Growth Regulation of *Vinca minor*[1]

Gary J. Keever, Josh B. Clark, and Teresa A. Morrison[2]
Department of Horticulture
Auburn University, Auburn, AL 36849

Abstract

Multiple applications of three rates each of B-Nine/Cycocel, Sumagic, Cutless, and Atrimmec were applied to common periwinkle grown in small containers in a greenhouse to control runner growth. All plant growth regulators (PGRs) suppressed runner elongation throughout the 30-week study. However, Atrimmec at 1500 to 4500 ppm severely injured plants for up to 20 weeks, and Cutless at 30 to 90 ppm reduced the number of runners for at least 24 weeks. There were no adverse effects associated with the application of B-Nine/Cycocel or Sumagic at the rates tested, 2500/1500 to 7500/1500 ppm and 15 to 45 ppm, respectively.

Index words: plant growth regulator, plant growth retardant, container production.

Species used in this study: common periwinkle *(Vinca minor* L.).

Growth regulators used in this study: Atrimmec (dikegulac-sodium), 2.3:4,6 bis-O-(1-methylethylidene)-α-L-xylo-2-hexofluranosonic acid; B-Nine (daminozide), butanedioic acid mono (2,2-dimethylhydrazide); Cutless (flurprimidol), a-(1-methylethyl)-a-[4-trifluoromethoxy) phenyl]-5-pyrimidinemethanol; Cycocel (chlormequat), (2-chlorethyl) trimethylammonium chloride; Sumagic (uniconazole), (E)-1-(p-chlorophenyl)-4,4-dimethyl-2-(1,2,4-triazol-1-yl)-1-penten-3-ol.

Significance to the Nursery Industry

A vigorous horizontal growth habit, coupled with pot-to-pot spacing during greenhouse production, results in intertwined shoots or runners of common periwinkle (*Vinca minor* L.) that are not easily mechanically pruned. Our results suggest that runner lengths of common periwinkle can be controlled during greenhouse production with foliar applications of B-Nine/Cycocel, Sumagic, Cutless, or Atrimmec by varying rate and frequency of application. Because of the severe stunting and foliar chlorosis exhibited following Atrimmec application, plants were considered unmarketable for several months. Cutless reduced the number of runners for most of the study resulting in plants that may be less marketable. The relative safety and effectiveness of B-Nine/Cycocel at 2500/1500 to 7500/1500 ppm and Sumagic at 15 to 45 ppm offer growers viable options to mechanical pruning when common periwinkle is grown in small containers at a close spacing, conditions that allow rapid intertwining of runners.

Introduction

Common periwinkle (*Vinca minor* L.) is one of the most widely planted ground covers in USDA Cold Hardiness Zones 4 to 8. With lilac-blue flowers in spring and prolific, mat-forming evergreen shoots or runners, common periwinkle can spread indefinitely. While lending itself to rapid establishment in the landscape, common periwinkle's vigorous horizontal growth habit results in intertwined runners that are difficult to mechanically pruned during container production and are easily damaged during handling.

Plant growth regulators (PGRs), such as daminozide (B-Nine, Uniroyal Chemical Co., Middlebury, CT), chlormequat (Cycocel, Olympic Horticultural Products, Mainland, PA), uniconazole (Sumagic, Valent Corp., Walnut Creek, CA), and dikegulac sodium (Atrimmec, PBI/Gordon Corp., Kansas City, MO), have been used for many years in the production of greenhouse crops. Flurprimidol, previously labeled as Cutless (Lesco, Rocky River, OH) and currently labeled for greenhouse use in Europe, is being evaluated for release in the United States as Topflor (SePRO Corp., Carmel, IN). None of these PGRs are specifically labeled for greenhouse or nursery use on *Vinca minor*, however Atrimmec is labeled for use on established common periwinkle in the landscape at 3125 ppm.

