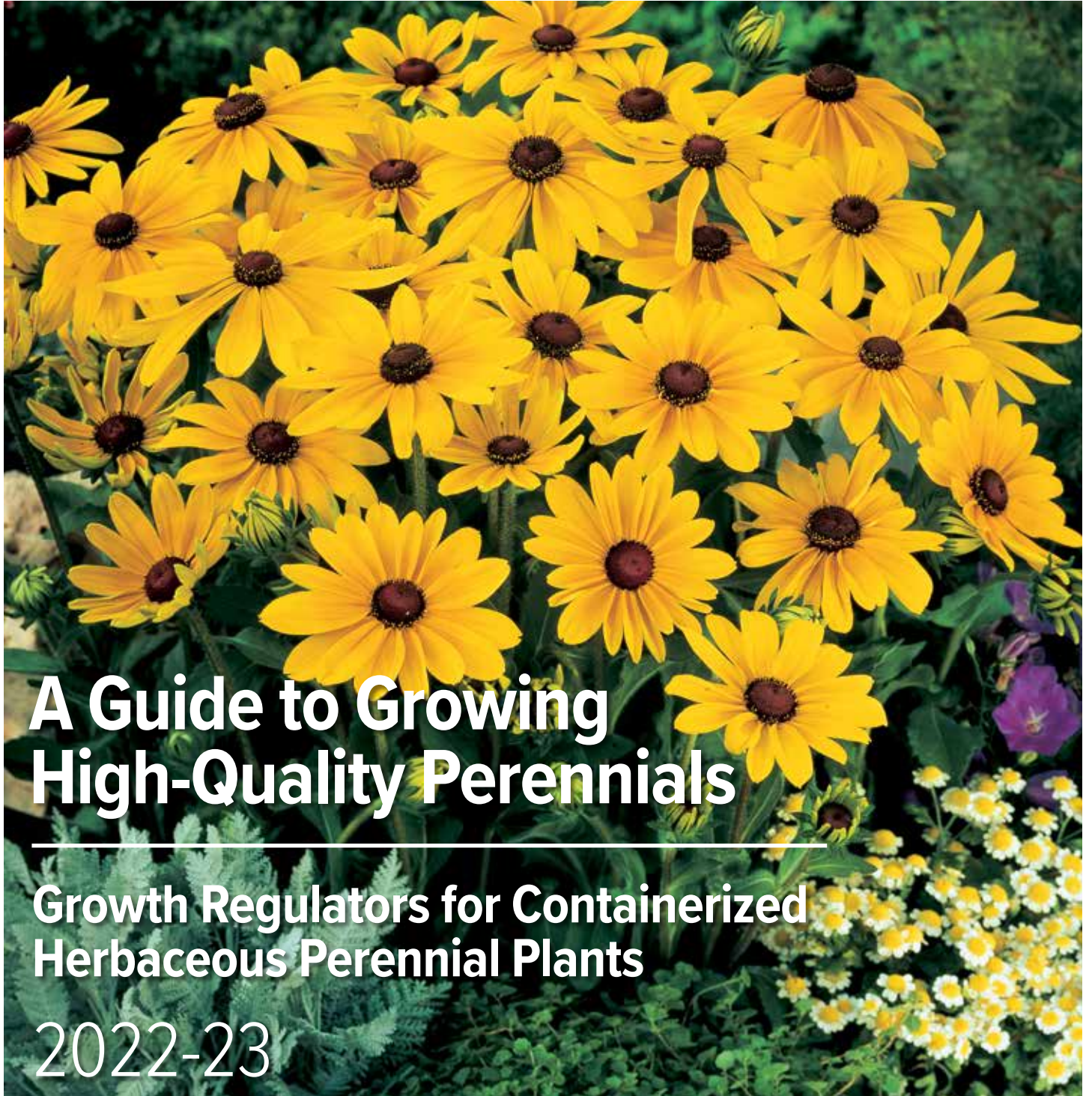


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# GROWERTALKS

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## A Guide to Growing High-Quality Perennials

Growth Regulators for Containerized  
Herbaceous Perennial Plants

2022-23

By W. Garrett Owen, University of Kentucky, and Joyce G. Latimer, Virginia Tech

# GROWERTALKS

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Dear friends and partners,

Over 35 years of PGR specialization has taught us never to rest easy in our innovation and we're excited to say our pipeline is more robust than ever. We continue to seek technologies that helps growers exceed the expectations and demands of today's quality-conscious customers and gardeners. With this latest PGR Guide, we strive to give growers another tool to maximize PGR technologies in the greenhouse.

At Fine Americas, our goal is to utilize the only full PGR portfolio in the industry to design a customized strategy to meet each grower's unique needs. We believe there's no such thing as a one-size-fits-all PGR approach; we're constantly evolving our product line to meet specific grower needs. That's reflected in this guide, as well as our line.

Two of our newest developments and additions to the Fine product line are Advocate® and Crest®.

Advocate is a growth stimulant that enhances root initiation and growth in plants propagated from cuttings. It can be tank mixed and applied with other products (fertilizers, fungicides, PGRs) and is effective on herbaceous and hard-to-root perennials, pot roses, tropicals and more.

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Finding new ways to innovate that ultimately improve plant production is always at the forefront of our work. Using Advocate and Crest in tandem is one such innovation we're excited to share. Using these two products in a program approach helps put your plants on the fast track to market—whether you're producing from cuttings or seed.

It's an exciting time to be in horticulture, and an exciting time to be privy to Fine Americas' incredible R&D efforts, supported by many of the industry's leading researchers and scientists. As we present the latest PGR Guide to you, we would like to recognize Dr. Joyce Latimer of Virginia Tech and her contribution to the industry.

For many years, we've had the privilege to partner with Dr. Latimer on both this PGR Guide and a number of important research studies. Joyce has been instrumental in the production of the Perennials PGR Guide since its inception in 2011 through updates to the large PGR tables and creation of articles describing the innovative research she's done in herbaceous perennials. Her contributions have been a great assistance to all growers of herbaceous perennials. This year marks Joyce's retirement from not only the industry, but also production of this PGR Guide. Please join us in wishing her nothing but the best and congratulating her on a career full of landmark contributions to horticulture.

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# Using Advocate and Advocate Tank Mixes During Perennial Propagation

By W. Garrett Owen & W. Ty Rich, University of Kentucky

Many herbaceous perennials can successfully be propagated from unrooted cuttings. Growers must maintain a favorable propagation environment and implement cultural practices to promote root initiation, growth and development.

While many growers may be challenged with managing and maintaining optimal environmental conditions, most all growers can easily implement rooting hormone applications. Rooting hormones can accelerate root initiation, improve rooting uniformity, aid in rooting of moderate to difficult-to-root species, and ultimately, reduce shrink and propagation time. For these reasons, rooting hormones are a great addition to any propagator's toolkit.

Traditionally, rooting hormones were applied by quickly dipping the excised end of the cutting in a talc powder prior to cutting stick, or weighing and dissolving a powder to form a solution. Now, liquid-based products are available, which can be sprayed on the foliage within 24 hours after cutting stick. Furthermore, growers must understand rooting hormones vary in formulations and contain different ingredients, such as indole-3-butyric acid (IBA). Recently, Fine Americas introduced Advocate, a liquid 20% IBA compound, which allows growers to easily dose the desired concentrate for mixing and application.

While North Carolina State University researchers evaluated Advocate applications for annual bedding plants (refer to the Annuals PGR Guide), at the University of Kentucky, we evaluated foliar application rates of Advocate and tank mixes containing Advocate + Configure (benzyladenine). Here's how we conducted the research and highlights of our findings.

## Research Trials

For each trial, unrooted cuttings were received from Dümme Orange. Cuttings were individually inserted into 105-cell propagation trays (30-mL individual cell vol.) filled with a pre-moistened commercial peat-based substrate (LM-111; Lambert Peat Moss) amended with (by vol.) 50% coarse perlite. Unrooted cuttings

were placed in a propagation environment under  $\approx 56\%$  shade cloth where ambient daylight was supplemented with  $\approx 74 \mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$  delivered from 600 W high-pressure sodium lamps to create a 16-hour photoperiod and benches providing root-zone heating of 72F (22C).

After 24-hours, unrooted cuttings of each species received foliar spray ►

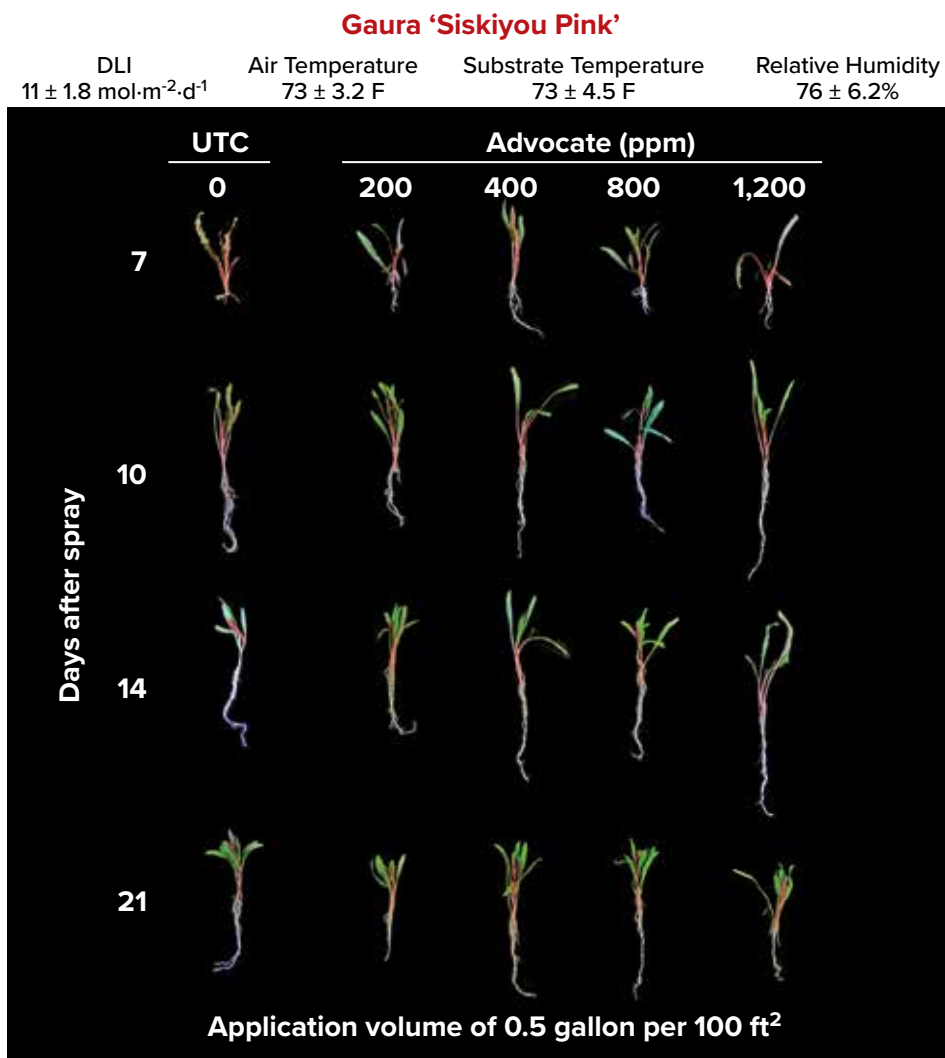


Figure 1. Gaura Siskiyou Pink cuttings at 7, 10, 14 and 21 days of propagation that received foliar spray applications of deionized water (0 ppm; control) or 200, 400, 800 or 1,200 ppm Advocate at a rate of 0.5 gal/100 sq. ft. with a handheld spray bottle from 6:00 to 7:00 a.m.

applications of deionized water (0 ppm; control), Advocate or Advocate + Configure with a handheld spray bottle from 6:00 to 7:00 a.m. Solutions were sprayed until the leaves were saturated, slightly dripping, and allowed to dry before misting resumed.

At 10 days, cuttings were irrigated daily with water supplemented with sulfuric acid to control alkalinity and fertilized with 75 ppm N provided by 17-4-17. For each trial, environmental data and Advocate or Advocate + Configure tank mix results are reported for 21-day-old cuttings.

### Advocate

In this initial trial, easy-, moderate- and difficult-to-root herbaceous perennial species were evaluated, including agastache, coreopsis, gaillardia, gaura, lavender, leucanthemum, perovskia, phlox, salvia and veronica. Cuttings of each species received a single foliar application containing either 0, 200, 400, 800 or 1,200 ppm Advocate at a rate of 0.5 gal/100 sq. ft. After 21 days, propagation daily light integral, air temperature, substrate temperature and relative humidity were  $11 \pm 1.8 \text{ mol} \cdot \text{m}^{-2} \cdot \text{d}^{-1}$ ,  $73 \pm 3.2\text{F}$ ,  $73 \pm 4.5\text{F}$  and  $76 \pm 6.2\%$ , respectively.

In general, the magnitude of root initiation and rooting uniformity varied by species. For example, regardless of Advocate application, gaura (Figure 1) cuttings exhibited significant root development and uniformity as early as seven days, while rooting in phlox (Figure 2) occurred by 14 days with enhanced rooting uniformity among cuttings sprayed with 400 and 800 ppm Advocate.

Throughout the trial, we observed epinasty or twisted growth among all species sprayed with 1,200 ppm Advocate (Figure 3). Though this concentration didn't inhibit root development, it did however reduce the aesthetic value of the rooted cuttings. Nonetheless, by 21 days, shoot and root metrics were similar among all Advocate concentrations. Therefore, based on this trial, we concluded:

- Recommended foliar applications rates are between 200 to 800 ppm Advocate.
- Do not exceed 800 ppm Advocate.

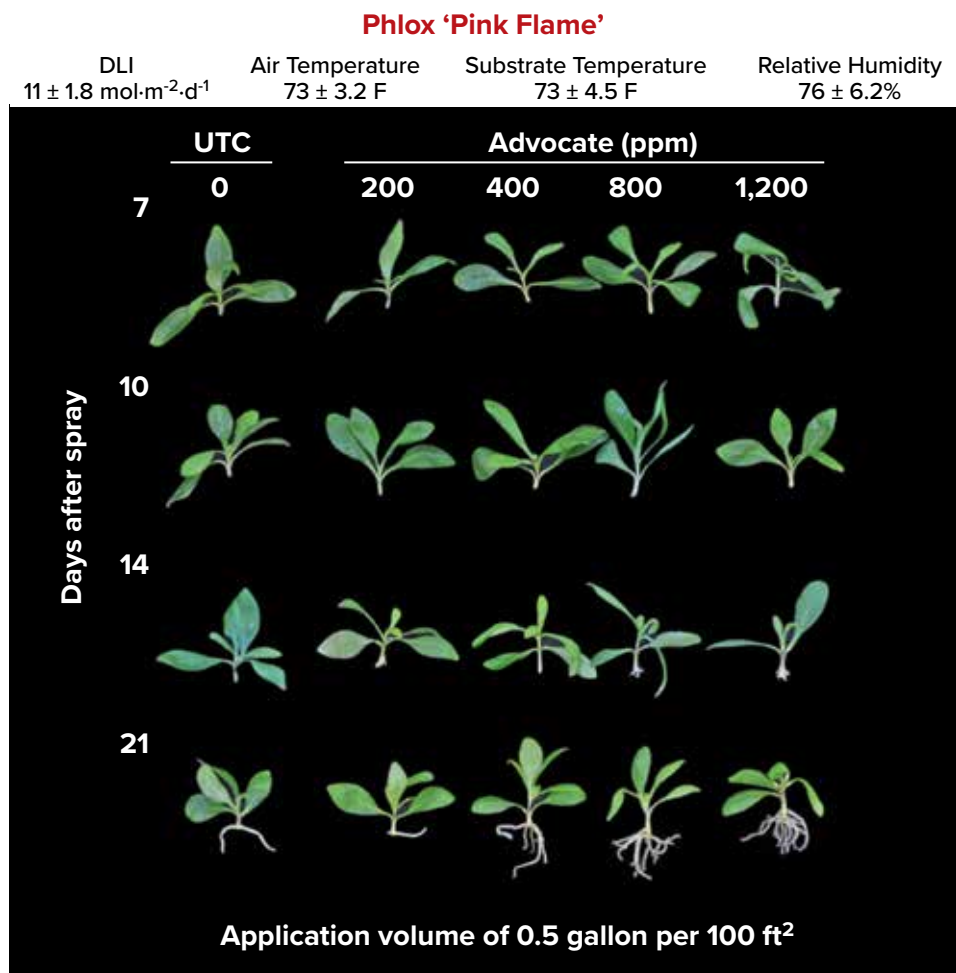


Figure 2. *Phlox paniculata* Flame Pink cuttings at 7, 10, 14 and 21 days of propagation that received foliar spray applications of deionized water (0 ppm; control) or 200, 400, 800 or 1,200 ppm Advocate at a rate of 0.5 gal/100 sq. ft. with a handheld spray bottle from 6:00 to 7:00 a.m.

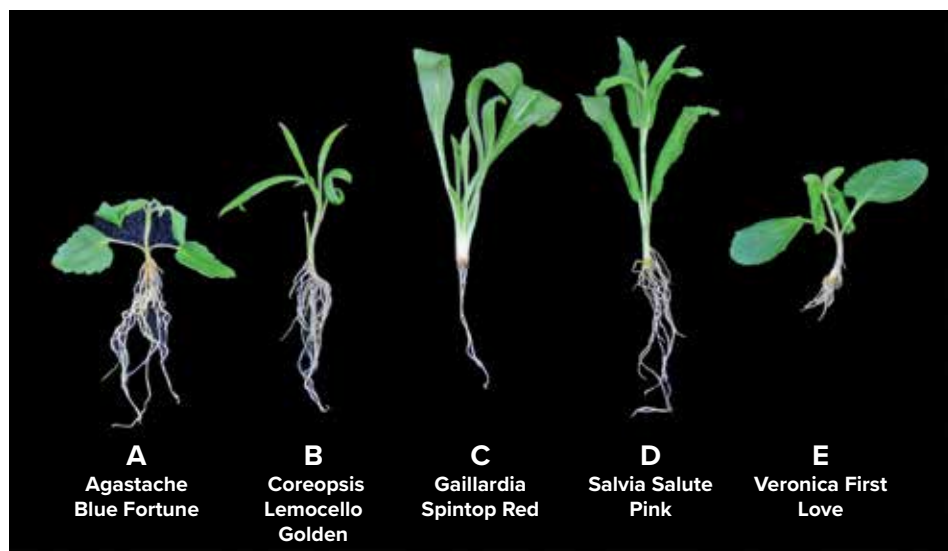


Figure 3. Epinasty or twisted growth of A) Agastache Blue Fortune; B) Coreopsis Lemocello Golden; C) Gaillardia Spintop Red; D) Salvia Salute Pink; and E) Veronica First Love cuttings sprayed with 1,200 ppm Advocate. Photos taken 14 days after foliar spray application at a rate of 0.5 gal/100 sq. ft.

- Root initiation response will vary among species.

- Uniform rooting will occur among cuttings with the potential to reduce propagation time by seven or 14 days.

- Growers should conduct trials to evaluate Advocate concentrations that work for species not listed here.

- Results may vary by propagation environmental conditions.

### Advocate + Configure

In this initial trial, herbaceous perennial species that often require growth control and branching were evaluated, including coreopsis, gaura, lamium and lavender. Cuttings of each species received a single foliar application containing 200 ppm Advocate at a rate of 0.5 gal/100 sq. ft., sprayed 24 hours after cutting stick. At 12 days after initial Advocate spray application, cuttings received a second foliar

spray application of 200 ppm Advocate + Configure at concentrations of 0, 50, 100, 200, 300, 400, 600 or 800 ppm at a rate of 0.5 gal/100 sq. ft. After 21 days, propagation daily light integral, air temperature, substrate temperature and relative humidity were  $12 \pm 1.8 \text{ mol}\cdot\text{m}^{-2}\cdot\text{d}^{-1}$ ,  $70 \pm 2.2\text{F}$ ,  $73 \pm 2.5\text{F}$  and  $70 \pm 3.2\%$ , respectively.

In general, the magnitude of extension growth control and branching varied by species while enhancing rooting in response to the PGR applications. For example, increasing from 50 to 400 ppm Configure significantly controlled extension growth of gaura (Figure 4) and lamium (Figure 5) while increasing axillary shoot number.

Meanwhile, little to no growth control or promotion was observed for coreopsis or lavender. Furthermore, we observed epinastic (twisted) growth among all species sprayed with 600 and 800 ppm Configure. Visually, root mass appeared to be less at higher concentrations of Configure, though we didn't measure any negative effects. Therefore, based on this trial, we concluded:


- Suggested foliar tank mix applications containing 200 ppm Advocate + 50 to 400 ppm Configure can be used.

