growth regulator (PGR), has both chemical pinching and growth retardant properties (1,12). A foliar spray of 2888 ppm Atrimmec reduced plant height and increased branching of *Capsicum annum* (12). Foliar applications of 750 to 2250 ppm Atrimmec resulted in shorter plants and increased the number of inflorescences of *Kalanchoe* (14). The objective of this study was to determine the effectiveness of several PGRs in inducing lateral budbreak and axillary shoot elongation of *Vinca minor*.

Materials and Methods

On February 8, 1988, cuttings of *Vinca minor* 'Alba' were stuck in 36-cell flats (one/cell) of Pro-Mix BX and placed in a double layer polyethylene greenhouse under intermittent mist (10 sec/5 min) until rooted and under natural daylength and light levels throughout the experimental period. Minimum day/night temperatures in the greenhouse were 21°C (70°F)/16°C (60°F). On April 28, 1988, cells were separated, rooted cuttings were pruned to 5 nodes, and lateral and basal shoots were removed. The following foliar spray treatments were then applied to the plants: 62.5, 125, or 250 ppm Pro-Shear; 1000, 2000, or 3000 ppm Atrimmec; 62.5, 125, or 250 ppm Accel; and 125, 250, or 500 ppm Promalin. Pruned controls were included for comparison. Sprays were applied just prior to runoff in a volume of about 2 ml (0.07 oz.) per plant. Buffer-X, a surfactant, was added at 0.2% to Pro-Shear, Promalin and Accel solutions. Plants were fertilized every 2 weeks with 200 ppm N from 20N-4.3P-16.6K (20-10-20) Peters Peatlite Special. Runner lengths and numbers were determined biweekly for 10 weeks beginning 2 and 4 weeks after treatment (WAT), respectively. Treatments were completely randomized with 10 single-plant replicates.

A second experiment was initiated to determine appropriate rates of the most effective branching compounds in the first experiment. On July 20, 1988, cuttings were stuck and rooted as described in the first experiment. Rooted cuttings were transplanted to 11.4 cm (4.5 in) standard pots of the same growth medium after 13 weeks. Plants were pruned to 5 nodes, and all lateral and basal shoots were removed just prior to treatment on October 25, 1988. Treatments consisted of a foliar spray of 250, 500 or 1000 ppm Promalin or Atrimmec. Pruned controls were included for comparison. Foliar spray treatments were reapplied without pruning on December 13, 1988, 7 WAT. Data taken 3, 5, 7 and 11 weeks after initial treatment (WAIT) included primary and basal (from the growth medium) runner numbers and primary runner lengths. Final data taken 16 WAIT consisted of primary runner numbers and lengths, nodes per primary runner, secondary runner numbers per primary runner and lengths of the 3 longest secondary runners. Treatments were completely randomized with 6 replicates of 2 plants each.

Results and Discussion

Experiment 1. As the rate of Promalin increased, primary runner numbers increased throughout the experimental period, while runner lengths increased quadratically through week 8 (Tables 1 and 2). Runner numbers were 73% to 186% greater than those of control plants 4 WAT and 32% to 116% higher 10 WAT. These results of increased lateral shoot development with Promalin application agree with earlier results with other crops (4,7,13). Runners were 63% to 104% longer than those of control plants 2 WAT but were only 17% to 31% longer 6 WAT. Similar runner lengths of Promalin-treated plants and controls 10 WAT reflect a reduction in the rate of shoot elongation with Promalin relative to that of controls that began as early as 6 WAT. Development of runners was initially suppressed by all rates of Atrimmec; over time the suppression dissipated and runner numbers exceeded those of control plants by 132% (1000 ppm) 6 WAT and 182% and 164% (2000 ppm) 8 and 10 WAT, respectively. Generally, more runners were produced from plants receiving the lower rates of Atrimmec. Beginning 4 WAT and continuing through the experimental period,

Table 1. Number of primary runners from five node cuttings of *Vinca minor* treated with PGRs, Expt. 1.

		Weeks after treatment[z]			
Treatment	Rate (ppm)	4	6	8	10
Promalin	125	3.8	3.8	4.1	4.3
	250	6.3	6.6	6.7	7.3
	500	5.8Q[y]	6.8C	6.8Q	6.8L
Atrimmec	1000	1.6	5.4	7.1	7.1
	2000	1.0	3.1	7.2	7.6
	3000	1.0Q	1.8C	5.8Q	6.3Q
Pro-Shear	62.5	1.7	2.4	3.3	3.3
	125	2.6	3.6	4.2	4.2
	250	3.1NS	3.4NS	4.0NS	4.6NS
Accel	62.5	2.3	2.6	3.1	3.7
	125	1.9	2.5	3.3	3.4
	250	1.3NS	3.6NS	3.6NS	4.0NS
Control		2.2	2.9	3.2	3.5
LSD[x]		1.3	1.6	1.7	1.6

[z]One runner formed on each plant regardless of treatment at week 2.

[y]Significance of regression analysis at P = 0.05: L = linear; Q = quadratic; C = cubic; NS = not significant; control included in regression.

[x]Mean separation within columns by a protected Fisher's least significant test, P = 0.05; LSD used for comparing individual treatment means.

Table 2. Length (cm) of primary runners from five node cuttings of *Vinca minor* treated with PGRs, Expt. 1.