These PGRs have effectively controlled growth of numerous other vines or woody ornamentals grown under nursery conditions, including Atrimmec (7, 8) and Sumagic (3) on Asian jasmine, Atrimmec (7) and Sumagic (3) on Carolina jessamine, Atrimmec on 'Goldflame' honeysuckle (1), and Cutless on 'China Girl' holly (5), butterfly-bush (4), and 'Shishi-Gashira' camellia (6). Of these PGRs only Sumagic has been tested on common periwinkle. Sumagic applied at 80 and 160 ppm as a soil drench or foliar spray in 25 ml (0.75 fl oz) to plants in 3.8 liter (#1) pots resulted in a 51% reduction in shoot length 52 days after application (2).

Because of the limitations of hand pruning in the greenhouse production of common periwinkle, we evaluated the use of multiple applications of the PGRs B-Nine/Cycocel, Sumagic, Cutless and Atrimmec as alternatives to mechanical pruning.

Materials and Methods

On August 22, 2003, *Vinca minor* in 1203 cell-packs were repotted into 0.95 liter (1 qt) round pots containing a pinebark:sand substrate (7:1 by vol) amended with 8.3 kg/m^3 (14 lb/yd^3) of 17N–2.2P–9.13K (Polyon 17–5–11, Pursell Industries, Sylacauga, AL), 0.9 kg/m^3 (1.5 lb/yd^3) Micromax (The Scotts Company, Marysville, OH) and 3 kg/m^3 (5 lb/yd^3) dolomitic limestone. Plants were spaced 23 cm (9 in) apart on benches in a double-polyethylene greenhouse [heat/vent set points of 18.3/26.5C (65/78F)] covered with 47% shade cloth and hand-watered as needed. On September 3 and again on October 17, 2003, 6 weeks after initial treatment (WAT), the following growth regulator treatments were applied: B-Nine/Cycocel at 2500/1500, 5000/1500, and 7500/1500 ppm; Sumagic at 15, 30, and 45 ppm; Cutless at 30, 60, and 90 ppm; Atrimmec at 1500, 3000, and 4500 ppm; and an untreated control. Treatments were reapplied on January 16,

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[2]Professor, Undergraduate Student, and Post-doctorate Fellow, resp.

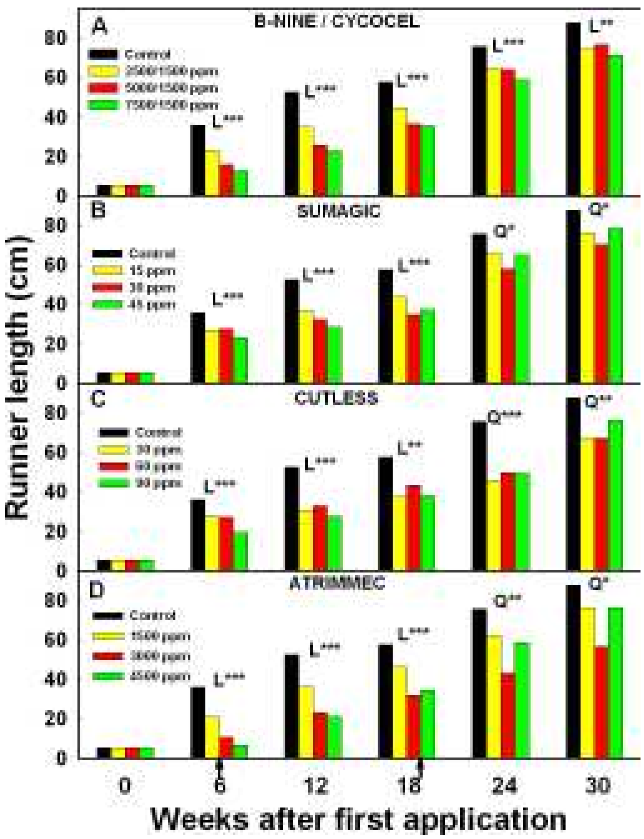

Fig. 1. Runner length of common periwinkle treated at week 0, 6, and 19 with B-Nine/Cycocel, Sumagic, Cutless, and Atrimmec. The three longest runners per plant were measured. Trends were linear (L) or quadratic (Q) at $P \leq 0.05$ (*), ≤ 0.01 (**), or ≤ 0.001 (***), based on orthogonal contrasts.