- Do not exceed 600 ppm Configure on young plants.

- Growth control and improved branching will vary among species.

- Growers should conduct trials to evaluate Advocate + Configure tank mix concentrations that work for species not listed here.

- Results may vary by propagation environmental conditions.

Overall, these trials demonstrated the ease and effectiveness of using Advocate for rooting herbaceous perennial cuttings. Growers should consider implementing Advocate into their propagation program to enhance rooting, improve rooting uniformity and reduce propagation time. Please note—species and cultivar variation will occur, therefore growers should always consider performing in-house trials. 

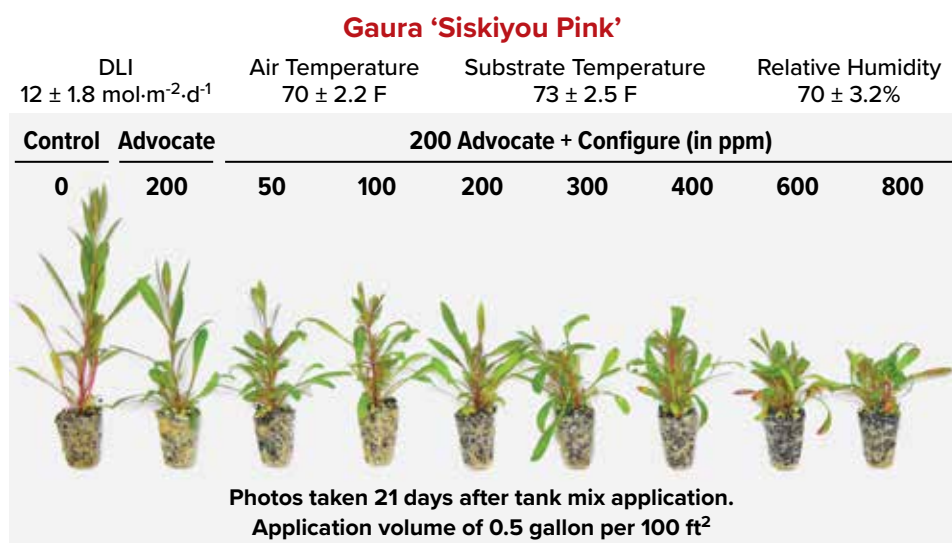


Figure 4. Gaura Siskiyou Pink cuttings at 21 days of propagation that received foliar spray applications of deionized water (0 ppm; control) or 200 Advocate + 0, 50, 100, 200, 300, 400, 600 or 800 ppm Configure at a rate of 0.5 gal/100 sq. ft. with a handheld spray bottle from 6:00 to 7:00 a.m.

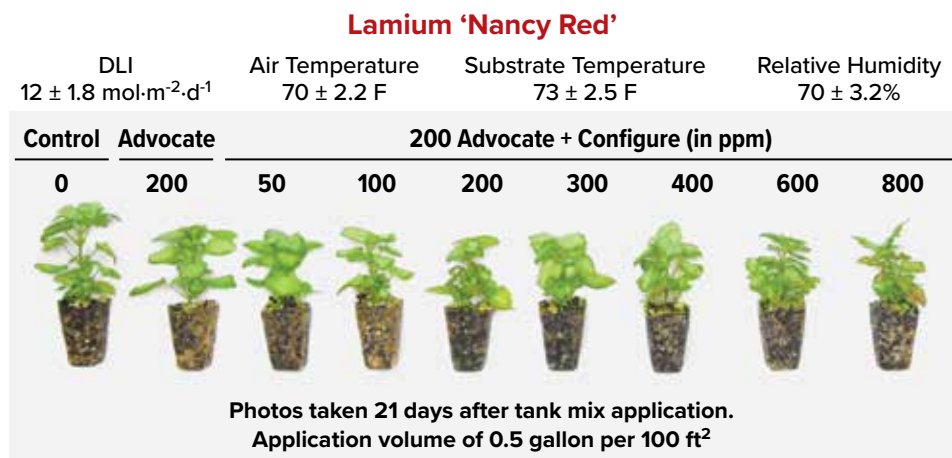


Figure 5. Lamium Red Nancy cuttings at 21 days of propagation that received foliar spray applications of deionized water (0 ppm; control) or 200 Advocate + 0, 50, 100, 200, 300, 400, 600 or 800 ppm Configure at a rate of 0.5 gal/100 sq. ft. with a handheld spray bottle from 6:00 to 7:00 a.m.

# Controlling Growth of Rudbeckia Cultivars

By W. Tyler Rich & W. Garrett Owen, University of Kentucky

Rudbeckia spp. are becoming increasingly popular herbaceous perennials for late-summer and fall sales because of their complementary fall flower colors ranging from brilliant yellow to orange, red or brown. Growers who produce rudbeckia know that growth control is needed. While various environmental and cultural practices may be deployed to control growth, plant growth regulators (PGRs) are excellent tools that can be utilized. To address growth control needs of tried-and-true and new rudbeckia cultivars, we sought to evaluate Concise and Piccolo drenches.

## Research

Liners of Autumn Colors, Cherry Brandy, Denver Daisy, Glowing, Happy, Indian Summer and Sunny Rudbeckia were transplanted between September 3 and 25, 2020. Plants were grown in 6.5-in. containers filled with a pre-moistened commercial soilless peat-based substrate formulated to contain (by vol.) 80% peat, 20% perlite and amended with limestone, wetting agent and a starter nutrient charge (Lambert Peat Moss LM-111). Plants were grown under a constant 68F (20C) and ambient daylight supplemented with  $\approx 125 \mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$  delivered from 600 W high-pressure sodium lamps to create a 16-h photoperiod.

The average air temperature, daily light integral and relative humidity were 68F,  $14 \text{ mol}\cdot\text{m}^{-2}\cdot\text{d}^{-1}$  and 70%, respectively. Throughout the trial, plants were irrigated with water supplemented with 93% sulfuric acid to control alkalinity and fertilized with 150 ppm N provided by 17-4-17. Plants also received monthly Epsom salt drench applications at 1 lb. per 100 gallons of water.

On October 14, PGR drench applications were applied. Six single-plant replications of each cultivar received a substrate drench of 5 fl. oz. (150-mL) of solution containing deionized water (0 ppm; control), 1, 2 or 4 ppm Concise (uniconazole), or 2.5, 5, 10 or 20 ppm Piccolo (paclobutrazol). For the trial, saucers were placed under each container, so no solution was leached. Plants were grown until visible pollen shed (anthesis) where data were collected, including plant height, diameter (taken in two directions and averaged) and plant dry mass. Time to flower was calculated from date of drench application to anthesis.

## Results


In general, at the concentrations used, growth control was not achieved with the Concise substrate drench concentrations investigated for most all cultivars except Glowing. For Glowing, plant height was significantly shorter by 22% (4.6 in.) when plants were drenched with 0 to 4 ppm Concise without negatively affecting dry weight and time to flower (Figure 1). Further investigations with higher drench concentrations or multiple low-dose drench applications are needed.

In general, 5 to 10 ppm Piccolo drench applications effectively controlled growth for all cultivars, while the magnitude of control varied among cultivars for plant diameter, dry mass and time to flower. For example, plant height of Glowing and Happy drenched with 0 to 10 ppm Piccolo was controlled by 150% (13 in.) and 35% (3.3 in.), respectively (Figures 2 to 3). Increasing Piccolo drench concentration from 0 to 10 ppm significantly delayed flowering of Glowing by eight days (Figure 2), while the effect wasn't observed for Happy; plants flowered within two days regardless of Piccolo concentration (Figure 3).

## Conclusion and application

Concise substrate drenches of 1 to 4 ppm didn't provide growth control for the cultivars trialed. The lack of growth control at the concentrations trialed was surprising. In general, uniconazole is the preferred PGR for perennial growth control. Higher concentrations may be required to achieve the desired level of growth control.

Piccolo drench concentrations of 5 to 10 ppm significantly controlled growth, but growers should be aware that drenches slightly delayed flowering, but effects vary by cultivar. (Please note: Growers will need to determine the desired level of control when selecting the optimal drench concentration of Piccolo.)

Furthermore, drench concentrations were determined under Kentucky-greenhouse growing conditions (38°N Latitude), but adjustments may be needed for other locations. For example, growers in northern locations may want to use  $\leq 5$  ppm Piccolo, while southern growers may want to utilize up to 10 ppm Piccolo. 

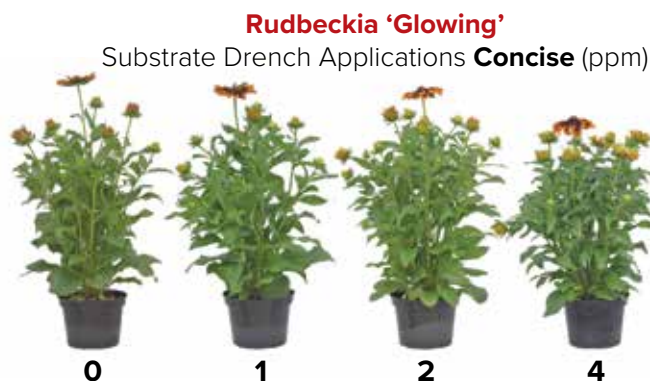


Figure 1. Glowing Rudbeckia drenched with 0, 1, 2 or 4 ppm Concise.

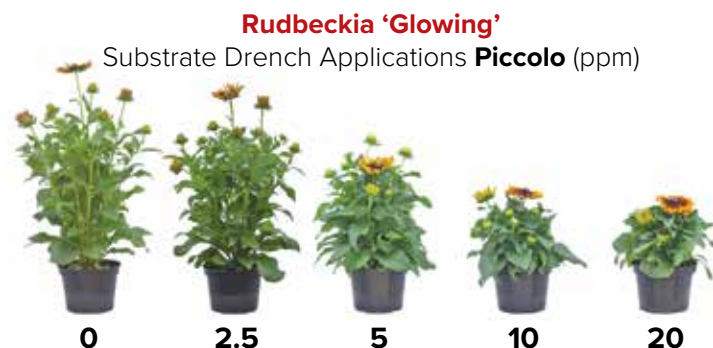


Figure 2. Glowing Rudbeckia drenched with 0, 2.5, 5, 10 or 20 ppm Piccolo.



Figure 3. Happy Rudbeckia drenched with 0, 2.5, 5, 10 or 20 ppm Piccolo.

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# Apply Fresco to Recover PGR-Stunted Herbaceous Perennials

By Joyce Latimer & Daniel Jackson, Virginia Tech

Mistakes happen! Sometimes it's a calculation error. Sometimes it's overspray onto sensitive crops. Sometimes the liners came in that way. Sometimes your plants have been stunted by an overdose of PGRs. You've seen recommendations on using Fresco, the combo product of the gibberellins GA4/7 + 6-BA (benzyladenine), to overcome that growth retardant effect and enhance the growth of stunted crops. Just in case you're still leery of using Fresco on your herbaceous perennials, we wanted to demonstrate the use of Fresco in enhancing the growth of herbaceous perennial plants previously stunted by the application of excessive growth retardant.

## What we did

Commercial liners of the herbaceous perennials were potted into quart pots and allowed to establish for about three weeks before the growth retardant was applied. The growth retardants used were Piccolo 10 XC or Concise. Fresco was applied as a single foliar spray at 0, 2.5, 5, 10 or 15 ppm.

*Gaura Siskiyou Pink* pots were drenched with 2 fl. oz. of 40 ppm Piccolo 10 XC. Fresco was applied 18 days later. Plant height and width were measured 10 days after the Fresco application.

For *Veronica First Love* plants, 60 ppm Concise was applied as a foliar spray at the label recommended volume of 1 gal./200 sq. ft. Fresco was applied 18 days

later. Plant height and width were measured 15 days after the Fresco application.

## What we found

***Gaura Siskiyou Pink*** plants were significantly stunted by the Piccolo 10 XC application with the height or width of treated plants only 47% or 50%, respectively, of that of untreated plants at 10 days after the Fresco treatment (Table 1). Height of plants treated with 10 ppm or 15 ppm Fresco was significantly greater than the height of those receiving no Fresco recovery treatment, but the 5 ppm Fresco treatment also produced saleable plants (Figure 1).


***Veronica First Love*** plants were significantly stunted by the Concise application with the height or width of treated plants only 50% or 38%, respectively, of that of untreated plants at 15 days after the Fresco treatment (Table 2). All rates of the Fresco application restored growth of veronica with little differences in final height or salability (Figure 2). Plant width increased with increasing rates of Fresco, improving the appearance of the plants, but all plants were restored to saleable condition.

## Fresco use tips

Notice how effective the low dose of 2.5 ppm Fresco was at restoring growth and salability of these PGR-stunted plants. We generally recommend spray rates of 1 to 5 ppm Fresco, depending on the severity of the stunting. Begin with the lower rates and wait seven days to determine if you've achieved the desired level of

growth recovery. After seven days, if you have not seen the level of recovery desired, an additional application may be made to continue the recovery. Only apply enough Fresco to restore the growth rate to overcome the growth retardant effect. Too much Fresco will cause excessive growth/stretching of the stem and flower stalks and weaken the overall plant structure. You want to restore growth, not force it. Results vary with the crop and the degree of stunting, so always start with a small trial and adjust the rates accordingly.

If you're more comfortable with drench or subirrigation applications, be aware that Fresco is the only GA4+7 + 6-BA combination product registered for these applications. Drenches and subirrigation can provide more even distribution of PGRs throughout the substrate, and therefore, more uniform uptake and distribution of the active ingredients in the plant. For media drenches, start with 1 to 3 ppm in sufficient volume cover the entire root system. Evaluate recovery after one week. If necessary, reapply Fresco at one-half the initial rate. For subirrigation applications, reduce initial rates by 25% to 50%. Again, evaluate the effects on a few plants before you apply Fresco to your entire crop.

As always, read and follow all label recommendations. Plant growth regulators are still pesticides, subject to all the safety and use regulations listed on the label. 

### Gaura Siskiyou Pink

Stunted (yes/no)	Fresco rate (ppm)	Plant height (cm)	Plant width (cm)
No	0	24.5 a	38.3 a
Yes	0	13.0 b	19.3 b
Yes	2.5	18.2 ab	23.6 b
Yes	5	18.5 ab	22.9 b
Yes	10	21.3 a	26.3 b
Yes	15	22.8 a	27.3 ab
p-value*		<0.01	<0.01

\*One-way ANOVA with mean separation by Tukey's HSD

Table 1. Height and width of *Gaura Siskiyou Pink* plants stunted with a 40-ppm drench of Piccolo 10 XC. Growth measured at 10 days after a spray application of Fresco at 0, 2.5, 5.0, 10 or 15 ppm.

### Veronica First Love

Stunted (yes/no)	Fresco rate (ppm)	Plant height (cm)	Plant width (cm)
No	0	42.2 a	31.6 a
Yes	0	20.8 b	19.4 c
Yes	2.5	23.7 b	22.6 bc
Yes	5	23.2 b	24.4 b
Yes	10	22.8 b	25.3 b
Yes	15	24.7 b	26.8 ab
p-value*		<0.01	<0.01

\*One-way ANOVA with mean separation by Tukey's HSD

Table 2. *Veronica First Love* plants stunted with a 60-ppm foliar spray application of Concise. Growth measured at 15 days after a spray application of Fresco at 0, 2.5, 5.0, 10 or 15 ppm.



Figure 1. *Gaura Siskiyou Pink* plants stunted with a 40-ppm drench of Piccolo 10 XC. Picture taken 10 days after a recovery application of 0, 2.5, 5.0, 10 or 15 ppm Fresco foliar spray.



Figure 2. *Veronica First Love* plants stunted with a 60-ppm foliar spray application of Concise. Picture taken 15 days after a recovery application of 0, 2.5, 5.0, 10 or 15 ppm Fresco foliar spray.



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# Wide Assortment of Available PGRs

By Brian E. Whipker, North Carolina State University, Joyce G. Latimer, Virginia Tech & W. Garrett Owen, University of Kentucky

## Here's an overview of PGRs now available for use on ornamental crops

The number of options available for controlling plant growth has greatly expanded over the past few years (Table 1). There are now options for controlling growth, expanding growth and encouraging branching. Each label has specific recommended dose ranges, recommendations and precautions (Table 2). Here is an overview of the PGRs now available for use on ornamental crops.

### Ancymidol

(Commercial names: **Abide** and **A-Rest**)

Ancymidol readily moves through the plant and is usually used on crops where other chemicals aren't effective (most notably in bulb crops) or on very high-value crops (i.e., plugs). Growers often prefer the use of ancymidol on plugs because of the lack of phytotoxicity and it's a "safer" PGR to apply (because its limited residual activity allows the plugs to grow out of the growth control effects after being transplanted).

### Chlormequat chloride

(Commercial names: **Citadel** and **Cycocel**)

For ornamental crops, it's most commonly used on poinsettias, geraniums, osteospermum and hibiscus. Foliar chlormequat chloride applications can result in a phytotoxic response (chlorosis), but the symptoms are acceptable because they're usually covered up with new leaf growth. In certain crops (i.e., poinsettias, geraniums and herbaceous perennials), a mixture of daminozide and chlormequat chloride (both may be used or applied at reduced rates) may be used. This usually provides for greater height control and reduces the potential for phytotoxicity. Substrate drenches are also effective, but not cost effective.

### Daminozide

(Commercial names: **Dazide** and **B-Nine**)

This material is applied only as a foliar spray because it's rapidly broken down when applied to the substrate. It's highly mobile in the plant and will rapidly move from the point of application to all parts of the plant. Daminozide is effective on most crops except lilies. It's highly effective in controlling growth of seedlings in plug flats and it's most effective in cooler climates. Note: The **Dazide** label now has a 12-hour REI instead of the 24-hour REI previously required.

### Dikegulac sodium

(Commercial name: **Atrimmec**)

Although Augeo, the greenhouse version of dikegulac sodium, is no longer on the market, Atrimmec has been available and registered for greenhouse and nursery use for a long time. Dikegulac sodium temporarily stops shoot elongation, thereby promoting lateral branching. Thus, it is a growth retardant and a pinching agent for ornamental crops, including azaleas, bougainvillea, clerodendron, fuchsia, grape ivy, geranium, lantana, lipstick vine, verbena and some of the herbaceous perennials. Be aware that Atrimmec typically causes greater phytotoxicity and distorted growth on herbaceous crops than Augeo did. So be cautious—especially at higher rates—and allow sufficient time for new plant growth to cover any damaged leaves. ▶

Table 1. The wide assortment of plant growth regulators available for ornamental crops.

CHEMICAL	PRODUCTS
Ancymidol	<b>Abide</b> , A-Rest
Chlormequat chloride	<b>Citadel</b> , Cycocel
Daminozide	<b>Dazide</b> , B-Nine
Dikegulac sodium	Atrimmec
Ethephon	<b>Collate</b> , Florel
Flurprimidol	Topflor
Paclobutrazol	<b>Piccolo</b> , <b>Piccolo 10 XC</b> , Bonzi, Pac O, Downsize (drenches only)
Uniconazole	<b>Concise</b> , Sumagic
Benzyladenine (BA)	<b>Configure</b>
Gibberellin (GA3)	<b>Florgib</b> , ProGibb T&O
BA+GA4+7	<b>Fresco</b> , Fascination
Indole-3-butyric Acid	<b>Advocate</b> , Hortus IBA

Table 2. Comparing Attributes of Plant Growth Regulators

Attributes	Plant Growth Regulator									
	Chemical	Ancymidol	Chlormequat chloride	Daminozide	Daminozide + Chlormequat chloride	Ethephon	Flurprimidol	Paclobutrazol	Uniconazole	Indole-3-butyric Acid
Trade name(s)	Abide, A-Rest	Citadel, Cycocel	Dazide, B-Nine	—	—	Collate, Florel	Topflor	Piccolo, Piccolo 10 XC, Bonzi, Downsize, Pac O	Concise, Sumagic	Advocate, Hortus IBA
Active ingredient (%)	0.03%	11.80%	85%	—	—	21.7%/3.9%	0.38%	0.4% 4% (Piccolo 10 XC)	0.06%	20.00%
Activity level	++	+	+	++	+	+++	+++	+++	+++	++
Multiple applications needed	++	+++	+++	++	++	+	+	+	+	++
Application type <sup>1</sup>										
Foliar spray	yes	yes	yes	yes	yes	yes	yes	yes <sup>1</sup>	yes	Unrooted cuttings
Substrate drench	yes	yes	no	no	no	yes	yes	yes	yes	Unrooted cuttings
Dips/Soaks	plugs/liners	plugs/liners	cuttings	—	—	bulbs, plugs/liners	bulbs, plugs/liners	bulbs, plugs/liners	bulbs, plugs/liners	Unrooted cuttings
Chemical absorption										
Ease of absorption	+++	+	+	+	++	+++	+++	+++	+++	+++
Time (hours)	0.5-1.0	4	18-24	18-24	12-16	0.5-1.0	0.5-1.0	0.5-1.0	0.5-1.0	0.5-1.0
Factors that improve absorption	high humidity, limited air movement, cloudy days, early morning or late afternoon applications									
Translocation within the plant	+++	+++	+++	+++	—	+	+	+	+	+++
Absorption sites										
Leaves	+++	+++	+++	+++	+++	++	++	++	++	+++
Stems	+	+	—	+	—	++	++	++	++	+++
Roots	++	+	—	—	+	+++	+++	+++	+++	—
Typical concentrations										
Foliar sprays (ppm or mg/L)	15-50	1,000-3,000	1,250-5,000	Daminozide: 750-5,000 + Chlormequat 750-1,500	250-1,000	1-80	1-200	0.5-50	100-400	
Drench (mg active ingredient per pot)	0.15-4.0 (1.25 to 33.8 ppm)	177-355 (1,500 to 3,000 ppm)	—	—	—	0.01-2.0 (0.08 to 17 ppm)	0.01-8.0 (0.1 to 68 ppm)	0.01-1.0 (0.1 to 11 ppm)	—	
Other factors										
Does pine bark substrates affect drenches?	++	—	—	—	—	++	++	++	++	—
Phytotoxicity potential	+	+++	+	+	++ (Do not apply to stressed plants)	+	+	+	+	+
Overdose potential	+	+	++	++	++	+++	+++	+++	+++	+
Optimum water pH	5.5-6.5	3.0-7.0	5.0-9.0	—	below 5.0	—	4.0-9.0	5.5-6.5	—	
Shelf life										
In the bottle (years)	<3	<2	<2	—	indefinite	<4	<4	<2	—	
Mixed solution	within 24 hours	within 24 hours	within 24 hours	within 24 hours	within 4 hours	within 24 hours	within 1 week	within 24 hours	within 24 hours	

— = Not applicable.