Treatment	Rate (ppm)	Weeks after treatment 2	4	6	8	10
Promalin	125	28.6	38.7	46.9	60.1	68.7
	250	30.3	41.5	48.6	63.3	66.7
	500	22.8Q[z]	34.3Q	42.1Q	58.6Q	64.6NS
Atrimmec	1000	17.1	17.2	18.6	29.2	38.6
	2000	17.1	17.2	17.4	20.8	29.2
	3000	15.2NS	15.2Q	15.4Q	15.8Q	21.7Q
Pro-Shear	62.5	21.4	33.7	44.6	59.7	66.2
	125	24.2	36.0	45.0	62.3	67.4
	250	29.4L	41.1L	49.0L	65.8L	70.4NS
Accel	62.5	25.7	38.6	46.2	61.3	70.2
	125	21.6	34.2	42.4	61.6	68.4
	250	22.1C	33.6C	42.1C	60.0L	64.6NS
Control		14.0	25.1	35.7	54.8	63.6
LSD[y]		5.9	6.1	6.3	7.6	7.0

[z]Significance of regression analysis at P = 0.05: L = linear; Q = quadratic; C = cubic; NS = not significant; control included in regression.

[y]Mean separation within columns by a protected Fisher's least significant test, P = 0.05; LSD used for comparing individual treatment means.

lengths of primary runners decreased with increasing Atrimmec rates.

Pro-Shear or Accel did not affect primary runner numbers at any of the biweekly sampling times, but increased runner lengths at all sampling times except 10 WAT. Since Atrimmec and Promalin both increased the numbers of runners produced, these PGRs were selected for comparison in a second test. Rates were lowered (Atrimmec) or increased (Promalin) to target a range more optimal to the stimulation of runner development.

Experiment 2. Primary runner numbers increased linearly or quadratically throughout the experimental period as rate of Promalin increased, from 65% to 154% 3 WAIT and from 63% to 148% 11; WAIT (Tables 3 and 4). Primary runner lengths were not affected by Promalin rate at any sampling time (data not shown). Additionally, secondary runner numbers and lengths increased cubically and quadratically, respectively, as Promalin rate increased (Table 4). The increase in secondary runner numbers and lengths ranged from 409% to 1400% and 54% to 59%, respectively. The increase in secondary runners resulted in noticeably fuller plants which should be more marketable. Basal runner numbers (data not shown) or the number of nodes per primary runner was not influenced by Promalin rate (Table 4).

Primary runner numbers were not affected by application of Atrimmec through week 11; however, runner numbers 16 WAIT increased quadratically as rate increased, with the greatest increase (22%) from the 1000 ppm Atrimmec treatment (Tables 3 and 4). Node number per primary runner decreased quadratically as rate of Atrimmec increased, while secondary runner numbers and lengths were not affected by Atrimmec application.

In conclusion, numbers of primary and secondary runners were increased by a single foliar spray of 125 to 500 ppm Promalin or 2 sprays of 250 to 1000 ppm Promalin applied 7 weeks apart. Application of Promalin to rooted cuttings of *Vinca* should reduce the frequency of pruning, while resulting in well-branched marketable plants. Atrimmec at 1000 to 3000 ppm increased primary runner numbers, but lower rates used in the second experiment were less effective in promoting runner formation. Different responses to Atrimmec in the 2 tests may be due to season or rates. Atrimmec is most

Table 3. Number of primary runners from five node cuttings of *Vinca minor* treated with PGRs, Expt. 2.

Treatment	Rate (ppm)	Weeks after treatment 3	5	7	11
Promalin	250	4.3	4.3	3.7	4.4
	500	5.7	5.7	5.7	5.7
	1000	6.6L[z]	6.6Q	7.2L	7.2L
Atrimmec	250	2.9	2.9	3.0	3.2
	500	2.2	2.2	2.2	2.2
	1000	3.1NS	3.1NS	3.2NS	3.2NS
Control		2.6	2.8	2.8	2.8
LSD[y]		1.6	1.3	1.4	1.3

[z]Significance of regression analysis at P = 0.05: L = linear; Q = quadratic; NS = not significant; control included in regression.

[y]Mean separation within columns by a protected Fisher's least significant test, P = 0.05; LSD used for comparing individual treatment means.

Table 4. Primary and secondary runners, nodes per primary runner and secondary runner lengths from five node cuttings of *Vinca minor* 16 WAT with PGRs, Expt. 2.

Treatment	Rate (ppm)	Primary runners/ plant	Nodes/ primary runner	Secondary runners/ primary runner	Secondary runner length[z]
Promalin	250	7.1	17.4	5.6	19.3
	500	8.8	15.5	8.4	20.7
	1000	7.6Q[y]	16.1NS	16.4C	19.9Q
Atrimmec	250	6.1	17.3	1.2	12.2
	500	7.5	15.7	1.1	11.6
	1000	8.3Q	13.0Q	1.0NS	10.4NS
Control		6.8	17.2	1.1	12.5
LSD[x]		2.5	3.0	2.7	3.1

[z]Mean length of three longest secondary runners.

[y]Significance of regression analysis at P = 0.05: Q = quadratic; C = cubic; NS = not significant; control included in regression..

[x]Mean separation within columns by a protected Fisher's least significant test, P = 0.05; LSD used for comparing individual treatment means.

effective when applied to lush spring growth or under good growing conditions. The second test was conducted in the winter (shorter daylengths and lower light levels). Growing conditions coupled with lower doses may have resulted in little or no pinching effect.

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