2004, 19 WAT, to all plants, except those receiving Atrimmec, which exhibited adverse effects from previous applications. Treatments were applied using a CO_2 sprayer with a flat spray nozzle (XR TeeJet 8002VS, Bellspray, Inc., Opelousas, LA) at 1.4 kg/cm^2 (20 psi) in solution volumes of 0.2 liter/m^2 (2 qt/100 ft^2). Temperature and relative humidity at the three times of application were 34.4C (94F) and 63% (September 3, 2003), 21.1C (70F) and 90% (October 17, 2003), and 22.8C (73F) and 36% (January 16, 2004). Treatments were arranged in a completely randomized design and replicated with 9 single plants per treatment.

At first treatment runner length, based on a random sampling of 40 runners from 10 or more pots, averaged 5.3 cm (2.1 in) and ranged from 4 to 7 cm (1.6 to 2.8 in). Lengths of the three longest runners and total runner counts per plant were determined every six weeks for 30 weeks. Data were subjected to analysis of variance, and orthogonal contrasts were used to test linear and quadratic response trends to PGR rates using SAS General Linear Model procedures (9).

Results and Discussion

B-Nine/Cycocel. Runner length decreased linearly at all sampling dates as B-Nine/Cycocel rate increased (Fig. 1). Decreases, relative to the non-treated control, ranged from 37 to 64% at 6 WAT, after which treatments were reapplied, resulting in a similar reduction in runner length of 33 to 56% at 12 WAT. By 18 WAT growth suppression had lessened, resulting in a decrease of 22 to 38%. The third application of B-Nine/Cycocel at 19 WAT appeared to have little effect on runner length suppression because the percent reduction at 24 WAT ranged from 15 to 22% and from 15 to 19% at 30 WAT. The number of runners was not affected by B-Nine/Cycocel treatment at any sampling date (data not shown).

Sumagic. Similar to results with B-Nine/Cycocel, runner length decreased with increasing rates of Sumagic at all sampling dates (Fig. 1). Linear decreases in runner length ranged from 24 to 35% at 6 WAT, at which time treatments were reapplied, and runner length suppression increased to 30 to 46% at 12 WAT, before decreasing to 24 to 40% at 18 WAT. At 24 and 30 WAT runner length changed quadratically with increasing Sumagic rates, decreasing 13 to 24% and 10 to 20%, respectively. Lower percent reductions in runner length at 24 and 30 WAT, even though treatments were reapplied at 19 WAT, indicate less effect of the third Sumagic application, while the quadratic response indicates little effect of rate over the range of 15 to 45 ppm. Sumagic had no effect on the number of runners at any sampling date (data not shown).

Cutless. Runner length decreased linearly with increasing rates of Cutless, 24 to 45% at 6 WAT, 37 to 48% at 12 WAT, and 25 to 35% at 18 WAT (Fig. 1). Following re-application of treatments 19 WAT, the runner length response changed quadratically at 24 and 30 WAT, indicating a similar level of suppression over the range of 30 to 90 ppm Cutless. A level of suppression at 24 WAT, 34 to 39%, similar to earlier sampling dates indicates Cutless was effective at a time when rapid shoot elongation was occurring in common periwinkle, as opposed B-Nine/Cycocel or Sumagic in which the level of suppression was decreasing at 24 WAT (Fig. 1). By 30 WAT and 11 weeks after the last application of Cutless, runner length suppression ranged from 12 to 24%, levels similar to those induced by B-Nine/Cycocel and Sumagic at 30 WAT.