Degree of activity: (+) least to (+++) greatest

<sup>1</sup> Check label for legal uses

### Ethephon phosphonic acid

(Commercial names: **Collate** and **Florel**)

This material is absorbed by the plant tissue, and due to a change in pH once absorbed into the plant cells, releases ethylene. Collate and Florel are used to promote flower bud abortion and vegetative branching in crops. Collate and Florel are applied as a foliar spray at concentrations of 250 to 500 ppm. Although ethephon has soil activity, it's not labeled for use as a drench or liner soak application.

### Flurprimidol

(Commercial name: **Topflor**)

Flurprimidol is a relatively recent introduction into the U.S. market, although it's been available in Europe since the 1990s. Flurprimidol is chemically closely related to ancymidol, but it has a greater degree of activity. Flurprimidol is also one of the most cost-effective growth retardants to use as a drench, with recommended use rates in a range similar to uniconazole on most plants. Flurprimidol is also available in a granular formulation for containerized ornamentals.

### Other Growth Regulators

Not all plant growth regulators are used to control plant height. Others are used to cause flower bud abscission, increase branching, promote flowering, stimulate shoot elongation and aid in rooting.

### Benzyladenine

(Commercial name: **Configure**)

Benzyladenine (BA) is used to promote branching and increase flower set. Configure has specific label recommendations for Christmas cactus, echinacea and hostas, as well as use directions for experimental applications on any annual, perennial, foliage or tropical plant grown in a greenhouse. Optimal results occur when the plant is actively growing and is physiologically receptive for growth or flower promotion. Configure has been very effective in improving branching of many herbaceous perennial crops, as both liners and finished plants. Benzyladenine doesn't readily move within the plant, therefore, complete coverage is required.

### Paclobutrazol

(Commercial names: **Piccolo**, **Piccolo 10 XC**, **Bonzi**, **Downsize [labeled for drench applications only]** and **Pac O**)

Paclobutrazol is the most widely used growth retardant for greenhouse-grown floriculture crops in the U.S. It's commonly applied as a foliar spray or a substrate drench. It can be applied as a single high-dose drench to provide season-long control of growth or as a low-dose drench of 0.1 to 1 ppm to provide temporary control of plant growth.

### Uniconazole

(Commercial names: **Concise** and **Sumagic**)

Uniconazole is applied as a foliar spray, as a substrate drench or as a liner soak. As a drench, uniconazole is applied at rates 50% lower than those recommended for paclobutrazol. This chemical is commonly used on perennials because it's highly effective on a very broad range of plant species.

### Gibberellins

(Commercial names: **Florgib** and **ProGibb T&O**)

Gibberellins can be applied to promote growth and overcome an over-application of gibberellin-inhibiting plant growth retardants. They're also used to promote stem elongation for tree forms of plants.

### Indole-3-butyric Acid

(Commercial names: **Advocate** and **Hortus IBA**)

Indole-3-butyric acid is used to promote adventitious root formation in vegetative unrooted cuttings. This material can be applied as a total immersion, spray, and basal quick and long dips. It's highly mobile in the plant and effective as a spray. Growers often apply IBA as a foliar spray 24 hours after cutting stick.


### Cautions

Both paclobutrazol and uniconazole are triazole-type chemicals. Ancymidol and flurprimidol are in a different chemical class, but have similar characteristics. These chemicals don't readily move within the plant since they're transported in the xylem and not in the phloem. Therefore, these four chemicals are absorbed by the leaves, but aren't readily transported out of the leaves to other parts of the plant. Thus, foliar sprays are applied with sufficient volume of water (2 qt. per 100 sq. ft.) to have some stem and soil activity.

The activity of flurprimidol, paclobutrazol and uniconazole are long lasting and at very low rates, thus the potential for error and crop overdose is greater than with other PGRs. Also note, ancymidol, flurprimidol, paclobutrazol and uniconazole are persistent on plastic surfaces and in soil. Do not reuse flats, pots or soil from treated plants, especially for plug production of sensitive crops.

### Benzyladenine + Gibberellin Combinations

(Commercial names: **Fresco** and **Fascination**)

These combination products are used on potted lilies as foliar sprays to avoid lower leaf yellowing and leaf drop, plus prolonging flower life. They're also used to overcome the effects of an over-application of gibberellin-inhibiting plant growth retardants. 



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By Dudley Dabbs



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It's like gaining an extra day of productivity each time you treat.

**Now, the New Dazide from Fine Americas has been reformulated so that it can be rewet** – providing a new level of flexibility that growers haven't had before. The New Dazide works better in adverse conditions and can be rewet within 36 hours of the initial application to reactivate any of the active ingredient remaining on leaves.

Just a light mist to moisten the leaf slightly ensures growers get every bit of power out of their daminozide. This may seem like a small reformulation, but for growers fighting to accomplish more with less, facing ever-tightening labor and schedule constraints, it provides new opportunities for productivity.

**The New Dazide provides another added benefit – it comes in a new plastic screw-top container.** Unlike the previous resealable bag packaging, the new container reseals tightly and easily to block out moisture – important with daminozide's highly water soluble nature. Growers reported that the old bag also didn't store or stack well, tending to fall over and spill. The new container solves those challenges.

In addition, Fine Americas has answered grower requests for easier handling by creating a new 20 lb. case with handles on both ends, making it easier to carry a case in each hand instead of trying to carry the old 40 lb. flexible case as it bent and buckled. The new rigid case also stacks and transports easily.

Plus, the new containers are better for the environment: The plastic is recyclable, compared to the old mylar bags that went straight to the trash.

For complete details on rates and timing for the New Dazide, see Fine's award-winning PGR Guides for annuals or perennials.



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# Growth Regulators for Containerized Herbaceous Perennial Plants

By Joyce G. Latimer, Virginia Tech & W. Garrett Owen, University of Kentucky

This table lists label rates, when available, and includes recommendations based on research from Virginia Tech and other published sources, as well as from plant suppliers and growers. Spray rates listed are recommended as applications at the label-recommended volume of 1 gal. per 200 sq. ft. unless otherwise stated. Use the rates listed as starting points for your own PGR trials.

Note: Not all uses are listed on the label; always check the product label before using. Consult product labels for a complete listing of precautions and recommended use rates. When using any PGR for the first time, always test the rate on a few plants and compare the results to untreated plants before treating an entire crop. Keep in mind that Sunbelt growers use higher rates than Northern growers.

**Please note:** Recommendations are color-coded according to source. Those in yellow are from Sunbelt sources; blue are from northern sources; green are from sources that do not specify area of the country, including product labels, many producer websites and cultural guides; and pink are recommendations related to increasing plant branching. For research results identified as “Fine Configure Guide,” see details and the original references in the Configure Product Information and University Trial Results (information on how to get it at the end of the table).

**For product mixing instructions, see the PGR Dilution Table on page 75.**

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Achillea millefolium</i> (Common Yarrow)	To control plant growth	Abide/A-Rest	Greater than 1.5 mg a.i. drench x 1	Summer Pastels – moderate control; Test higher than 1.5 mg a.i. drench rates (3.3 fl. oz./pot); Drench volume and mg a.i. vary with container size	South
			1 to 2 ppm drench x 1	Drench volume and mg a.i. vary with container size	Unspecified
			50 to 100 ppm spray x 1	Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required	North
		Collate/Florel	500 or 1,000 ppm spray x 1 to 3	Higher rates or more frequent treatment gave moderate growth control; All treatments increased number of inflorescences with slight delay in flowering	North
		Dazide/B-Nine	5,000 ppm spray x 2	Red Beauty and Paprika – good control with 2 applications 2 weeks apart; Moonshine – less responsive	South
			2,500 to 5,000 ppm spray x 2 to 3	Tutti Frutti – 2,500 ppm daminozide applied at weekly intervals until desired control is established; Apply lower rates early in production and higher rates later under better growing conditions	North
			Tank mix	2,000 ppm daminozide plus 3 ppm uniconazole applied at weekly intervals until desired control is established	North
		Dazide/B-Nine + Citadel/Cyocel Tank Mix	5,000 + 1,500 ppm spray x 1	Paprika	South
			3,000 + 1,500 ppm spray x 4	Summer Pastels – at 2-week intervals	North
		Citadel/Cyocel	Not responsive at 5,000 ppm spray x 1	Coronation Gold – not responsive	South
			1,500 ppm spray x 4	Summer Pastels – at 2-week intervals	North
		Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize (drenches only)	96 to 120 ppm spray x 1	Coronation Gold, Summer Pastels	South
			60 ppm spray x 4	Summer Pastels – at 2-week intervals	North
			1.0 mg a.i. drench x 1	Summer Pastels – good control with a 1.0 mg a.i. drench (3.3 fl. oz./pot); Drench volume and mg a.i. vary with container size	South
			1 to 2 ppm drench x 1	Multiple applications may be necessary; Drench volume and mg a.i. vary with container size	Unspecified

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<b>Achillea millefolium</b> (Common Yarrow) <i>continued</i>	To control plant growth <i>continued</i>	<b>Concise</b> /Sumagic	10 to 30 ppm spray x 1	Paprika and Coronation Gold – excellent control at lower rates; Red Beauty and Moonshine not responsive at 60 ppm spray x 1	South
			0.25 mg a.i. drench x 1	Summer Pastels; Higher than 0.25 mg a.i. drench rates reduced number of flowers (3.3 fl. oz./pot); Drench volume and mg a.i. vary with container size	
			7 to 15 ppm spray x 1 to 4	Apply lower rates early in production and higher rates later under better growing conditions; Summer Pastels – 15 ppm sprays x4 at 2-week intervals	North
		Topflor	150 ppm spray x 1	Coronation Gold – multiple applications may be required	South
	To increase lateral or basal branching	<b>Configure</b>	600 ppm spray x 2	Moonshine; 60% increase in branching when applied as liner (21 days after sticking) and again at 5 days after transplanting; No phyto	Branching
<b>Agastache hybrids</b> (Anise Hyssop)	To control plant growth	<b>Collate</b> /Floreil	500 ppm spray x 4	Blue Fortune – excessive height control, but no delay in flowering; applied at 2-week intervals	North
		<b>Dazide</b> /B-Nine	5,000 ppm spray x 2 to 3	Blue Fortune	South
			1,200 to 5,000 ppm spray x 1 to 3	All hybrids; Weekly applications as necessary	North
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	5,000 + 1,500 ppm spray x 1	Blue Fortune	South
			2,500 + 1,000 ppm spray to 5,000 + 1,500 ppm spray x 2 to 3	Weekly applications as necessary	North
		<b>Piccolo/Piccolo 10 XC</b> /Bonzi/Pac O/Downsize (drenches only)	1 to 2 ppm drench x 1	Drench volume and mg a.i. vary with container size	North
			30 to 60 ppm spray x 1	Good control	
			80 to 160 ppm spray x 1	Tutti Frutti – use lower rates; Purple Haze – use higher rates; Multiple applications may be required	South
			Less than 5 ppm drench x 1	Tutti Frutti – stunted at 5 ppm at 2 fl.oz. per quart pot; Purple Haze – excellent control with 8 ppm drench at 10 fl.oz. per trade gallon pot; Drench volume and mg a.i. vary with container size	
		<b>Concise</b> /Sumagic	10 to 30 ppm spray x 1	Cultivar variation, Blue Fortune, Blue Boa – use lower rates; Purple Haze – use higher rates	South
			2 ppm drench x 1	Purple Haze – Drench at 10 fl. oz. per trade gallon pot; Drench volume and mg a.i. vary with container size	
			Less than 1 ppm liner soak x 1 or 1 ppm liner drench x 1	Blue Boa – excessive growth control after liner soak or drench (0.3 fl. oz. per 72-size cell) just prior to transplanting; reduce rate	
			5 to 10 ppm spray x 1	Good control	
		To enhance lateral branching	<b>Configure</b>	300 to 500 ppm spray x 1 on liners	Purple Haze – 300 ppm at 4 days after liners were removed from mist increased lateral branching; Multiple applications during liner production or higher rates decreased root growth. Tutti Frutti – 500 ppm spray the day after removal from mist increased branching of liners and finished plants
	<b>Ajuga reptans</b> (Bugleweed)	To control plant growth	<b>Dazide</b> /B-Nine	2500 ppm spray x 1	Multiple applications may be required
<b>Piccolo/Piccolo 10 XC</b> /Bonzi/Pac O/Downsize (drenches only)			1 to 2 ppm drench x 1	Drench volume and mg a.i. vary with container size	
<b>Concise</b> /Sumagic			2.5 ppm spray x 1	Use caution in applying uniconazole as plants can be very sensitive	North
<b>Collate</b> /Floreil			300 to 500 ppm spray x 1 on liners	For branching	Branching

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Alcea hybrids</i> (Hollyhock)	To control plant growth	<b>Abide/A-Rest</b>	100 ppm spray x 6	Chaters Doubles – weekly sprays	North
		<b>Citadel/Cycocel</b>	500 ppm spray x 3+	Alcea Spring Celebrities Series – weekly after true leaf appears with no more than 3 applications on plugs. For finishing, as needed until buds appear. Stop PGR applications when bud emergence is detected to prevent deformation of flowers	Unspecified
		<b>Dazide/B-Nine</b>	5,000 ppm spray x 6	Chaters Doubles – weekly sprays	North
			2,500 ppm spray x 3+	For Alcea Spring Celebrities Series – apply weekly after true leaf appears with no more than 3 applications on plugs. For finishing, as needed until buds appear. Stop PGR applications when bud emergence is detected to prevent deformation of flowers	Unspecified
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize</b> (drenches only)	15 ppm spray x 1	Effective early in crop cycle	North
			3 to 6 ppm drench x 1	Drench late in crop to counter rapid elongation that occurs as the plants approach flowering; Drench volume and mg a.i. vary with container size	
			0.5 ppm drench x 1	Alcea Spring Celebrities Series – light drench when initial flower spike has extended to 6-8 inches will keep plant more compact for shipping; Drench volume and mg a.i. vary with container size	Unspecified
<b>Concise/Sumagic</b>	2.5 ppm spray x 1	Early treatment most effective	North		
<i>Alchemilla mollis</i> (Lady's Mantle)	To control plant growth	<b>Dazide/B-Nine</b>	Not responsive at 5,000 ppm spray x 2	Not responsive	South
		<b>Dazide/B-Nine + Citadel/Cycocel Tank Mix</b>	5,000 + 1,500 ppm spray x 1	Multiple applications at 10- to 14-day intervals may be necessary	South
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize</b> (drenches only)	Not responsive at 200 ppm spray x 1	Not responsive	South
			30 ppm spray x 1 to 3	Multiple applications may be necessary	Unspecified
			6 ppm drench x 1	Drench volume and mg a.i. vary with container size	
		<b>Concise/Sumagic</b>	Not responsive at 90 ppm spray x 1	Not responsive	South
<i>Amsonia</i> (Blue Star)	To control plant growth	<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O</b>	30 ppm spray x 1	Storm Cloud – apply when plant is 4 to 6 inches tall	North
			5 ppm spray x 1	Multiple applications may be necessary	North
		<b>Concise/Sumagic</b>	1 ppm drench x 1	Drench volume and mg a.i. vary with container size	
<i>Aeonium hybrid</i> (succulents)	Increase offsets	<b>Configure</b>	Not responsive at 50 to 400 ppm spray x 1	Single foliar spray applied 2 weeks after potting	Branching
<i>Agave hybrid</i> ( <i>A. guiengola</i> <i>A. gemniflora</i> )	Increase offsets	<b>Configure</b>	Not responsive at 100 to 800 ppm spray x 2	Two foliar sprays applied 1 month apart, starting 6 weeks after potting	Branching
<i>Alpinia</i> (Red Ginger)	Induce lateral or basal branching	<b>Configure</b>	Not responsive at 100 ppm soak x 1	Foliar soak of rooted plants	Branching



CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Aquilegia x hybrida</i> (Hybrid Columbine)	To control plant growth, apply as flower stalks get above foliage	<b>Abide/A-Rest</b>	25 ppm spray x 2 to 3	Apply weekly sprays	North
			25 to 50 ppm spray x 1	Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required	
			65 to 132 ppm spray x 1;	Apply when plants are well-rooted with 5 to 8 leaves	Unspecified
			2 to 4 ppm drench x 1	Apply when plants are well-rooted with 5 to 8 leaves	
		<b>Collate/Florel</b>	Not responsive at 750 ppm sprays x 5	Pink & White – height and flowering not responsive to weekly sprays	North
		<b>Dazide/B-Nine</b>	5,000 ppm spray x 2	McKana Giants	South
			5,000 ppm spray x 4 to 5	Music Pink & White – excellent control with 4 applications at 2-week intervals; Origami Blue & White and Pink & White – excellent control with 5 weekly applications	North
			Tank Mix	Songbird F1, Swan F1 Series, Star series – tank mix spray of 1,875 to 2,000 ppm daminozide + 10 ppm ancymidol as needed	
			Tank Mix	Tank mix spray of 2,000 ppm daminozide + 3 ppm uniconazole x 2 to 3 weekly	
		<b>Dazide/B-Nine + Citadel/Cycozel</b> Tank Mix	2,500 ppm + 1,000 ppm spray x 2 to 3	Apply as flower stalks get above foliage; weekly applications	North
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize</b> (drenches only)	Not responsive at 240 ppm spray x 1	McKana Giants was not responsive	South
			30 ppm spray x 2 to 3	Apply weekly Origami Blue & White and Pink & White – not responsive at 90 ppm sprays x 5 weekly applications	North
			30 ppm spray x 1 to 3	Multiple applications may be necessary	Unspecified
			6 ppm drench x 1	Drench volume and mg a.i. vary with container size	
<b>Concise/Sumagic</b>	Not responsive at 120 ppm spray x 1	McKana Giants – not responsive	South		
	5 to 15 ppm spray x 2 to 4	Apply 5 ppm sprays 2 to 3 weekly; Music Pink & White and Origami Blue & White – good control with 15 ppm sprays x 4 to 5	North		
<i>Aquilegia flabellate</i> (Columbine)	Induce lateral or basal branching	<b>Configure</b>	Not responsive at 50 to 1,600 ppm spray x 1	No effect of single foliar spray applied 2 weeks after potting	Branching
<i>Aquilegia vulgaris</i> (Columbine)	To control plant growth	<b>Dazide/B-Nine</b>	1,500 to 2,500 ppm spray x 1	Clementine, Winky Double and Winky Single Series – multiple applications may be necessary	Unspecified
	Induce lateral or basal branching	<b>Configure</b>	Not responsive at 600 ppm spray x 1	Winky Purple White – no effect with our screening rate; Test multiple applications or higher rates	Branching
<i>Arenaria montana</i> (Sandwort)	To control plant growth	<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O</b>	5 ppm spray x 1 on liners	Avalanche – liners were responsive	South

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Artemisia arborescens</i> (Powis Castle)	To control plant growth	Collate/Florel	300 to 500 ppm spray x 1 on liners	Liners	Unspecified
		Dazide/B-Nine	2,500 ppm spray x 2 to 3	Multiple applications as needed	
		Piccolo/Piccolo 10 XC/Bonzi/Pac O	5 to 40 ppm spray x 1	Responsive to 5 to 40 ppm paclobutrazol sprays	
		Concise/Sumagic	5 to 8 ppm spray x 1	Multiple applications may be required	
<i>Artemisia schmidtiana</i> (Wormwood, White Sage)	To control plant growth	Collate/Florel	300 to 500 ppm spray x 1 on liners	Liners	Unspecified
		Dazide/B-Nine	5,000 ppm spray x 2	Silver Mound – moderate control with multiple applications	South
		Dazide/B-Nine + Citadel/Cycocel Tank Mix	5,000 + 1,500 ppm spray x 1	Silver Mound – multiple applications may be required	South
		Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize (drenches only)	50 to 200 ppm spray x 1	Silver Mound – may require multiple applications	South
			40 to 50 ppm spray x 1	Responsive; may require multiple applications	Unspecified
			6+ ppm drench x 1	Drench volume and mg a.i. vary with container size	North
		Concise/Sumagic	30 to 60 ppm spray x 1	Cultivars vary in response; Oriental Limelight – sensitive; Silver Mound – moderate; Powis Castle – less responsive; Multiple applications may be necessary	South
<i>Arunacus hybrid</i> (Goat's beard)	To control plant growth	Concise/Sumagic	5 ppm spray x 1	Apply 3 to 4 weeks after transplanting. Multiple applications may be needed at 7 to 10 day intervals	North
<i>Asclepias tuberosa</i> (Butterfly Weed)	To control plant growth	Abide/A-Rest	25 to 50 ppm spray x 1 to 3	Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required	North
			26 ppm spray x 1	Multiple applications may be required	Unspecified
			2 ppm drench x 1	Drench volume and mg a.i. vary with container size	
		Dazide/B-Nine	Not responsive at 5,000 ppm spray x 3	Not responsive	South
			3,750 to 5,000 ppm spray	Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required	North
		Dazide/B-Nine + Citadel/Cycocel Tank Mix	Not responsive at 5,000 + 1,500 ppm spray x 1	Not responsive	South
			2,500 + 1,500 ppm spray x 1	Label rate for Royal Red (Cycocel)	Unspecified
		Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize (drenches only)	Not responsive at 50 ppm spray x 1	Hello Yellow – no effect on plant height, but reduced width	South
			Not responsive at 2 ppm drench x 1	Drenches applied at 2 fl.oz. per quart pot; Drench volume and mg a.i. vary with container size	
			10 to 20 ppm spray x 1 to 2	Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required	North
		Concise/Sumagic	30 to 60 ppm spray x 1	Label rate	Unspecified
			45 ppm spray x 1	Good control	South
		To induce lateral branching	Configure	5 to 10 ppm spray x 1	Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required
	Not responsive at 600 ppm spray x 1			Higher rates or multiple applications may be effective	Branching

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<p><b><i>Aster dumosus</i></b> (Symphyotrichum dumosum) (Bushy Aster)</p> <p><b><i>Aster x frikartii</i></b> (Frikart's Aster)</p> <p><b><i>Aster novae-angliae</i></b> (New England Aster)</p>	To control plant growth	<b>Dazide</b> /B-Nine	5,000 ppm spray x 2	Apply first application after pinching when new shoots are approximately 1-in. long	South
			2,500 to 4,000 ppm spray x 1 to 3	Apply first application after pinching when new shoots are approximately 1-in. long; Rates vary depending on variety vigor, temperature and growth stage of the crop; Do not apply daminozide after buds reach pea size to avoid flower discoloration and delay	Unspecified
			2,500 ppm spray x 2	Good control	North
			Tank mix	Tank mix of 2,000 ppm daminozide + 3 ppm uniconazole sprays x 1 to 2	
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	Not responsive at 5,000 + 1,500 ppm spray x 1	A. dumosus Sapphire – not responsive to this rate	South
		<b>Piccolo/Piccolo 10 XC</b> /Bonzi/Pac O/Downsize (drenches only)	80 ppm spray x 1	A. dumosus Sapphire; A. x frikartii Monarch and Monch – not responsive to 240 ppm spray x 1	South
			2 to 16 ppm drench x 1	A. x frikartii Monarch and Monch – responsive; Drench applied at 2 fl. oz. per quart pot; Volume and mg a.i. vary with container size	
			30 ppm spray x 1 to 2	Apply 7 to 10 days apart	North
			6+ ppm drench x 1	Drench volume and mg a.i. vary with container size	
			30 to 50 ppm sprays x 1	Multiple applications may be required	Unspecified
			2 ppm drench x 1	Some growers use a paclobutrazol drench to hold their crop at a given height; Drench volume and mg a.i. vary with container size	
			<b>Concise</b> /Sumagic	30 ppm spray x 1	A. dumosus Sapphire; A. x frikartii Alpine Mix, Monarch and Monch – not responsive to 60 ppm spray x 1
		2.5 to 10 ppm spray x 1		Very effective, but results have been quite variable; Multiple applications may be required	Unspecified
		0.1 to 1.0 ppm drench x 1		Drench volume and mg a.i. vary with container size	
		Topflor	Not responsive at 60 ppm spray x 1	A. dumosus Sapphire – not responsive in fall trial	South
	To induce lateral branching	<b>Collate</b> /Florel	300 to 500 spray x 1 on liners	Liners responsive	Branching
		<b>Configure</b>	Phytotoxic at 600 ppm spray x 1	Significant phytotoxic response with a single spray applied to liners or transplanted plants	Branching
	<p><b><i>Astilbe x arendsii</i></b> (False Spirea)</p> <p><b><i>Astilbe chinensis</i></b> (Chinese Astilbe)</p> <p><b><i>Astilbe thunbergii</i></b> (False Spirea)</p>	To control plant growth	<b>Abide</b> /A-Rest	100 ppm spray x 6	A. thunbergii Ostrich Plume – weekly applications; A. arendsii Granat – no control with 4 sprays at 2-week intervals
<b>Collate</b> /Florel			500 ppm spray x 4	Granat – stunting with 4 sprays at 2-week intervals; Did not delay flowering	North
<b>Dazide</b> /B-Nine			5,000 ppm spray x 2	Timing is critical; Apply 2 sprays 1 week apart beginning soon after inflorescences begin to elongate; Growth regulators were ineffective when they were applied prior to inflorescence elongation	North
			Less than 5,000 ppm spray x 2	A. chinensis Purpurkerze – stunted, use lower rate and/or fewer applications; A. x arendsii Elizabeth Bloom – not responsive to 5,000 ppm x 2	South
			5,000 ppm spray x 6	A. thunbergii Ostrich Plume – weekly applications; A. arendsii Granat – no control with 4 sprays at 2-week intervals	North
<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix			Less than 5,000 + 1,500 ppm spray x 1	A. chinensis Purpurkerze stunted; Reduce both daminozide and chlormequat rates	South

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Astilbe x arendsii</i> (False Spirea)  <i>Astilbe chinensis</i> (Chinese Astilbe)  <i>Astilbe thunbergii</i> (False Spirea) <i>Continued</i>	To control plant growth <i>continued</i>	Citadel/Cycocel	1,500 ppm spray x 1	A. chinensis Purpurkerze – moderate control	South
			750 to 1,500 ppm spray x 1 to 3	Apply lower rates early in production and higher rates later under better growing conditions A. thunbergii Ostrich Plume – weekly applications of 1,500 ppm x 6; A. arendsii Granat – no control with 1,500 x 4 at 2-week intervals	North
		Piccolo/Piccolo 10 XC/Bonzi/ Pac O/Downsize (drenches only)	40 to 80 ppm spray x 1 to 2	A. chinensis Purpurkerze – good control with 40 ppm x 1 A. x arendsii Elizabeth Bloom – use multiple applications of 80 ppm	South
			30 ppm spray x 2	Apply weekly after inflorescences begin to elongate	North
			6+ ppm drench x 1	Treat after inflorescences begin to elongate: Drench volume and mg a.i. vary with container size	
		Concise/Sumagic	90 ppm spray x 6	A. thunbergii Ostrich Plume – weekly applications; A. arendsii Granat – no control with 4 sprays at 2-week intervals	South
			25 to 35 ppm spray x 1 to 2	A. chinensis Purpurkerze – good control with 1 spray A. x arendsii Elizabeth Bloom – use multiple applications	
			15 ppm spray x 6	A. thunbergii Ostrich Plume – 15 ppm spray x 6 weekly resulted in excellent control; A. arendsii Granat – 15 ppm spray x 4 at 2-week intervals resulted in stunting	
		5 ppm spray x 2 to 3	Apply to A. arendsii 2 to 3 weeks after transplant; Multiple applications at 7- to 10-day intervals as necessary; Apply when flower stems begin to appear above foliage		
		<i>Baptisia australis</i> and <i>Baptisia</i> <i>hybrids</i>	To control plant growth	Piccolo/Piccolo 10 XC/Bonzi/ Pac O/Downsize (drenches only)	45 to 60 ppm spray x 2 to 3
6 to 18 ppm drench x 1	Decadence, Baptisia hybrids – apply when plants are 6-inches tall; Drench is more effective than sprays; Drench volume and mg a.i. will vary with container size				
Concise/Sumagic	1 ppm drench x 1 at 6 inches in height			American Goldfinch or Pink Lemonade – follow drench with 5 ppm sprays for additional control as needed; Drench volume and mg a.i. will vary with container size	North
	Not responsive to 60 ppm spray x 1			Test higher rates or multiple spray applications	South
	1.5 ppm drench x 1			Drench volume and mg a.i. will vary with container size	South
<i>Bellis perennis</i>	To control plant growth	Dazide/B-Nine	1,000 to 2,000 ppm spray x 1 to 2	Multiple applications may be required	North
<i>Boronia heterophylla</i> (Red Boronia)	Induce lateral or basal branching	Configure	100 ppm foliar spray x 6 on mature plants	Mature plants in mid-fall – spray every 3 days for 18 days increased branching over pinching; Transient phytotoxicity noted.	Branching
			50 ppm foliar spray x 4 on rooted cuttings	Rooted cuttings in mid-fall – spray every 2 days for 4 to 8 days. Higher rates and more applications caused phytotoxicity and reduced flowering	
<i>Boronia metastigma</i> (Brown Boronia)	Induce lateral branching and additional cuttings	Configure	100 ppm foliar spray x 3	Weekly sprays starting 2 months prior to taking cuttings increased branching but subsequent cuttings rooted very poorly compared to control	Branching
<i>Buddleia davidii</i> (Butterfly Bush)	To control plant growth	Collate/Florel	300 to 500 ppm spray x 1 on liners	Liners responsive	Unspecified
		Dazide/B-Nine	5,000 ppm spray x 2	Royal Red good but no control of Pink Delight; Apply at 10- to 14-day intervals	South
			2,500 ppm spray x 2+	Multiple applications as needed	Unspecified

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<b><i>Buddleia davidii</i></b> (Butterfly Bush) <i>continued</i>	To control plant growth <i>continued</i>	<b>Dazide/B-Nine + Citadel/Cycocel</b> Tank Mix	Not responsive at 5,000 + 1,500 ppm spray x 1	Royal Red, Pink Delight – not responsive	South
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize</b> (drenches only)	Not responsive at 160 ppm spray x 1	Royal Red not responsive	South
			Not responsive at 10 ppm drench x 1	Royal Red not responsive; Drench applied at 10 fl. oz. per trade gal. pot (~3 mg a.i.); Volume and mg a.i. vary with container size	
			10 mg a.i. drench x 1	Dubonnet – good control with drench (3.3 fl. oz./2.8-L pot); Drench volume and mg a.i. vary with container size	
			5 to 40 ppm spray x 2	Multiple applications as needed	Unspecified
			6 ppm drench x 1	Drench volume and mg a.i. vary with container size	North
		<b>Concise/Sumagic</b>	60 ppm spray x 1	Moderate control of Royal Red; Multiple applications may be required;	South
			0.025 ppm drench x 1	Drench applied at 10 fl. oz. per trade gal. pot; Volume and mg a.i. vary with container size	
			20 ppm spray x 2	Moderate height control of Pink Delight with 2 applications 7 days apart; Additional applications may be necessary	
			5 ppm spray x 1 to 2	Begin PGR applications about 2 weeks following the pinch and reapply at 7 to 10 day intervals if additional control is necessary	North
		Topflor	125 ppm spray x 1	Good control of growth of Royal Red with no delay in flowering	South
<b><i>Buddleia fallowiana</i></b> <b><i>Lochinch</i></b> (Butterfly Bush)	To control plant growth	<b>Concise/Sumagic</b>	60 ppm spray x 2 to 3	Multiple applications required	South
			1.5 ppm drench x 1	Drench applied at 10 fl. oz. per trade gal. pot; Drench volume and mg a.i. vary with container size	
<b><i>Buddleia weyeriana</i></b> <b><i>Honeycomb</i></b> (Butterfly Bush)	To control plant growth	<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O</b>	4 ppm liner soak x 1	Good control	South
		<b>Concise/Sumagic</b>	2 ppm liner soak x 1	Moderate control	South
<b><i>Caladium bicolor</i></b>	To control plant growth	<b>Dazide/B-Nine</b>	2,500 ppm spray x 6 to 8	As needed at 5- to 7-day intervals	North
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize</b> (drenches only)	30 ppm spray x 1	Apply near end of crop cycle to improve shelf life	North
			8 ppm drench x 1	Drench when shoots have emerged but before leaves unfold (approximately 2 to 3 weeks after potting); Drench volume and mg a.i. vary with container size	
<b><i>Calamagrostis x acutifolia</i></b> <b><i>Karl Foerster</i></b> (Feather Reed Grass)	To control plant growth	<b>Dazide/B-Nine</b>	Not responsive at 5,000 ppm spray x 2	Not responsive	South
		<b>Dazide/B-Nine + Citadel/Cycocel</b> Tank Mix	5,000+1,500 ppm spray x 2	Good height control with Karl Foerster	South
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O</b>	Not responsive to 160 ppm spray x 1	Not responsive	South
		<b>Concise/Sumagic</b>	Not responsive to 60 ppm spray x 1	Not responsive	South
			1 ppm liner soak x 1	Good height control with a 2-minute liner soak	
		Topflor	Not responsive to 120 ppm spray x 1	Not responsive	South

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION		
<i>Campanula carpatica</i> (Carpathian Bellflower)	To control plant growth	<b>Abide/A-Rest</b>	25 to 50 ppm spray x 1	<i>C. carpatica</i> or <i>C. persicifolia</i> may require 50 ppm sprays, especially later in the spring; Multiple applications may be required	North		
			100 ppm spray x 6	<i>C. glomerata</i> : Very good control on Kent Belle and Birch Hybrid with weekly applications; Superba not responsive; Cherry Bells stunted			
		<i>Campanula glomerata</i> (Clustered Bellflower)	usually do not require PGRs, but are responsive to most of them. Under low-light conditions or for toning and shaping, one application is usually sufficient. If necessary, make a second application 7 to 10 days after the first	<b>Collate/Florel</b>	500 ppm spray x 4	<i>C. glomerata</i> Superba good control with 4 sprays at 2-week intervals; No delay in flowering. Phytotoxic to <i>Campanula</i> Kent Belle; Did not reduce flower buds; Reduced growth	North
					<i>Campanula persicifolia</i> (Peach-leaved Bellflower)	<b>Dazide/B-Nine</b>	2,500 to 3,750 ppm spray x 1 to 2
		<b>Citadel/Cycocel</b>	750 ppm spray x 1	<i>C. carpatica</i> ; Multiple applications may be required			North
			<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize (drenches only)</b>	Less than 1,500 ppm spray x 3	Label rate <i>C. carpatica</i> ; Excessive height reduction; Reduce rate or frequency (Cycocel)	Unspecified	
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize (drenches only)</b>		10 to 20 ppm spray x 1	<i>C. carpatica</i> cultivars are very sensitive to paclobutrazol; Multiple applications may be required, especially later in the spring	North	
			15 ppm spray x 1 to 3	<i>C. carpatica</i> : Multiple spray applications may be necessary	Unspecified		
		3 ppm drench x 1	Drench volume and mg a.i. vary with container size				
		<b>Concise/Sumagic</b>	2 to 4 ppm spray x 1	<i>C. carpatica</i> cultivars are very sensitive to uniconazole; Multiple applications may be required, especially later in the spring	North		
Topflor	10 to 30 ppm spray x 1	Rate range determined largely under mid-Atlantic conditions using medium-vigor cultivars; Adjust for your area (Label)	Unspecified				
<i>Canna x generalis</i>	To control plant growth	<b>Dazide/B-Nine</b>	Not responsive at 7,500 ppm spray x 1	No growth reduction, but delayed flowering	South		
			<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize (drenches only)</b>	66 to 99 ppm spray x 1	<i>C. x orchoides</i> requires higher rates	South	
		1 to 4 ppm drench x 1		For height control of Cannova series; apply 2 weeks after transplant at volume appropriate for the growing container; Drench volume and mg a.i. vary with container size	Unspecified		
		Topflor	Less than 50 ppm spray x 1	<i>C. x orchoides</i> growth reduced about 40% up to 8 weeks after treatment; No delay in flowering	South		
			50 to 80 ppm spray x 1	Rate range determined largely under mid-Atlantic conditions using medium-vigor cultivars; Adjust for your area (Label)	Unspecified		
<i>Carex buchananii</i>	To control plant growth	<b>Concise/Sumagic</b>	20 ppm spray x 1	Moderate height control of <i>C. flagellifera</i> Toffee Twist with an increase in early tillers. Use lower rate on <i>C. buchananii</i> and <i>C. comans</i> Frosted Curls; this rate stunted both cultivars and reduced number of tillers on Frosted Curls	South		
			<i>Carex comans</i>	To increase tillering	<b>Configure</b>	Not responsive at 500 or 1,000 ppm spray x 1	No increase in number of tillers on <i>C. buchananii</i> , <i>C. comans</i> Frosted Curls, <i>C. flagellifera</i> Toffee Twist up to 8 weeks after treatment; No effect on plant height
<i>Caryopteris x clandonensis</i> (Bluebeard)	To control plant growth	<b>Dazide/B-Nine</b>				Not responsive at 5,000 ppm spray x 2	Dark Knight not responsive
			2,500 ppm spray x 1 to 2	Multiple spray applications may be necessary	Unspecified		
		<b>Dazide/B-Nine + Citadel/Cycocel Tank Mix</b>	Not responsive at 5,000/1,500 ppm spray x 1	Dark Knight not responsive	South		
			<b>Piccolo/Piccolo 10 XC/Bonzi/Paczo</b>	Not responsive at 160 ppm spray x 1	Dark Knight not responsive	South	
5 to 40 ppm spray x 1 to 2	Multiple spray applications may be necessary	Unspecified					