Increasing rates of Cutless resulted in linear decreases in the number of runners at all sampling dates, except 30 WAT (Fig. 2). The number of runners decreased 19 to 47%, 19 to 56%, 25 to 58%, and 16 to 48% at 6, 12, 18, and 24 WAT, respectively. A reduction in runners during production should

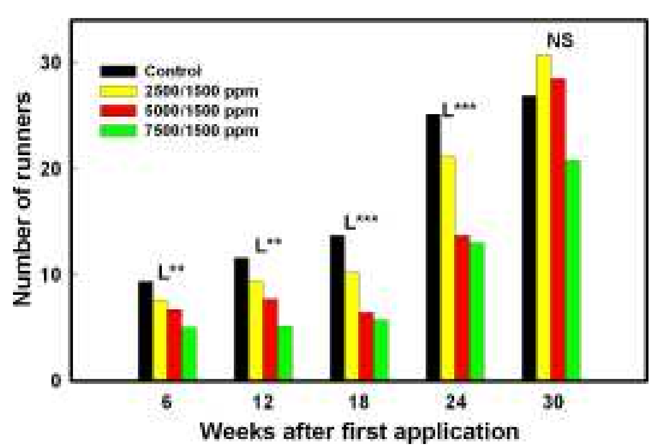

Fig. 2. Runner number of common periwinkle treated with Cutless at 0, 6, and 19 weeks after initial treatment. Trends were non-significant (NS) or linear (L) at $P \leq 0.01$ (**) or $P \leq 0.001$ (***), based on orthogonal contrasts.

lessen the intertwining commonly experienced during close-spaced production. However, because the number of runners also influences the quality of common periwinkle, these decreases are undesirable for marketability. The non-significant response at 30 WAT or 11 weeks after the last application indicates a dissipation of the retarding effect of Cutless on new runner development and suggests that the marketability problem noted earlier is less if sufficient time is allowed between final application of Cutless and marketing.

Atrimmec. Increasing rates of Atrimmec resulted in a linear decrease in runner length of 42 to 82% at 6 WAT (Fig. 1). Plants in all treatments exhibited severely stunted shoots and chlorotic and distorted foliage that worsened following reapplication of Atrimmec at 6 WAT, indicating a cumulative effect. Severe injury from 1500 ppm Atrimmec suggests that the labeled rate of Atrimmec for use on common periwinkle in the landscape, 3125 ppm, is either too high or established plants in the landscape are more tolerant than those grown in greenhouses. A similar response to Atrimmec was reported on Asian jasmine (7, 8) and Carolina jessamine (7). Adverse symptoms persisted until about 20 WAT. Runner length also decreased linearly 31 to 60% and 20 to 44% with increasing Atrimmec rate at 12 and 18 WAT, respectively. At 24 and 30 WAT the reduction in runner length relative to the control ranged from 18 to 43% and 13 to 35%, respectively, with the largest decrease from 3000 ppm Atrimmec. The number of runners decreased linearly 24 to 31% at 6 WAT with increasing rates of Atrimmec, but were not affected by Atrimmec treatments at later dates (data not shown).

At the rates and number of applications applied, B-Nine/Cycocel, Sumagic, Cutless, and Atrimmec provided significant shoot suppression of common periwinkle, indicating these PGRs would be effective in the greenhouse production of periwinkle in small containers. However, Cutless reduced the number of runners per plant during most of the 30-week test, and Atrimmec severely stunted shoots and distorted and discolored foliage for up to 20 weeks during which time plants were considered unmarketable. Our results from applying multiple applications of B-Nine/Cycocel and Sumagic at 2500/1500 to 7500/1500 ppm and 15 to 45 ppm, respectively, suggest that the level of shoot control of common periwinkle can be manipulated by varying the rate and application frequency of either of these treatments without any adverse effects.

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