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Caryopteris x clandonensis</i> (Bluebeard) <i>continued</i>	To control plant growth <i>continued</i>	<b>Concise</b> /Sumagic	30 ppm spray x 1	Good control of Dark Knight	South
			5 to 8 ppm spray x 1 to 2	Multiple spray applications may be necessary	Unspecified
<i>Centaurea montana</i>	To control plant growth	<b>Dazide</b> /B-Nine	2,500 to 5,000 ppm spray x 1 to 3	Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required	North
		<b>Concise</b> /Sumagic	7 to 15 ppm spray	Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required	North
<i>Coreopsis grandiflora</i> (Tickseed)	To control plant growth	<b>Abide</b> /A-Rest	0.375 mg a.i. drench x 1	Moderate growth control of Early Sunrise and enhanced flowering with 3.3 fl. oz./pot; Drench volume and mg a.i. vary with container size	South
			25 to 50 ppm spray x 2 to 3	Apply at weekly intervals	North
		<b>Dazide</b> /B-Nine	2,500 to 5,000 ppm spray x 2	Lower rates on liners; Good control of Sunray with multiple applications to 10- to 14-day intervals under nursery conditions	South
			2,500 to 5,000 ppm spray x 2 to 3	Apply one week after pinching to control growth of SunKiss or Utopia Series cultivars; Apply lower rates early in production and 5,000 ppm later under better growing conditions; Multiple applications may be required	North
			Tank Mix	Tank mix spray of 2,000 ppm daminozide + 15 ppm paclobutrazol x 2 to 3 Tank mix spray of 2,000 ppm daminozide + 3 ppm uniconazole	
			5,000 ppm spray x 2	Foliar sprays at 5,000 ppm applied twice after transplant work well; First application can be done 2 weeks after transplant followed by a second application 2 weeks later; Early Sunrise requires more PGRs than Rising Sun or Sunfire	Unspecified
		<b>Citadel</b> /Cycocel	1,250 to 1,500 ppm spray x 2 to 3	Apply at weekly intervals; 3 applications of 1,500 ppm at 10-day intervals resulted in moderate growth reduction of Sunray	North
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	5,000 + 1,500 ppm spray x 1	Moderate control of Sunray; Multiple applications may be required; much lower rates on liners	South
			2,500 + 1,000 ppm spray x 2 to 3	Apply at weekly intervals	North
			Greater than 2,500 + 1,500 ppm spray x 1	Label rate: Increase daminozide rate for better control of Baby Sun and Sunray (Cycocel)	Unspecified
		<b>Piccolo</b> / <b>Piccolo 10 XC</b> /Bonzi/ Pac O/Downsize (drenches only)	Less than 5 ppm spray x 1 for liners	Excessive control with Baby Sun plugs in California	South
			80 to 100 ppm spray x 1	Sunray and Baby Sun responsive	
			5 to 10 ppm drench x 1	Sunray and Baby Sun; Drenches applied at 2 fl. oz. per qt. pot; Volume and mg a.i. vary with container size	
			2.5 mg a.i. drench x 1	Applied as 3.3 fl. oz./pot; Moderate growth control of Early Sunrise and enhanced flowering; Drench volume and mg a.i. vary with container size	North
30 to 45 ppm spray x 2 to 3	Treat as leaves reach edge of pot; Spray applications at weekly intervals; 3 applications of 30 ppm at 10-day intervals resulted in good control of Sunray				
2 to 6 ppm drench x 1	Heliot and Santa Fe; Drench volume and mg a.i. vary with container size				

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Coreopsis grandiflora</i> (Tickseed) <i>continued</i>	To control plant growth <i>continued</i>	<b>Concise/Sumagic</b>	15 to 40 ppm spray x 1 to 2	Multiple applications of lower rates; May delay flowering of Sunray	South
			0.25 mg a.i. drench x 1	Moderate growth control of Early Sunrise and enhanced flowering with 3.3 fl. oz./pot; Drench volume and mg a.i. vary with container size	
			5 to 10 ppm spray x 1 to 3	Excellent control of Early Sunrise; Apply one week after pinching to control growth of SunKiss or Utopia Series cultivars; Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required	North
			2 to 4 ppm spray x 1	Control of Heliot and Santa Fe	Unspecified
		Topflor	150 ppm spray x 1	Reduced height and days to flower of Early Sunrise	South
<i>Coreopsis rosea</i> (Pink Coreopsis)	To control plant growth	<b>Dazide/B-Nine</b>	1,500 to 2,500 ppm spray x 1	Effective on American Dream	Unspecified
			5,000 to 7,500 ppm spray x 1	Good growth control of American Dream with little effect on flowering	South
		<b>Citadel/Cycocel</b>	1,500 ppm spray x 6	Good control of growth of Sweet Dreams and the hybrid Limerock Ruby with 6 weekly applications	North
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize</b> (drenches only)	4 to 8 ppm liner soak x 1	Moderate response to lower rate with Sweet Dreams; Rates up to 8 ppm resulted in good control	South
			40 ppm spray x 1	Finished plants in California	
			2 ppm drench x 1	Drench volume and mg a.i. vary with container size	North
			6 ppm drench x 1	Drench volume and mg a.i. vary with container size	
		<b>Concise/Sumagic</b>	90 ppm spray x 6	Good control of growth of Sweet Dreams and the hybrid Limerock Ruby with 6 weekly applications	South
			40 ppm spray x 1	Moderate control of American Dream; Multiple applications may be required	
			0.5 ppm liner soak x 1	Sweet Dreams – good growth control	
		Topflor	2 to 4 ppm spray x 1	Effective on American Dream	Unspecified
			75 to 100 ppm spray x 1	American Dream – moderate control; Multiple applications may be required	South
		<i>Coreopsis verticillata</i> (Thread Leaf Coreopsis)	To control plant growth	<b>Abide/A-Rest</b>	6 ppm drench x 1
<b>Collate/Florel</b>	500 to 1,000 ppm spray x 1 to 3			Moonbeam – no response in plant growth or days to flower, but 40% increase in number of flower inflorescences. With Moonbeam stock plants – good growth control with 600 ppm sprays x 4 biweekly; Increased branching; Removed flower buds	North
	5,000 ppm spray x 1 to 3			Moonbeam and overwintered Golden Gain – good control, but slight flower delay; Apply at 10- to 14-day intervals	South
<b>Dazide/B-Nine</b>	2,500 to 5,000 ppm spray 1 to 3			Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required; Cruizin' Main Street – good control	North
	1,500 to 2,500 ppm spray x 1 to 3			Moonbeam and Zagreb	Unspecified
	Tank mix			Tank mix spray of 2,000 ppm daminozide + 3 ppm uniconazole x 1 to 2 weekly; good control for Cruizin' Main Street	North
<b>Dazide/B-Nine + Citadel/Cycocel</b> Tank Mix	5,000 + 1,500 ppm spray x 1			Effective on overwintered Golden Gain	South
	Greater than 2,500 + 1,500 ppm spray x 1			Zagreb and Golden Gain – label rate; Increase daminozide rate for better control (Cycocel)	Unspecified



CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<b><i>Coreopsis verticillata</i></b> (Thread Leaf Coreopsis) <i>continued</i>	To control plant growth <i>continued</i>	<b>Citadel/Cycozel</b>	Not responsive at 1,500 ppm spray x 1	Overwintered Golden Gain – not responsive	South
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize</b> (drenches only)	Not responsive at 160 ppm spray x 1	Moonbeam or overwintered Golden Gain – spray application not effective	South
			Less than 6 ppm drench x 1	Moonbeam – 6 ppm drench applied at 2 fl. oz. per 4-in. pot; Some distortion of laterals with this drench rate; volume and mg a.i. vary with container size	
			30 to 60 ppm spray x 1	Cruizin' Main Street – good control	North
			1 to 2 ppm drench x 1	Drench volume and mg a.i. vary with container size	
			<b>Concise/Sumagic</b>	15 to 20 ppm spray x 1	Moonbeam – good control with spray application; overwintered Golden Gain – growth was moderately responsive at 45 ppm spray x 1; Multiple applications necessary
		Less than 1 ppm drench x 1		Moonbeam – stunted at 1 ppm drench; Test rates approximately 0.5 ppm; Drench applied as 2 fl. oz. per qt. pot; Volume and mg a.i. vary with container size;	
		2 to 4 ppm spray x 1		Moonbeam and Zagreb	Unspecified
		5 to 10 ppm spray x 1 to 2		Cruizin' Main Street – one 5 to 7 ppm spray of uniconazole gives good control; Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required	North
		Topflor	75 to 100 ppm spray x 1	Moonbeam – good growth control with no delay in flowering; Higher rates resulted in high-quality ratings	South
<b><i>Coreopsis</i></b>	Induce lateral or basal branching on liners or finished plants	<b>Configure</b>	300 to 600 ppm spray x 1 on liners	Various cultivars including American Dreams, Sweet Dreams, Moonbeam, Rum Punch and Zagreb are responsive to a single foliar application to increase lateral and basal branching in liners and finished plants; Multiple applications may improve response	Branching
<b><i>Cortaderia selloana</i></b> (Pampas Grass)	To control plant growth	<b>Abide/A-Rest</b>	4 mg a.i. drench x 1	Moderate growth control; Drench volume and mg a.i. vary with container size	South
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize</b> (drenches only)	1 to 2 mg a.i. drench x 1	Good control of plant growth, shorter, but less diameter as well; Volume and mg a.i. vary with container size	South
			<b>Concise/Sumagic</b>	Less than 1 mg a.i. drench x 1	This rate resulted in continued growth regulation under landscape conditions; Test lower rates; Volume and mg a.i. vary with container size
		40 ppm spray x 1		Rosea – good height control with no effect on tiller number	
	To increase tillering	<b>Configure</b>	Not responsive to 500 or 1,000 ppm spray x 1	Rosea – not responsive in increasing number of tillers	Branching
<b><i>Delosperma cooperi</i></b>	To control plant growth	<b>Dazide/B-Nine</b>	1,500 to 2,500 ppm spray x 1 to 2	Multiple applications may be necessary	Unspecified
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize</b> (drenches only)	80 ppm spray x 1	Table Mountain – short term control with spray application; Multiple applications required	South
			Less than 10 ppm drench x 1	Excessive reduction in growth with 10 ppm drench at 2 fl. oz. per quart pot; test lower rates; Volume and mg a.i. vary with container size	
		<b>Concise/Sumagic</b>	3 to 4 ppm spray x 1 to 3	Multiple applications may be necessary	Unspecified
	To induce lateral branching	<b>Configure</b>	Not responsive at 600 ppm spray x 2	Not responsive; Higher rates or multiple applications may be effective	Branching

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Delphinium x elatum</i> (Larkspur, Hybrid Bee Delphinium)	To control plant growth	<b>Abide/A-Rest</b>	4 ppm drench x 1	Apply as flower stalks start to elongate; Blue Bird – good control; Drench applied at 10 fl. oz. per trade gal. pot; Volume and mg a.i. vary with container size	South
			100 ppm spray x 3 to 6	Volkerfreiden – applications 7 to 14 days apart resulted in stunting; Magic Fountain and Pacific Giants – good control	North
			5 ppm drench x 1	Drench volume and mg a.i. vary with container size	
		<b>Collate/Florel</b>	750 ppm spray x 4	Guardian – good growth control with weekly sprays; Some flower delay. Pacific Giants not responsive to 500 ppm sprays x 4 at 2-week intervals; Delayed flowering	North
		<b>Dazide/B-Nine</b>	Not responsive at 5,000 ppm spray x 2	Astolat – not responsive	South
			5,000 ppm spray x 3 to 6	Volkerfreiden – applications 7 to 14 days apart gave moderate control; Guardian and Magic Fountain – good control; Pacific Giants – no growth control	North
		<b>Dazide/B-Nine + Citadel/Cycocel Tank Mix</b>	Not responsive at 5,000 + 1,500 ppm spray x 1	Astolat – not responsive	South
		<b>Citadel/Cycocel</b>	1,500 ppm sprays x 4 to 6	Volkerfreiden and Guardian – weekly applications gave moderate control; Magic Fountain and Pacific Giants – not responsive to weekly sprays	North
		<b>Piccolo/Piccolo 10 XC/Bonzi/ Pac O/Downsize (drenches only)</b>	40 to 100 ppm spray x 1	Astolat – moderate control at lower rates; Black Knight moderate control at higher rates; Multiple applications may be necessary; Blue Bird – height not responsive to 60 ppm spray x 1; Slight reduction in width	South
			Less than 2 ppm drench x 1	Blue Bird – very sensitive to drenches; Drench applied at 10 fl. oz. per qt. pot; Volume and mg a.i. vary with container size	
			20 to 30 ppm spray x 1 to 2	Guardian series or Million Dollar Sky – make first application just as the flower stem is just beginning to rise above the basal foliage and second application 7 to 10 days later if necessary; Rates greater than 30 ppm sprays or more frequent applications resulted in stunting of other cultivars	North
			15 to 20 ppm spray x 1 or 2	Apply first spray at 12-in. tall; Apply second spray 2 weeks later if needed; Guardian F1 Series – apply 20 ppm spray as needed; Excalibur series – apply 15 ppm 10 to 14 days apart	Unspecified
			2 to 4 ppm drench x 1	Apply drench 1 week after transplant; Volume and mg a.i. vary with container size	
			<b>Concise/Sumagic</b>	30 to 45 ppm spray x 1	Astolat – multiple applications may be required
		1 ppm drench x 1		Blue Bird – very short-term response; Multiple applications or higher rate required; Drench applied at 10 fl. oz. per trade gal. pot; Volume and mg a.i. vary with container size	South
		5 ppm spray x 1 to 2		Guardian series or Million Dollar Sky – make first application just as the flower stem is just beginning to rise above the basal foliage and second application 7 to 10 days later if necessary	North
		1 ppm drench x 1		Drench volume and mg a.i. vary with container size	
		Topflor	15 ppm spray x 1	Blue Bird – good control	South
			6 ppm drench x 1	Drench volume and mg a.i. vary with container size	North
	To increase branching	<b>Configure</b>	Not responsive at 600 ppm spray x 1	Galahad – not responsive; Higher rates may be effective	Branching

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<b><i>Delphinium grandiflorum</i></b>	To control plant growth; make first application just as the flower stem is beginning to rise above the basal foliage and second application 7 days later if necessary	<b>Abide/A-Rest</b>	25 to 50 ppm spray x 2		North
			100 ppm spray x 4 to 5	Summer Blues – applications 7 to 14 days apart gave excellent control; Sky Blue and Summer Nights – stunted by applications 7 to 14 days apart; reduce frequency of application	
		<b>Collate/Florel</b>	500 ppm spray x 4	Sky Blue – good growth control with 4 sprays at 2-week intervals; Little flower delay	North
		<b>Dazide/B-Nine</b>	2,500 ppm spray x 2		North
			Tank mix	Tank mix sprays of 2,000 ppm daminozide + 15 ppm paclobutrazol x 2	
			Tank mix	Tank mix sprays of 2,000 ppm daminozide + 3 ppm uniconazole x 1 to 2	
			Not responsive at 5,000 ppm spray x 4 to 5	Summer Blues, Sky Blue or Summer Nights – Applications 7 to 14 days apart gave no control	
		<b>Dazide/B-Nine + Citadel/Cycocel Tank Mix</b>	2,500 + 1,000 ppm spray x 2		North
		<b>Citadel/Cycocel</b>	1,500 ppm spray x 4 to 5	Summer Blues – applications 7 to 14 days apart gave good control; Sky Blue or Summer Nights – no control	North
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O</b>	30 ppm spray x 2	Rates greater than 30 ppm sprays or more frequent applications resulted in stunting of some cultivars	North
15 to 20 ppm spray x 1 to 2	For Delfix series – apply 1 or 2 applications of 15 ppm 10 to 14 days apart. For Diamonds Blue F1 – apply 20 ppm spray as needed		Unspecified		
<b>Concise/Sumagic</b>	5 ppm spray x 2	Summer Blues – a single application of 5 ppm spray at 10 days after potting gave excellent control; Sky Blue and Summer Nights – 15 ppm spray rate with more frequent applications resulted in stunting; Pacific Giants – 10 ppm spray x 2 stunted growth	North		
<b><i>Dianthus gratianopolitanus</i></b> (Cheddar Pinks)	To control plant growth	<b>Dazide/B-Nine</b>	2,500 ppm spray x 1	Growth regulators typically not required, but daminozide can be applied if growing conditions cause stretch	Unspecified
			Tank mix	Tank mix spray of 2,000 ppm daminozide + 3 ppm uniconazole x 1	North
<b><i>Dianthus barbatus</i></b> (Sweet William)	To control plant growth	<b>Abide/A-Rest</b>	100 ppm spray x 4	Four spray applications at 2-week intervals gave moderate control	North
		<b>Collate/Florel</b>	Not responsive at 500 ppm spray x 4	No response to 4 spray applications at 2-week intervals	North
		<b>Dazide/B-Nine</b>	2,500 to 3,000 ppm spray x 1 to 2	Barbarini hybrids	Unspecified
			2,500 to 3,750 ppm spray x 2 to 3	Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required; Significant cultivar variation in response	North
			Tank Mix	Tank mix spray of 2,000 ppm daminozide + 3 ppm uniconazole x 1 to 2, as needed for compact growth	
		<b>Dazide/B-Nine + Citadel/Cycocel Tank Mix</b>	2,000 + 1000 ppm spray x 1	Coconut Punch	Unspecified
<b>Citadel/Cycocel</b>	Not responsive at 1,500 ppm spray x 4	No response to 4 spray applications at 2-week intervals	North		
<b><i>Dianthus hybrida</i></b>					

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Dianthus barbatus</i> (Sweet William)  <i>Dianthus hybrida</i> <i>continued</i>	To control plant growth <i>continued</i>	<b>Piccolo/Piccolo 10 XC</b> /Bonzi/Pac O/Downsize (drenches only)	5 to 8 ppm spray x 1 to 2	Barbarini, Charms, Diabunda, Dulce, Elation, Fandango, Super Farfait and Venti Parfait hybrids	Unspecified
			60 ppm spray x 4	4 spray applications at 2-week intervals gave excellent control	North
			6 ppm drench x 1	Drench volume and mg a.i. vary with container size	Unspecified
			15 to 20 ppm spray x 3 to 4	Bouquet F1 Series, Rockin' Red F1 – as needed	South
			5 ppm spray x 1 on liners	Stagirond (Rondo mix) – good control of liners	Unspecified
		<b>Concise</b> /Sumagic	3 to 5 ppm spray x 1 to 2	Barbarini hybrids	Unspecified
			15 ppm spray x 1	Single application early in production	South
			15 ppm spray x 4	4 spray applications at 2-week intervals gave excellent control	North
			1 ppm drench x 1	Drench volume and mg a.i. vary with container size	Unspecified
<i>Dicentra spectabilis</i> (Common Bleeding Heart)	To control plant growth, make first spray application as soon as shoot growth is visible; Second application 5 days later	<b>Abide</b> /A-Rest	Less than 50 ppm spray x 2	This rate was phytotoxic causing leaf tip chlorosis; Higher rates reduced number of flowers	South
			50 to 100 ppm spray x 1 to 2	Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required	North
			26 ppm spray x 1	Spray rates above 132 ppm cause curling and burn of foliage	Unspecified
			2 ppm drench x 1	Drench volume and mg a.i. vary with container size	Unspecified
		<b>Dazide</b> /B-Nine	3,000 ppm spray x 2	Slight (approximately 4 days) delay in flowering	South
			2,000 to 2,500 ppm spray x 2	Begin applications when Valentine plants reach 3-in. tall and reapply as needed at 7- to 10-day intervals	North
		<b>Citadel</b> /Cycocel	Not responsive at 2,000 ppm spray x 2		South
		<b>Piccolo/Piccolo 10 XC</b> /Bonzi/Pac O	50 ppm spray x 2	No effect on plant flowering	South
<b>Concise</b> /Sumagic	1 to 5 ppm spray x 2	Excellent growth control with no delay in flowering	South		
<i>Digiplexis Illumination Flame</i>	To control plant growth	<b>Concise</b> /Sumagic	10 ppm spray x 1	Spray just as the flower spikes are beginning to elongate	North
			1 ppm drench x 1	Drench just as the flower spikes are beginning to elongate; Drench volume and mg a.i. vary with container size	
	To enhance lateral branching	<b>Configure</b>	600 ppm spray x 1	Enhanced lateral branching; Lower rates may be effective	Branching
<i>Digitalis purpurea</i> (Foxglove)	To control plant growth	<b>Abide</b> /A-Rest	25 ppm spray x 2 to 3	To control plant growth, apply just as inflorescence begins to elongate above foliage; 2 to 3 spray applications 7 days apart	North
			5 ppm drench x 1	To control plant growth, apply just as inflorescence begins to elongate above foliage; Drench volume and mg a.i. vary with container size	
			Rates not tested	Camelot series – Syngenta only recommends application before elongation of flower spike; Will respond to ancymidol	Unspecified
			15 ppm spray x 1	Foxy	South
			4 ppm drench x 1	Drench volume and mg a.i. vary with container size	
		<b>Collate</b> /Florel	500 ppm spray x 4	Foxy – good growth control with 4 sprays at 2-week intervals; Delayed flowering	North

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Digitalis purpurea</i> (Foxglove) <i>continued</i>	To control plant growth <i>continued</i>	<b>Dazide</b> /B-Nine	Not responsive at 5,000 ppm spray x 4	Foxy not responsive to multiple applications	South
			2,500 to 5,000 ppm spray x 2 to 4	Foxy – good growth control with 4 applications at 2-week intervals; weekly applications necessary	North
			2,500 to 3,000 ppm spray x 1 to 2	Virtuoso hybrids, Camelot series, Dalmatian series – apply in the plug stage to produce more compact plants that are easier to ship; For finished plants, apply just as the flower spike begins to elongate	Unspecified
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	Not responsive at 5,000 + 1,500 ppm spray x 1	Foxy – not responsive	South
		<b>Citadel</b> /Cycocel	1,500 ppm spray x 4	Foxy – good growth control with 4 applications at 2-week intervals	North
		<b>Piccolo/Piccolo 10 XC</b> /Bonzi/ Pac O/Downsize (drenches only)	30 to 45 ppm spray x 2 to 3	Multiple spray applications may be necessary	North
			6 to 10 ppm drench x 1	Drench volume and mg a.i. vary with container size	
		<b>Concise</b> /Sumagic	30 ppm spray x 1	Foxy – excellent height control; Moderate width reductions	South
			5 ppm spray x 2 to 3	Multiple applications at weekly intervals may be required	North
			1 ppm drench x 1	Drench volume and mg a.i. vary with container size	
			5 ppm spray x 2	Virtuoso hybrids and Camelot – apply just as the flower spike begins to elongate; Two applications 7 days apart should provide good control; Dalmatian F1 series – spray as needed;	Unspecified
			3 ppm spray x 1 on plugs	PGRs applied in the plug stage will produce more compact plants that are easier to ship; Camelot will respond to uniconazole	
		Topflor	6+ ppm drench x 1	Drench volume and mg a.i. vary with container size	North
<i>Echinacea purpurea</i>  <i>Echinacea hybrids</i> (Purple Coneflower)	To control plant growth	<b>Abide</b> /A-Rest	25 ppm spray x 2 to 3	Apply sprays weekly beginning when flower stalks are near leaf canopy and beginning to elongate	North
			50 to 100 ppm spray x 2	Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required; 6 weekly applications at 100 ppm stunted Magnus	
		<b>Collate</b> /Florel	500 ppm spray x 1	White Swan – moderate growth control; No flower data	South
			500 ppm spray x 3	Bravado – biweekly sprays gave moderate growth regulation with no effect on flower date or number of inflorescences or branches; 1,000 ppm x 3 reduced growth and delayed flowering slightly	North
		<b>Dazide</b> /B-Nine	5,000 ppm spray x 2	Bravado and Magnus – apply at 10- to 14-day intervals for control	South
			5,000 ppm spray x 6	Magnus – weekly applications gave good control	North
			2,500 ppm spray x 2 to 3	Apply sprays weekly beginning when flower stalks are near leaf canopy and beginning to elongate	
			Tank Mix	Tank mix spray 2,500 ppm daminozide + 5 ppm uniconazole x 2 to 3 at weekly intervals	
		<b>Citadel</b> /Cycocel	1,250 to 1,500 ppm spray x 2 to 6	Apply 1,250 ppm sprays weekly 2 to 3 times beginning when flower stalks are near leaf canopy and beginning to elongate; Magnus – 6 weekly applications at 1,500 ppm gave excellent control	North
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	5,000 + 1,500 ppm spray x 1 to 2	Magnus – good control; May require multiple applications at 10- to 14-day intervals	South
			2,500 + 1,250 ppm spray x 2 to 3	Apply weekly sprays beginning when flower stalks are near leaf canopy and beginning to elongate	North
			2,500 + 750 ppm spray x 1	Recommends after using <b>Configure</b> (see below), if additional height control is necessary on tissue culture Echinacea	Unspecified

(PGRs in **bold typeface** are from Fine Americas, Inc.)

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Echinacea purpurea</i>  <i>Echinacea hybrids</i> (Purple Coneflower) <i>continued</i>	To control plant growth <i>continued</i>	<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize</b> (drenches only)	120 ppm spray x 1	Doubledecker – moderate control	South
			15 ppm spray x 3 to 4	First spray before budding; Evaluate weekly to determine need for additional control	
			30 to 90 ppm spray x 2 to 6	Apply 30 ppm sprays 2 to 3 times weekly beginning when flower stalks are near leaf canopy and beginning to elongate; Magnus – 90 ppm sprays x 6 weekly gave good control	North
			6 ppm drench x 1	Drench volume and mg a.i. vary with container size	
			15 to 30 ppm spray x 2	Prairie Splendor – Use multiple spray applications	Unspecified
			2 to 6 ppm drench x 1	Prairie Splendor – 3 ppm; Drench volume and mg a.i. vary with container size	
			2 to 4 ppm liner soak x 1	Soak liners for 30 sec	
		<b>Concise/Sumagic</b>	30 ppm spray x 1 to 2	Ruby Star – multiple applications may be required; Bravado – sensitive, test rates less than 30 ppm	South
			5 to 10 ppm spray x 2 to 3	Apply 5 ppm sprays weekly beginning when flower stalks are near leaf canopy and beginning to elongate; Three 10 ppm sprays applied at 2-week intervals beginning at bolting provided good control of Magnus with no effect on flowering	North
			1 ppm drench x 1	Drench volume and mg a.i. vary with container size	
			30 to 40 ppm spray x 1	Multiple applications of lower rate may be applied as necessary	Unspecified
			Topflor	22 to 45 ppm spray x 1 to 2	Ruby Star – short-term control; Multiple applications may be required
		22 ppm spray x 2 to 3		Apply weekly sprays beginning when flower stalks are near leaf canopy and beginning to elongate	North
	To increase basal branching	<b>Configure</b>	300 to 600 ppm spray x 1 to 2 on liners or finished plants	Increases basal branching; Multiple applications may be required; Little effect on plant height. Do NOT use on cultivars in the Sombrero or Pow Wow series	Branching
<i>Erysimum linifolium</i> (Wallflower)	To control plant growth	<b>Dazide/B-Nine</b>	5,000 ppm spray x 2	Multiple applications at 10 to 14 day intervals	South
		<b>Dazide/B-Nine + Citadel/Cycocel Tank Mix</b>	5,000 + 1,500 ppm spray x 1	May require multiple applications	South
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O</b>	80 to 120 ppm spray x 1	Moderate control	South
		<b>Concise/Sumagic</b>	15 ppm spray x 1	Good control	South
		Topflor	30 ppm spray x 1	Good control	South
<i>Eupatorium coelestinum</i> (Hardy Ageratum)	To control plant growth	<b>Dazide/B-Nine</b>	Not responsive at 5,000 ppm spray x 2	Not responsive	South
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize</b> (drenches only)	Not responsive at 240 ppm spray x 1		South
			8 to 10 ppm drench x 1	Moderate control with drenches applied at 2 fl. oz. per quart pot	
		<b>Concise/Sumagic</b>	60 ppm spray x 1		South
Not responsive at 1 ppm drench x 1	Drench applied at 4 fl. oz. per quart pot				

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<b><i>Eupatorium rugosum</i></b> (Ageratina altissima) (Chocolate Bonset, White Snake Root)	To control plant growth	<b>Concise</b> /Sumagic	60 to 90 ppm spray x 1 to 3	Moderate, short-term growth control. Multiple applications recommended	South
			4 ppm drench x 1	Moderate, short-term growth control. Drench applied at 2 fl. oz. per quart pot	
			2 to 6 ppm liner soak x 1	Moderate, short-term growth control. Liners soaked for 30 seconds	
<b><i>Euphorbia dulcis</i></b> (Purple Spurge)	To increase branching	<b>Configure</b>	600 ppm spray x 1	Chameleon – this rate was our screening rate. Lower rates may be effective	Branching
<b><i>Euphorbia hybrid</i></b> (Wood Spurge)	To control plant growth	<b>Dazide</b> /B-Nine	Not responsive at 5,000 ppm spray x 3	Efanthia and Despina – Not responsive	South
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	Not responsive at 5,000 + 1,500 ppm spray x 2	Efanthia and Despina – Not responsive	South
		<b>Piccolo/Piccolo 10 XC</b> /Bonzi/Pac O	40 to 80 ppm spray x 1	Efanthia and Despina – Good control	South
			30 ppm spray x 2 to 3	Multiple applications at weekly intervals may be required	North
		<b>Concise</b> /Sumagic	30 ppm spray x 1	Efanthia and Despina – Good control	South
			5 ppm spray x 1 to 2	Multiple applications at weekly intervals may be required	North
		Topflor	30 ppm spray x 1	Efanthia and Despina – Good control	South
			45 ppm spray x 1	Good control	North
<b><i>Gaillardia x grandiflora</i></b> (Blanket Flower)	To control plant growth	<b>Abide</b> /A-Rest	50 ppm spray x 3	Begin weekly applications when stems are rapidly elongating and before flower buds appear	North
			Tank mix	Tank mix spray of 15 ppm ancymidol + 2.5 ppm uniconazole as needed	Unspecified
		<b>Collate</b> /Florel	500 ppm spray x 4	Burgundy – growth control and delayed flowering with 4 sprays at 2-week intervals	North
		<b>Dazide</b> /B-Nine	5,000 ppm spray x 3	Burgundy – responsive; Apply at 10- to 14-day intervals; Goblin (Gold Kobold) – not responsive at 5,000 ppm spray x 2	South
			2,500 to 5,000 ppm spray x 2 to 4	Begin weekly applications when stems are rapidly elongating and before flower buds appear; Burgundy- excellent control with 5,000 ppm spray x 4 at 2-week intervals	North
			Tank Mix	A tank mix spray of 2,500 to 3,750 ppm daminozide + 15 to 30 ppm paclobutrazol x 1 to 3 Make first application after bud set, but before stem elongation and a second application before the first bud opens	
			Tank Mix	Tank mix spray of 2,500 ppm daminozide + 5 ppm uniconazole x 3	
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	5,000 + 1,500 ppm spray x 1	Burgundy – responsive to a single application; Goblin (Gold Kobold) – not responsive	South
			3,000 + 1,250 ppm spray x 3	Begin weekly applications when stems are rapidly elongating and before flower buds appear	North
		<b>Piccolo/Piccolo 10 XC</b> /Bonzi/Pac O/Downsize (drenches only)	Not responsive at 160 ppm spray x 1	Goblin (Gold Kobold) – not responsive at 160 ppm spray x 1	South
			Not responsive at 5 ppm drench x 1	Goblin (Gold Kobold) – not responsive; drench applied at 4 fl. oz. per qt. pot; Drench volume and mg a.i. vary with container size	
			30 to 60 ppm spray x 3	Begin weekly applications when stems are rapidly elongating and before flower buds appear; Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required; Four applications of 60 ppm sprays at 2-week intervals gave excellent control of Burgundy	North

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<b>Gaillardia x grandiflora</b> (Blanket Flower) <i>continued</i>	To control plant growth <i>continued</i>	<b>Concise/Sumagic</b>	60 ppm spray x 1	Burgundy – moderate control; May require multiple applications; Goblin (Gold Kobold) – not responsive to uniconazole applied as a 60 ppm spray, a 5 ppm liner soak or a 2 ppm drench applied at 4 fl. oz. per qt. pot)	South
			7 to 15 ppm spray x 2 to 3	Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required; Begin weekly applications of 10 ppm sprays when stems are rapidly elongating and before flower buds appear	North
	To induce lateral branching	<b>Collate/Florel</b>	500 ppm spray x 1	One application after roots have established in final container to enhance branching	Branching
		<b>Configure</b>	600 ppm spray x 1 or 2 on liners or finished plants	Gallo Yellow, Dazzler and Gallo Red – had increased branching, but EXCESSIVE DELAYS in flowering	Branching
<b>Gaura lindheimeri</b> (White Gaura, Wand Flower, Butterflies)	To control plant growth	<b>Abide/A-Rest</b>	100 ppm spray x 4 to 5	Sprays at 7- to 14-day intervals gave excellent control of Rose, no control of Whirling Butterflies and stunted Blush; Reduce number of applications	North
			1 to 2 ppm drench x 1	Drench volume and mg a.i. vary with container size	Unspecified
		<b>Collate/Florel</b>	500 ppm spray x 4	No growth control of Whirling Butterflies with 4 sprays at 2-week intervals, but appeared to increase branching; Slight delay in flowering	North
			500 ppm spray x 2	Corrie's Gold – moderate growth control with 2 sprays at 2-week interval	South
		<b>Dazide/B-Nine</b>	3,000 to 5,000 ppm spray x 2	Siskiyou Pink, Whirling Butterflies and Corrie's Gold; Apply at 10- to 14-day intervals	South
			3,000 to 5,000 ppm spray x 2 to 5	Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required; Blush and Rose – multiple applications at 7- to 14-day intervals gave good control; Whirling Butterflies – not responsive	North
			Tank Mix	More upright cultivars will require multiple applications; Tank mix spray 2,000 ppm daminozide + 30 ppm paclobutrazol x 1 to 3 Tank mix spray 2,000 ppm daminozide + 5 ppm uniconazole x 1 to 2	
			2,500 to 4,000 ppm spray x 1 to 3	The first application should be 7 to 10 days after the first pinch	Unspecified
		<b>Dazide/B-Nine + Citadel/Cycocel Tank Mix</b>	5,000 + 1,500 ppm spray x 1	Corrie's Gold – good control; Whirling Butterflies – moderate control; Multiple applications may be required	South
			2,500 + 750 to 1,000 ppm spray x 1	Sparkle White – multiple applications may be required	Unspecified
			2,000 + 1,000 ppm spray x 1 to 3	More upright cultivars will require multiple applications	North
		<b>Citadel/Cycocel</b>	1,250 to 1,500 ppm spray x 1 to 5	More upright cultivars will require multiple applications; Blush and Rose – good control with 1,500 ppm spray x 5 weekly; Whirling Butterflies – not responsive at 1,500 ppm spray x 4 at 2-week intervals	North
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize</b> (drenches only)	80 to 100 ppm spray x 1	Corrie's Gold – 80 ppm resulted in good growth control; Siskiyou Pink – 100 ppm x 1 gave only moderate growth control; Test multiple applications or higher rate.	South
			15 ppm drench x 1	Drench applied at 2 fl. oz. per qt. pot; Volume and mg a.i. vary with container size.	
			2 to 4 ppm liner soak x 1	Pink Fountain – good growth control with liner soak	



CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<b>Gaura lindheimeri</b> (White Gaura, Wand Flower, Butterflies) <i>continued</i>	To control plant growth <i>continued</i>	<b>Piccolo/Piccolo 10 XC</b> /Bonzi/ Pac O/Downsize (drenches only) <i>continued</i>	30 to 90 ppm spray x 4 to 5	More upright cultivars will require multiple applications of 30 ppm sprays; Blush and Rose – good control with 90 ppm spray weekly; Whirling Butterflies – good control with 60 ppm sprays at 2-week intervals	North
			6+ ppm drench x 1	Drench volume and mg a.i. vary with container size	
			30 to 50 ppm spray x 1	Will control unwanted growth	Unspecified
		<b>Concise</b> /Sumagic	15 to 60 ppm spray x 1	Significant cultivar differences in response: Whirling Butterflies – growth excessively reduced by 15 ppm x 1; Corrie’s Gold – 30 ppm x 1 gave short-term growth regulation; Dauphin – only moderately controlled by 60 ppm x 1; Siskiyou Pink – not responsive to a 60 ppm spray x 1	South
			3 to 15 ppm spray x 1 to 5	One 5 ppm spray controls compact cultivars; More upright cultivars will require multiple applications; Blush and Rose – stunted with 15 ppm spray x 5 weekly; Whirling Butterflies – good control without affecting flowering with 10 ppm sprays x 2 at 2-week intervals; Apply lower rates early in production and higher rates later under better growing conditions	North
	Topflor	100 ppm spray x 1	Corrie’s Gold – moderate height control; Test multiple applications or higher rates	South	
	To increase branching	<b>Configure</b>	500 to 600 ppm spray x 1 to 2 on finish plants 300 ppm spray x 1 to 2 on liners	Siskiyou Pink, Whirling Butterflies – increased branches, shoots and flower stalks; For liners, single or multiple foliar sprays applied when removed from mist. Snow Fountain liners – not responsive to 600 ppm spray x 1	Branching
<b>Geranium Rozanne</b> (Cranesbill Geranium)	To control plant growth	<b>Dazide</b> /B-Nine	2,500 ppm spray x 1 to 3	Brookside – multiple applications as needed	Unspecified
			Tank mix	Tank mix spray of 2,000 ppm daminozide + 3 ppm uniconazole as needed to control overall plant size	North
		<b>Concise</b> /Sumagic	3 to 5 ppm spray x 1 to 3	Brookside – multiple applications as needed	Unspecified
	To induce lateral branching	<b>Configure</b>	Not responsive at 600 ppm spray x 1	This rate was our screening rate. Higher rates or multiple applications may be effective	Branching
<b>Geum</b> (Avens)	To control plant growth	<b>Piccolo/Piccolo 10 XC</b> /Bonzi/Pac O	30 ppm spray x 1 to 3	For control of flower height, apply at 7 to 10 day intervals as stems begin to emerge from the foliage	North
		<b>Concise</b> /Sumagic	5 ppm spray x 1 to 3	For control of flower height, apply at 7 to 10 day intervals as stems begin to emerge from the foliage	North
<b>Gladiolus x hybridus</b> (Gladiolus)	To control plant growth	<b>Abide</b> /A-Rest	100 ppm soak x 1	Amsterdam and Bananarama – Soak corms for 24 hours prior to potting.	North
<b>Hedera canariensis</b> (Algerian Ivy)	To control plant growth	<b>Piccolo/Piccolo 10 XC</b> /Bonzi/ Pac O/Downsize (drenches only)	1 to 2 ppm drench x 1	Apply after plant fills container to keep runners under control	Unspecified
		<b>Concise</b> /Sumagic	6 to 8 ppm spray x 1 to 2	Apply after plant fills container to keep runners under control	Unspecified
	Induce lateral or basal branching	<b>Configure</b>	50 to 200 ppm spray x 3	Foliar spray every 2 weeks starting 2 weeks after potting increased branching	Branching
<b>Helenium autumnale</b> (Sneezeweed)	To control plant growth	<b>Dazide</b> /B-Nine	2,500 ppm spray x 1	Mariachi Salsa – may require higher rates in the South	North
			2,500 ppm spray x 2 to 4	Mardi Gras – apply weekly prior to bud set	Unspecified
			2,500 ppm spray x 2	Coppelia – moderate height control	South

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Helenium autumnale</i> (Sneezeweed) <i>continued</i>	To control plant growth <i>continued</i>	<b>Dazide/B-Nine + Citadel/Cycocel Tank Mix</b>	Not responsive at 5,000 + 1,500 ppm spray x 1	Coppelia – reduced width but no height control	South
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O</b>	Not responsive to 160 ppm spray x 1	Coppelia – not responsive	South
		<b>Concise/Sumagic</b>	Not responsive to 60 ppm spray x 1	Coppelia – not responsive	South
	To induce lateral branching	<b>Configure</b>	Not responsive to 600 ppm spray x 1 20 to 40 ppm spray x 3	Coppelia – not responsive; This was our test rate; Higher rates or multiple applications may be more effective Foliar sprays weekly in summer increased lateral branching and delayed flowering but increased flower number	Branching
<i>Helianthus simulans</i> (Swamp Sunflower)	To control plant growth	<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize (drenches only)</b>	4 mg a.i. drench x 1	4 fl.oz. applied per trade gallon pot; Drench volume and mg a.i. vary with container size	South
		Topflor	4 mg a.i. drench x 1	4 fl.oz. applied per trade gallon pot; Drench volume and mg a.i. vary with container size	South
<i>Heliopsis helianthoides</i> (False Sunflower, Sunflower Heliopsis)	To control plant growth	<b>Dazide/B-Nine</b>	Less than 5,000 ppm spray x 2	Summer Sun – very sensitive to daminozide under nursery conditions; Test at lower rates	South
			2,500 ppm spray x 1 shortly after pinching	Tuscan Gold – apply shortly after pinching if needed	North
		<b>Dazide/B-Nine + Citadel/Cycocel Tank Mix</b>	5,000 + 1,500 ppm spray x 1	Summer Sun – persistent control under nursery conditions; Test lower rates	South
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize (drenches only)</b>	Not responsive at 160 ppm spray x 1	Summer Sun – not responsive under nursery conditions	South
			Not responsive at 10 ppm drench x 1 to liners	Summer Green – not responsive to liner drench just prior to transplanting; Drench applied to liners at 0.3 fl. oz. per 72-size cell; Volume and mg a.i. will vary with container size	
			6 ppm drench x 1	Drench volume and mg a.i. vary with container size	North
	<b>Concise/Sumagic</b>	Not responsive at 60 ppm spray x 1	Summer Sun – not responsive under nursery conditions	South	
To increase lateral branching	<b>Configure</b>	600 ppm spray x 2	Summer Green – applied at transplant and again 2 weeks after transplant doubled number of lateral branches and enhanced growth	Branching	
<i>Helleborus × hybridus</i> (Lenten Rose)	To tone the foliage	<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize (drenches only)</b>	1 to 2 ppm drench x 1	Toning foliage; Volume and mg a.i. will vary with container size	Unspecified
		<b>Concise/Sumagic</b>	3 to 4 ppm spray x 1	Toning foliage	Unspecified
	Induce lateral or basal branching	<b>Configure</b>	50 to 800 ppm spray x 1	Foliar spray applied every 2 weeks for 12 weeks during the summer; Some increase in branching; No phytotoxicity, but leaves were feathered	Branching
<i>Hemerocallis</i> (Daylily)	To control plant growth	<b>Abide/A-Rest</b>	2 ppm drench x 1	Happy Returns – moderate control of height, but significant reduction of flower stalk height; Applied at 10 fl. oz. per trade gal. pots; Volume and mg a.i. will vary with container size	South
			50 to 100 ppm spray x 2	Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required	North
			5+ ppm drench x 1	Applied to overwintered plants at shoot emergence; Drench volume and mg a.i. will vary with container size	

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<b>Hemerocallis</b> (Daylily) <i>continued</i>	To control plant growth <i>continued</i>	<b>Dazide</b> /B-Nine	3,750 ppm spray x 2 to 3	2 to 3 weekly spray applications	North
			Tank Mix	Tank mix spray of 3,750 daminozide + 5 ppm uniconazole x 1	
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	2,500 + 1,250 ppm spray x 2 to 3	Weekly spray applications	North
		<b>Piccolo/Piccolo 10 XC</b> /Bonzi/ Pac O/Downsize (drenches only)	160 to 180 ppm spray x 1	Mary Todd and Hyperion – moderate height control; Black Eyed Stella or Prairie Blue Eyes – not responsive; Irish Elf responsive to single 50 ppm spray application	South
			2 ppm drench x 1	Happy Returns, Hyperion and Prairie Blue Eyes – drench application gave moderate control of height, but significantly reduced flower stalk height; Applied at 10 fl. oz. per trade gal. pots; Volume and mg a.i. will vary with container size	
			45 ppm spray x 2 to 3	Spray applications at weekly intervals	North
			5 to 6+ ppm drench x 1	Rhythm Rainbow – apply 5 ppm drench when plants are 6 to 8 inches tall; Drench volume and mg a.i. will vary with container size	
		<b>Concise</b> /Sumagic	0.5 to 1.0 ppm drench x 1	Butter Pat, Sammy Russell, Happy Returns and Frankly Scarlet – moderate control of height with 10 fl. oz. per trade gal. pots, but significant reduction of flower stalk height; Use care with higher rate; Bare root liners of Pink Song not responsive to 1 ppm drench applied at 2 fl.oz. per quart pot; Volume and mg a.i. will vary with container size	South
			5 to 10 ppm spray x 2 to 3	Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required	North
			1.0 ppm drench x 1	Drench when grown under greenhouse conditions; Drench volume and mg a.i. will vary with container size	
			Not responsive at 60 ppm spray x 1	Bare root liners of Pink Song not responsive to uniconazole	South
		Not responsive at 2 ppm liner soak x 1	Bare root liners of Pink Song not responsive		
	To increase basal branching	<b>Configure</b>	Not responsive at 600 ppm spray x 1	Strutters Ball – not responsive to our screening rate of 600 ppm; Higher rates or multiple applications may be effective	Branching
			2,500 ppm spray x 1 to 3	Weekly applications increased the number of ramets (basal plantlets)	
			2,500 or 5,000 ppm spray x 1 to 5	Foliar spray for 1, 2, 3, 4, or 5 consecutive weeks increased offset formation; higher rates and more applications were generally optimal	
<b>Heuchera</b> (Coral Bells)	To control plant growth	<b>Abide</b> /A-Rest	100 ppm spray x 6	Bloody Mary – good control with weekly applications	North
		<b>Dazide</b> /B-Nine	3,750 to 5,000 ppm spray x 2	Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required; Bloody Mary – good control with 5,000 ppm spray x 6 weekly	North
			<b>Citadel</b> /Cycocel	1,500 ppm spray x 6	Bloody Mary – good control with weekly applications
		<b>Piccolo/Piccolo 10 XC</b> /Bonzi/ Pac O/Downsize (drenches only)	Not responsive at 120 ppm spray x 1	Silver Lode – not responsive	South
			30 ppm spray x 2	Spray at weekly intervals; Height of flower stems can also be reduced by applying when flower buds approach the top of the canopy, may require two weekly applications	North
			6 ppm drench x 1	Drench volume and mg a.i. vary with container size	
			10 to 25 ppm spray x 1	Generally not needed	Unspecified

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Heuchera</i> (Coral Bells) <i>continued</i>	To control plant growth <i>continued</i>	<b>Concise</b> /Sumagic	5 to 15 ppm spray x 2 to 6	Spray 5 ppm at weekly intervals; Height of flower stems can also be reduced by applying when flower buds approach the top of the canopy, may require two weekly applications; Apply 5 ppm sprays early in production and 10 ppm sprays later under better growing conditions; Multiple applications may be required; Bloody Mary – excellent control with 15 ppm spray x 6 weekly	North
			2 to 4 ppm spray x 1	Generally not needed	Unspecified
	To increase basal branching	<b>Configure</b>	600 ppm spray x 1	Raspberry Ice and Silver Lode – increased basal branching at our screening rate; Lower rates may be effective	Branching
<i>Hibiscus moscheutos</i> (Hardy Hibiscus Rose Mallow)	To control plant growth	<b>Abide</b> /A-Rest	100 ppm spray x 5 or 6	Disco Belle Mix – excellent control; Luna Blush or Luna Red – not responsive	North
		<b>Collate</b> /Florel	Less than 500 ppm spray x 4	Pink Champagne – biweekly sprays excessively reduced growth without increasing branching; Reduce number of applications	North
		<b>Dazide</b> /B-Nine	3,750 to 5,000 ppm spray x 5 to 8	Disco Belle Mix – moderate control; Luna Blush or Luna Red – not responsive; Treat about 1 week after pinch with weekly sprays as necessary	North
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	3,750 + 1,000 ppm spray x 2 or 2,500 + 1,250 ppm spray x 2 to 3	For best results, begin PGR applications about 3 to 7 days following a pinch – apply weekly if additional control is needed	North
			2,500 + 750 to 1,000 ppm spray x 1	Luna – apply spray about 2 weeks after transplant and again 2 weeks later, if necessary	Unspecified
			Unspecified	<b>Dazide</b> /B-Nine can delay flowering; Only use when <b>Citadel</b> /Cycocel rate must exceed 750 ppm for adequate control	
		<b>Citadel</b> /Cycocel	500 ppm spray x 2	Lord Baltimore – good control with spray applications	South
			Less than 2,000 ppm drench x 1	Lord Baltimore – stunting with 2,000 ppm drench applied at 4 fl. oz. per 6-in. pot; Reduce drench rate; Volume and mg a.i. vary with container size	
			750 to 1,000 ppm spray x 3	Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required; Disco Belle Mix, Luna Blush and Luna Red – multiple sprays with 1,500 ppm caused excessive stunting	North
			Up to 750 ppm spray x 1	Do not apply until length of new shoots (after pinch) is 0.5 to 1.0 inch; Do not apply after visible bud	Unspecified
		<b>Piccolo</b> / <b>Piccolo 10 XC</b> /Bonzi/Pac O/Downsize (drenches only)	10 to 45 ppm spray x 6 to 8	For best results, begin PGR applications about 1 week after pinch; apply weekly if additional control is needed	North
			5 to 10 ppm drench x 1	Apply about 1 week after pinch, when new growth reaches 4 to 6 inches after soft pinch; Drench volume and mg a.i. vary with container size	
		<b>Concise</b> /Sumagic	10 to 20 ppm spray x 1 to 2	Grenache – good control with 20 ppm spray x 1; Luna Blush – height control with 10 ppm spray x 2; Make second application 2 to 3 weeks after first, if necessary	South
			0.5 ppm drench x 1	Very sensitive to uniconazole drenches; Drench applied at 10 fl. oz. per trade gal. pot; Volume and mg a.i. vary with container size	North
			5 to 10 ppm spray x 6 to 8	Apply lower rates early in production and higher rates later under better growing conditions; Treat about 1 week after pinch, apply weekly sprays as necessary	
			1 ppm drench x 1	One application 1 week after pinch is usually sufficient; Drench volume and mg a.i. will vary with container size	
		To increase branching	<b>Configure</b>	500 ppm spray x 4	Pink Champagne – biweekly sprays increased branching with reduction in plant height

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<b>Hosta</b>	To control plant growth, spray when leaves begin to unfold	<b>Abide/A-Rest</b>	25 to 50 ppm spray x 2 to 3	Spray when leaves begin to unfold; Gold Standard and H. hyacinthia – 100 ppm sprays x 4 to 6 stunted growth, but gave excellent control of Royal Standard	North
			5 ppm drench x 1	Drench after first few leaves have expanded; Volume and mg a.i. will vary with container size	
		<b>Dazide/B-Nine</b>	5,000 ppm spray x 4 to 6	Royal Standard – good control; Gold Standard – not responsive	North
			Tank Mix	Tank mix spray 2,500 ppm daminozide + 5 ppm uniconazole effective; Multiple applications may be needed at 7-day intervals on larger varieties or under warm greenhouse conditions; H. undulata is more sensitive, reduce rates to 2,000 ppm daminozide + 3 ppm uniconazole	
		<b>Dazide/B-Nine + Citadel/Cycocel Tank Mix</b>	3,000 + 1,500 ppm spray x 4 to 6	Royal Standard – good control	North
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize (drenches only)</b>	6 to 10 ppm drench x 1	Effective growth control; Drench volume and mg a.i. will vary with container size	North
			90 ppm spray x 4 to 6	H. hyacinthia – sprays stunted growth; Gold Standard, Royal Standard – not responsive	
			30 ppm spray x 1 to 3	Multiple spray applications may be necessary	Unspecified
		<b>Concise/Sumagic</b>	5 to 15 ppm spray x 2 to 3	Apply when leaves begin to unfurl; 5 ppm spray weekly;	North
				H. hyacinthia, Gold Standard and Royal Standard – 15 ppm spray x 4 to 6 gave good control	
			1 ppm drench x 1	Drench volume and mg a.i. will vary with container size	South
			20 ppm spray x 1	Single application early in production	
	To increase basal branching	<b>Collate/Florel</b>	500 ppm spray x 4	Royal Standard – biweekly sprays increased branching with slight reduction in plant height	Branching
		<b>Configure</b>	500 to 3,000 ppm spray x 1 to 2	See Fine <b>Configure</b> Product Information guide for detailed application instructions and cultivar responses	Branching
			500 ppm spray x 4	Biweekly sprays increased branching of Royal Standard with little reduction in plant height	
<b>Hypericum calycinum</b> (Aaron's Beard, St. John's Wort)	To control plant growth	<b>Dazide/B-Nine</b>	Not responsive at 5,000 ppm spray x 2	Not responsive in nursery trials	South
			1,500 to 2,500 ppm spray x 2 to 3	As needed	North
		<b>Dazide/B-Nine + Citadel/Cycocel Tank Mix</b>	Not responsive at 5,000 + 1,500 ppm spray x 1	Not responsive in nursery trials	South
			2,500 + 1,000 ppm spray x 2 to 3	Weekly applications	North
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize (drenches only)</b>	120 to 160 ppm spray x 1	Moderate control with a single spray application under greenhouse conditions; Not responsive in nursery trials	South
			4 ppm drench x 1	Excellent control with 4 ppm drench at 10 fl. oz. per trade gallon pot under greenhouse conditions; Drench volume and mg a.i. vary with container size	
			30 ppm spray x 2 to 3	Weekly applications	North

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Hypericum calycinum</i> (Aaron's Beard, St. John's Wort) <i>continued</i>	To control plant growth <i>continued</i>	<b>Concise</b> /Sumagic	30 ppm spray x 1	Good growth regulation	South
			1 ppm drench x 1	Drench applied at 10 fl. oz. per trade gallon pot; Drench volume and mg a.i. vary with container size	
			4 to 6 ppm spray x 2 to 3	Weekly applications as needed	North
<i>Iris germanica</i>  <i>Iris hybrids</i> (Tall Bearded Iris)	To control plant growth	<b>Abide</b> /A-Rest	Not responsive at 100 ppm spray x 6	Immortality – not responsive to weekly sprays	North
		<b>Dazide</b> /B-Nine	Not responsive at 5,000 ppm spray x 6	Immortality – not responsive to weekly sprays	North
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	Not responsive at 5,000 + 1,500 ppm spray x 6	Immortality – not responsive to weekly sprays	North
		<b>Citadel</b> /Cycocel	Not responsive at 1,500 ppm spray x 6	Immortality – not responsive to weekly sprays	North
		<b>Piccolo</b> / <b>Piccolo 10 XC</b> /Bonzi/Pac O/Downsize (drenches only)	90 ppm spray x 6	Immortality – weekly sprays gave good control	North
			6 to 10 ppm drench x 1	More responsive to drenches than to spray applications; Drench volume and mg a.i. will vary with container size	
	<b>Concise</b> /Sumagic	Not responsive at 15 ppm spray x 6	Immortality – not responsive to weekly sprays	North	
To increase basal branching	<b>Configure</b>	100 ppm spray x 1	Slight increase in basal branching	Branching	
<i>Iris siberica</i> (Siberian Iris)	To control plant growth	<b>Dazide</b> /B-Nine	Tank mix	Tank mix spray of 2,500 ppm daminozide + 5 ppm uniconazole x 2 to 3 weekly applications	North
		<b>Piccolo</b> / <b>Piccolo 10 XC</b> /Bonzi/Pac O/Downsize (drenches only)	90 ppm spray x 1	Caesar's Brother – a single spray controlled growth; Chilled Wine – not responsive to 180 ppm spray x 1	South
			Less than 2 to 4 ppm drench x 1	Caesar's Brother – use lower drench rates; Chilled Wine – use higher rates; Drench applied at 10 fl. oz. per trade gal. pot; Drench volume and mg a.i. vary with container size	
			6 to 10 ppm spray x 1 to 2	Multiple applications as needed	North
<i>Jovibarba hirta</i> (Hens and Chicks)	Induce lateral or basal branching	<b>Configure</b>	1,600 ppm spray x 1	Increased number of offsets	Branching
<i>Knautia macedonica</i> (crimson scabiosa, Knautia)	To control plant growth	<b>Dazide</b> /B-Nine	2,500 ppm spray x 1 to 2	Multiple applications at 7 to 10 day intervals	North
		<b>Piccolo</b> / <b>Piccolo 10 XC</b> /Bonzi/Pac O	30 ppm spray x 1 to 2	Multiple applications at 7 to 10 day intervals	North
		<b>Concise</b> /Sumagic	5 ppm spray x 1 to 2	Multiple applications at 7 to 10 day intervals	North
<i>Kniphofia uvaria</i> (Torch lily, Red hot poker)	To control plant growth	<b>Dazide</b> /B-Nine	Not responsive at 5,000 ppm spray x 2	Bressingham Comet – not responsive	South
			Not responsive at 160 ppm spray x 1	Bressingham Comet – not responsive	South
		<b>Piccolo</b> / <b>Piccolo 10 XC</b> /Bonzi/Pac O	30 to 45 ppm spray x 1	Echo series – multiple applications required to obtain adequate height control	North
			<b>Concise</b> /Sumagic	45 ppm spray x 1	Bressingham Comet – good control
		5 to 7.5 ppm spray x 1	Echo series – multiple applications required to obtain adequate height control	North	

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<b><i>Lamiastrum galeobdolon</i></b> (Yellow Archangel, Golden Dead Nettle)	To control plant growth	<b>Dazide</b> /B-Nine	3,750 to 5,000 ppm spray x 2	Hermann's Pride – excellent control of runners with 5000 ppm x 2; Apply at 10-14 day intervals	South
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	2,500 + 1,500 ppm spray x 1	Hermann's Pride – excellent control of runners	South
		<b>Piccolo/Piccolo 10 XC</b> /Bonzi/ Pac O/Downsize (drenches only)	80 ppm spray x 1	Hermann's Pride – moderate width control	South
			3 to 5 ppm drench x 1	Drench volume and mg a.i. vary with container size	Unspecified
		<b>Concise</b> /Sumagic	15 ppm spray x 1	Hermann's Pride – moderate width control	South
		Topflor	45 ppm spray x 1	Hermann's Pride – moderate width control; May need multiple applications	South
<b><i>Lamium maculatum</i></b> (Spotted Dead Nettle)	To control plant growth	<b>Abide</b> /A-Rest	50 ppm spray x 2 to 3	Multiple applications may be required; Orchid Frost – excessive width reduction with 100 ppm spray x 4 at 2-week intervals	North
		<b>Dazide</b> /B-Nine	5,000 ppm spray x 2	Pink Pewter – moderate control; Beacon Silver – not responsive under nursery conditions	South
			2,500 to 3,750 ppm spray x 2 to 3	Begin applications when canopy starts to close; Multiple applications as necessary; Orchid Frost – good width reduction with 5,000 ppm x 4 sprays at 2-week intervals	North
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	5,000 + 1,500 ppm spray x 1	Pink Pewter – moderate control; Multiple applications may be required; Beacon Silver – not responsive under nursery conditions	South
			Not responsive at 3,000 + 1,500 ppm spray x 4	Orchid Frost – not responsive with 4 sprays at 2-week intervals	North
		<b>Citadel</b> /Cycocel	750 to 1,500 ppm spray x 2 to 3	Multiple applications may be required; Orchid Frost – good width reduction with 1,500 ppm sprays x 4 at 2-week intervals	North
		<b>Piccolo/Piccolo 10 XC</b> /Bonzi/ Pac O/Downsize (drenches only)	40 ppm spray x 1	Pink Pewter – good control, but multiple applications may be necessary; Beacon Silver – not responsive with 160 ppm spray x 1 under nursery conditions	South
			30 to 60 ppm spray x 2 to 3	Lower rate recommended at weekly intervals; Orchid Frost – good width reduction with 60 ppm sprays x 4 at 2-week intervals	North
			3 to 5 ppm drench x 1	Drench volume and mg a.i. vary with container size	Unspecified
		<b>Concise</b> /Sumagic	30 ppm spray x 1	Pink Pewter – moderate control; Multiple applications may be required; Beacon Silver – not responsive with 60 ppm x 1 under nursery conditions	South
			5 to 15 ppm spray x 2 to 3	Lower rate recommended; Orchid Frost – excellent width reduction with 15 ppm sprays x 4 at 2-week intervals	North
<b><i>Lantana camara</i></b>	To control plant growth	<b>Dazide</b> /B-Nine	2,500 ppm spray x 1 on liners	Dallas Red or New Gold – No effect on growth or branching of liners or finished plants	South
		<b>Piccolo/Piccolo 10 XC</b> /Bonzi/Pac O	40 to 50 ppm spray x 1	Moderate growth control	Unspecified
			4 to 8 ppm liner soak x 1	Soak for 30 seconds; moderate growth control	Unspecified
		<b>Concise</b> /Sumagic	20 to 30 ppm spray x 1	Moderate growth control	Unspecified
		<b>Collate</b> /Florel	Not responsive at 500 ppm spray x 1 on liners	Dallas Red or New Gold – No effect on growth or branching of liners or finished plants	Branching

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Lavandula angustifolia</i> (Lavender)	To control plant growth	<b>Abide/A-Rest</b>	25 ppm spray x 2 to 3	Weekly applications as necessary	North
			5,000 ppm spray x 1	Provence – moderate control applied once in liner stage	South
		<b>Dazide/B-Nine</b>	1,500 to 3,000 ppm spray x 1	Ellegance or Mini Blue – multiple applications as needed	Unspecified
			2,500 to 5,000 ppm spray x 2 to 3	Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications at weekly intervals may be required	North
			<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize</b> (drenches only)	30 ppm spray x 2	Weekly applications as necessary
		6 ppm drench x 1		Drench volume and mg a.i. vary with container size	
		<b>Concise/Sumagic</b>	15 ppm spray x 1	Blue Scent	Unspecified
			5 to 10 ppm spray x 1 to 3	Hidcote Blue or Munstead – as needed	Unspecified
			15 to 30 ppm spray x 1	Phenomenal – for control of flower stalk height, apply when flower stalk reaches the top of the foliage. Higher rate delayed flower opening by 5 days	South
			5 to 10 ppm spray x 2	Weekly applications at 5 ppm as necessary; Sweet Romance – may need 5 ppm spray x 1 for compact growth; Apply lower rates early in production and higher rates later under better growing conditions	North
<i>Lavandula x intermedia</i> (Lavandin)	To control plant growth		<b>Dazide/B-Nine</b>	5,000 ppm spray x 2	Silver Edge (Walvera) – good growth control; Apply at 10- to 14-day intervals
		1,500 to 2,500 ppm spray x 2 to 3		Weekly sprays as needed	North
		<b>Dazide/B-Nine + Citadel/Cycoceel Tank Mix</b>	5,000 + 1,500 ppm spray x 1	Silver Edge (Walvera) – good growth control	South
			2,500 + 1,000 ppm spray x 2 to 3	Weekly sprays as needed	North
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O</b>	Not responsive at 160 ppm spray x 1	Silver Edge (Walvera) – not responsive	South
			30 ppm spray x 2 to 3	Weekly sprays	North
		<b>Concise/Sumagic</b>	Not responsive at 60 ppm spray x 1	Silver Edge (Walvera) – not responsive to 60 ppm spray x 1	South
			4 to 6 ppm spray x 2 to 3	Weekly sprays as needed	North
	To increase lateral branching of liners	<b>Configure</b>	300 ppm spray x 2 on liners	Provence – 2 sprays, first after rooting and again 2 weeks later, increased lateral and basal branching with slight reduction in root growth; Apply after liners are well rooted	Branching
	<i>Leucanthemum x superbum</i> (Shasta Daisy)	To control plant growth	<b>Abide/A-Rest</b>	25 ppm spray x 2 to 3	Weekly sprays as necessary; Becky – stunting with 100 ppm spray x 6
5 ppm drench x 1				Drench volume and mg a.i. will vary with container size	
<b>Collate/Florel</b>			750 ppm spray x 4	Ice Star – weekly sprays reduced growth while increasing the number of inflorescences; Thomas Killen – 500 ppm spray x 3 at 2 week intervals gave moderate growth control, but reduced number of inflorescences per shoot and number of shoots per pot	North



CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<b><i>Leucanthemum x superbum</i></b> (Shasta Daisy) <i>continued</i>	To control plant growth <i>continued</i>	<b>Dazide</b> /B-Nine	Not responsive at 5,000 ppm spray x 2	Alaska and Becky – not responsive	South
			2,500 to 5,000 ppm spray x 4 to 6	Amazing Daisies – 2,500 ppm spray as needed; Becky and Ice Star – 5,000 ppm sprays weekly	North
			Tank mix	Tank mix spray 2,500 ppm daminozide + 15 ppm paclobutrazol x 1 to 2	
			Tank mix	Tank mix spray 2,000 ppm daminozide + 3 to 5 ppm uniconazole x 1 to 2	
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	Not responsive at 5,000 + 1,500 ppm spray x 1	Becky – not responsive; Test higher daminozide rate	South
		<b>Citadel</b> /Cycocel	Not responsive at 4,000 ppm spray x 1	Becky – not responsive	South
			1,500 ppm spray x 4 to 6	Becky and Ice Star – good control with weekly sprays	North
		<b>Piccolo/Piccolo 10 XC</b> /Bonzi/Pac O/Downsize (drenches only)	Less than 40 ppm spray x 1	Alaska – sensitive to paclobutrazol; test rates below 40 ppm; Becky – moderate, short-term response to 120 ppm spray x 1; multiple applications or higher rates required	South
			10 to 30 ppm spray x 2 to 3	Apply lower rates early in production and higher rates later under better growing conditions; Weekly sprays as necessary; Becky and Ice Star – stunting with 90 ppm spray x 6	North
			6 ppm drench x 1	Drench volume and mg a.i. will vary with container size	
	<b>Concise</b> /Sumagic	Less than 15 ppm spray x 1	Alaska – sensitive to uniconazole; test rates below 15 ppm; Becky – not responsive to 60 ppm spray x 1; multiple applications or higher rates required	South	
		5 to 10 ppm spray x 1 to 2	Amazing Daisies – weekly sprays as necessary; Becky and Ice Star – stunting with 15 ppm spray x 6	North	
	Topflor	6 ppm drench x 1	Drench volume and mg a.i. will vary with container size	North	
	To increase basal branching	<b>Configure</b>	300 ppm spray x 1 to 2 for liners	Snowcap – single or multiple foliar sprays applied after rooting increased basal branching, but slightly reduced root growth; Apply after liners are well rooted	Branching
			600 ppm spray x 1 to 2 on finished plants	Becky and Alaska – applied to finish plants once increased branching short term, but doubled the number of flowers of Alaska; 600 ppm was our screening rate; Higher rates or multiple applications may be more effective	
<b><i>Liatis spicata</i></b> (Spike Gayfeather)	To control plant growth	<b>Abide</b> /A-Rest	50 ppm spray x 2 to 3	Weekly applications; Kobold Blue – stunting with 100 ppm spray x 6	North
		<b>Collate</b> /Florel	Not responsive at 500 to 1,000 ppm spray x 1 to 3	Kobold – not responsive to biweekly sprays	North
		<b>Dazide</b> /B-Nine	3,750 ppm spray x 2 to 3	Weekly applications; Kobold Blue – not responsive to 5,000 ppm sprays x 6 weekly	North
			Tank mix	Tank mix spray of 2,500 ppm daminozide + 5 ppm uniconazole x 2 to 3	
		<b>Citadel</b> /Cycocel	Not responsive at 1,500 ppm spray x 6	Kobold Blue – not responsive to weekly applications	North
		<b>Piccolo/Piccolo 10 XC</b> /Bonzi/Pac O	Not responsive at 160 ppm spray x 1	Floristan Violet – not responsive	South
			90 ppm spray x 6	Kobold Blue – weekly applications gave good control	North

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Liatris spicata</i> (Spike Gayfeather) <i>continued</i>	To control plant growth <i>continued</i>	<b>Concise</b> /Sumagic	Not responsive at 60 ppm spray x 1	Floristan Violet – not responsive	South
			15 ppm spray x 6	Kobold Blue – weekly applications gave good control	North
<i>Lobelia cardinalis</i> (Cardinal flower)	To control plant growth	<b>Abide</b> /A-Rest	25 ppm spray x 2 to 3	Weekly sprays	North
			5 ppm drench x 1	Drench volume and mg a.i. will vary with container size	
		<b>Dazide</b> /B-Nine	Not responsive at 5,000 ppm spray x 2	Not responsive	South
			2,500 to 5,000 ppm spray x 2 to 3	Apply lower rates early in production and higher rates later under better growing conditions; Weekly applications may be required	North
			Tank mix	Good height control with Tank mix spray 2,000 ppm daminozide + 3 ppm uniconazole x 2 to 3 weekly applications	
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	Not responsive at 5,000 + 4,000 ppm spray x 1	Not responsive	South
			2,500 + 1,000 ppm spray x 2 to 3	Weekly sprays	North
		<b>Citadel</b> /Cycocel	1,250 ppm spray x 2 to 3	Weekly sprays	North
		<b>Piccolo</b> / <b>Piccolo 10 XC</b> /Bonzi/Pac O/Downsize (drenches only)	Not responsive at 60 ppm spray x 1	Not responsive	South
			30 ppm spray x 2 to 3	Weekly sprays	North
			6 ppm drench x 1	Drench volume and mg a.i. will vary with container size	
		<b>Concise</b> /Sumagic	30 ppm spray x 1	Good control	South
			5 ppm spray x 2 to 3	Weekly sprays	North
			1 ppm drench x 1	Drench volume and mg a.i. will vary with container size	
	Topflor	6 ppm drench x 1	Drench volume and mg a.i. will vary with container size	North	
To increase lateral branching	<b>Configure</b>	600 ppm spray x 1	This rate was our screening rate; Lower rates may be effective	Branching	
<i>Lobelia x speciosa</i> (Hybrid Lobelia)	To control plant growth	<b>Abide</b> /A-Rest	25 to 50 ppm spray x 2 to 3	Weekly spray applications at 7-day intervals	North
		<b>Dazide</b> /B-Nine	2,500 to 5,000 ppm spray x 2 to 3	Weekly sprays	North
			1,250 ppm spray x 2 to 3	Weekly sprays	North
		<b>Citadel</b> /Cycocel	1,500 ppm spray x 3	Label rate: Compliment Scarlet and Queen Victoria (Cycocel)	Unspecified
			<b>Piccolo</b> / <b>Piccolo 10 XC</b> /Bonzi/Pac O	120 ppm spray x 2 to 3	Fan Deep Rose – moderate response to a single application; Multiple applications required
		30 ppm spray x 1		Starship series and Vulcan Red – multiple sprays may be required	Unspecified
		<b>Concise</b> /Sumagic	5 to 10 ppm spray x 2 to 3	Apply lower rates early in production and higher rates later under better growing conditions; Weekly sprays at 5 ppm; Starship series and Vulcan Red – 5 ppm sprays as needed	North
	To increase lateral branching	<b>Configure</b>	600 ppm spray x 1	Fan Deep Rose – increased number of shoots, not branches; This rate was our screening rate; Higher rates or multiple applications may be more effective	Branching

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<b>Lupinus spp.</b> (Lupines)	To tone or control plant growth	<b>Dazide/B-Nine</b>	2,500 ppm spray x 2 to 3	Weekly as needed	North
			Tank Mix	Tank mix spray 2,000 to 2,500 ppm daminozide + 3 ppm uniconazole x 2 to 3; Staircase series to tone or harden foliage. To reduce the height of the flower, apply weekly just as the flower stem is beginning to elongate above the foliage	
	<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O</b>	20 ppm spray x 2 to 3	Weekly as needed	North	
	To increase lateral branching	<b>Configure</b>	175 ppm spray x 1	Staircase series – apply about 5 weeks after transplanting, when plant is well rooted	Branching
<b>Lysimachia</b> (Loosestrife)	To control plant growth	<b>Dazide/B-Nine</b>	5,000 ppm spray x 2	Snow Candles – moderate control; Apply at 10- to 14-day intervals	South
		<b>Dazide/B-Nine + Citadel/Cycocel</b> Tank Mix	2,500 + 1,500 ppm spray x 1	Snow Candles – moderate control of height and width	South
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O</b>	120 ppm spray x 1	Snow Candles – moderate control of height and width	South
		Topflor	30 ppm spray x 1	Snow Candles – moderate control of height and width	South
	To increase lateral branching	<b>Configure</b>	100 to 150 ppm spray x 1 on liners	Increased branching	Branching
<b>Malva alcea</b> (Hollyhock Malva)	To control plant growth	<b>Dazide/B-Nine</b>	Not responsive to 5,000 ppm spray x 2	Not responsive	South
		<b>Citadel/Cycocel</b>	750 to 1,500 ppm spray x 1	Not responsive	South
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O</b>	Much less than 40 ppm spray x 1	Very sensitive; Test rates around 10 to 20 ppm	South
			15 ppm spray x 1	Effective at controlling plant height when applied early in the crop	North
		<b>Concise/Sumagic</b>	Much less than 15 ppm spray x 1	Very sensitive; Test rates around 2 to 5 ppm	South
			2.5 ppm spray x 1	Effective at controlling plant height when applied early in the crop	North
<b>Miscanthus sinensis</b> (Maiden grass)	To control plant growth	<b>Citadel/Cycocel</b>	1,500 ppm spray x 4	Weekly sprays reduced plant height moderately	North
		<b>Dazide/B-Nine</b>	Not responsive at 5,000 ppm spray x 2	Gracillimus – not responsive	South
			5,000 ppm spray x 4	Weekly sprays reduced plant height moderately	North
		<b>Dazide/B-Nine + Citadel/Cycocel</b> Tank Mix	Not responsive at 5,000 + 1,500 ppm spray x 2	Gracillimus – not responsive	South
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize</b> (drenches only)	Not responsive at 160 ppm spray x 1	Gracillimus – not responsive	South
			10 ppm drench x 1	Apply when plants are 10 to 12 inches tall; drench volume and mg a.i. will vary with container size	North

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Miscanthus sinensis</i> (Maiden grass) <i>continued</i>	To control plant growth <i>continued</i>	<b>Concise</b> /Sumagic	40 to 60 ppm spray x 2 to 3	Gracillimus – moderate height control only at 2 weeks after single treatment; Multiple applications may provide control	South
			2 ppm liner soak x 1	Gracillimus – very responsive to liner soaks	
			15 ppm spray x 4	Excessive growth regulation with weekly sprays; Reduce spray frequency	North
			2 ppm drench x 1	Apply when plants are 10 to 12 inches tall; drench volume and mg a.i. will vary with container size	
		Topflor	Not responsive at 120 ppm spray x 1	Gracillimus – not responsive	South
			10 ppm drench x 1	Apply when plants are 10- to 12-in. tall; drench volume and mg a.i. will vary with container size	North
	To increase tillering	<b>Collate</b> /Florel	750 ppm spray x 4	Weekly sprays reduced plant height and increased number of tillers	Branching
		<b>Configure</b>	Not responsive 500 or 1,000 ppm spray x 1	Gracillimus – not responsive	Branching
<i>Monarda didyma</i> (Bee Balm)	To control plant growth	<b>Abide</b> /A-Rest	25 ppm spray x 2 to 3	Weekly sprays	North
			1 to 2 ppm drench x 1	Drench volume and mg a.i. vary with container size	Unspecified
		<b>Collate</b> /Florel	500 ppm spray x 2	Gardenview Scarlet – good growth control; No flower data	South
			500 ppm spray x 3	Blue Stocking – biweekly sprays gave moderate growth control with slight delay in flowering and moderate reduction in the number of inflorescences; No effect on branching.	North
				Marshall's Delight – stunting and delayed flowering with 500 ppm sprays x 4; Reduce frequency of application	
		<b>Dazide</b> /B-Nine	5,000 ppm spray x 2 to 3	Mahogany, Marshall's Delight and Raspberry Wine – good control; Blue Stocking – not responsive	South
			2,500 to 3,750 ppm spray x 2 to 3	Weekly sprays at lower rates; Marshall's Delight – not responsive at 5,000 ppm spray x 4 at 2 week intervals	North
				Tank mix	Tank mix spray of 2,000 ppm daminozide + 3 ppm uniconazole x 2 to 3
		<b>Citadel</b> /Cycocel	Not responsive at 4,000 ppm spray x 1	Blue Stocking – not responsive	South
			1,500 ppm spray x 4	Marshall's Delight – excellent control with sprays at 2-week intervals	North
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	5,000 + 1,500 ppm spray x 1	Mahogany and Marshall's Delight – good control; Multiple applications may be required	South
			2,500 + 1,000 ppm spray x 2 to 3	Weekly applications	North
		<b>Piccolo</b> / <b>Piccolo 10 XC</b> /Bonzi/ Pac O/Downsize (drenches only)	100 ppm spray x 1	Raspberry Wine – good control; Blue Stocking, Jacob Kline or Mahogany – not responsive with 160 ppm spray x 1	
			6 to 8 ppm drench x 1	Raspberry Wine – good control with 6 ppm drench x 1 applied as 2 fl. oz. per qt. pot; Jacob Kline – moderate control with 8 ppm drench x 1 applied as 10 fl. oz. per trade gal. pot, but reduced the number of flowers. Drench volume and mg a.i. vary with container size	South
				16 ppm liner soak x 1	Raspberry Wine – good but short-term control with liner soak
			30 to 60 ppm spray x 2 to 4	Weekly 30 ppm sprays; Marshall's Delight – excellent control with 60 ppm sprays x 4 at 2-week intervals	North
			45 ppm spray x 1 to 3	Multiple spray applications may be necessary	
			3 to 6 ppm drench x 1	Drench volume and mg a.i. vary with container size	Unspecified

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Monarda didyma</i> (Bee Balm) <i>continued</i>	To control plant growth <i>continued</i>	<b>Concise</b> /Sumagic	15 to 30 ppm spray x 1	Mahogany, Marshall's Delight, Blue Stocking and Jacob Cline – good control	South
			1 ppm drench x 1	Jacob Cline – drench applied at 4 fl. oz. per qt. pot; Drench volume and mg a.i. vary with container size	
			5 to 15 ppm sprays x 2 to 4	Weekly sprays at 5 ppm; Marshall's Delight – stunting with 15 ppm sprays x 4 at 2-week intervals; reduce rate or frequency	North
			15 to 30 ppm spray x 1	Multiple applications of lower rate may be applied as necessary	Unspecified
		Topflor	Less than 37 ppm spray x 1	Excessive control of Jacob Cline	South
<i>Muhlenbergia capillaris</i> (Pink Muhlygrass)	To control plant growth	<b>Concise</b> /Sumagic	40 ppm spray x 1	Early control of growth; Multiple applications may be required	South
	To increase tillering	<b>Configure</b>	Not responsive at 500 or 1,000 ppm spray x 1	Small early increase in number of tillers that did not persist after 2 weeks after treatment; Test multiple applications	Branching
<i>Myosotis sylvatica</i> (Forget Me Nots)	To control plant growth	<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	3,500 + 750 ppm spray x 1 to 3	May require multiple applications	North
<i>Nepeta x faassenii</i> (Catmint)	To control plant growth	<b>Abide</b> /A-Rest	25 ppm spray x 2 to 3	Weekly applications	North
			<b>Dazide</b> /B-Nine Tank Mix	2,500 to 5,000 ppm spray x 5	Blue Moon, Pink Cat – weekly applications at 2,500 ppm; Walker's Low – good control with 5,000 ppm spray x 5 weekly
		Tank Mix		Tank mix spray 2,000 ppm daminozide + 3 ppm uniconazole x 2 to 3	Unspecified
		Tank Mix		Tank mix spray 3,750 ppm daminozide + 6 to 8 ppm uniconazole x 2 to 3	
		<b>Citadel</b> /Cycocel	1,500 ppm spray x 5	Walker's Low – weekly applications gave good control	North
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	5,000 + 1,500 ppm spray x 1	Six Hills Giant – good control; Multiple applications may be required	South
			2,500 + 1,000 ppm spray x 3	Six Hills Giant – excellent control	North
		<b>Piccolo</b> / <b>Piccolo 10 XC</b> /Bonzi/ Pac O/Downsize (drenches only)	15 ppm spray x 1	Walker's Low – single application at 3 weeks after planting gave good control	South
			30 ppm spray x 2 to 3	Walker's Low, Kitten Around – repeat at 7- to 10-day intervals beginning when plants are 4- to 6-in. high; Multiple spray applications may be necessary	North
			5 ppm drench x 1	Good control with drench of 4 fl. oz. per 5.5-in. pot at 1 week after planting; Drench volume and mg a.i. affected by pot size; Higher drench rates resulted in leaf necrosis	
			Greater than 20 ppm liner soak x 1	Liner soak gave only 3 weeks control; Test higher rate	
			<b>Concise</b> /Sumagic	5 to 15 ppm spray x 1 to 3	Walker's Low – repeat 5 ppm sprays x 3 at 7- to 10-day intervals beginning when plants are 4- to 6-in. high; Or, apply a single spray of 15 ppm at 8 days after planting or 2 sprays of 10 ppm (at 1 and 3 weeks after planting)
	To increase lateral branching	<b>Configure</b>	600 ppm spray x 1 to 2 on liners	Applied once at 5 days after transplant or twice [at liner stage (7 days after sticking) and at 5 days after transplant] increased number of lateral branches; slight reduction in plant growth	Branching
<i>Oenothera fruticosa youngii</i> (Sundrops)	To control plant growth	<b>Dazide</b> /B-Nine	2,500 ppm spray x 1 to 3	Multiple applications may be necessary	Unspecified
		<b>Concise</b> /Sumagic	5 to 10 ppm spray x 1	If necessary, uniconazole is effective	North
	To increase lateral branching	<b>Configure</b>	Not responsive to 50 to 1,600 ppm spray x 1	Not responsive to single spray applied 2 weeks after potting	Branching

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Opuntia microdasys</i> (Pricklypear cactus)	Induce lateral branching	<b>Configure</b>	Not responsive to 100 to 200 ppm spray x 1	Not responsive	Branching
<i>Paeonia lactiflora</i> (Peony)	To control plant growth	<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize</b> (drench only)	30 to 90 ppm drench x 1	Fall drench application has little effect on growth or flowering of Sarah Bernhardt or Inspecteur Lavergne; higher rates may reduce the number of shoots per plant.	South
			<b>Concise/Sumagic</b>	10 to 20 ppm drench x 1	Drench applied in spring prior to shoot emergence resulted in moderate height control but may reduce flowering; Drench volume and mg a.i. affected by container size
		30 to 45 ppm drench x 1		Apply prior to spring emergence for moderate growth regulation of Sarah Bernhardt or Inspecteur Lavergne	
		Not responsive at 10 to 20 ppm sprench x 1 (4x volume)		Spring growth was not responsive to sprenches applied the previous fall or after Spring emergence	
			30 to 45 ppm sprench x 1	Fall drench has little effect on plant growth of Sarah Bernhardt or Inspecteur Lavergne but increased the number of flowering shoots per plant.	
	Induce basal branching	<b>Configure</b>	100 to 1,600 ppm crown soak x 1	BA applied as a 5-minute pre-plant soak of peony crown divisions in the fall caused buds to sprout about 20 days earlier and over a shorter time period; 400 ppm optimal	Branching
			Not responsive at 250 or 500 ppm crown soak x 1	Not responsive to 2-min pre-plant soaks of divisions in the fall	
<i>Panicum virgatum</i> (Switchgrass)	To control plant growth	<b>Abide/A-Rest</b>	Not responsive at 100 ppm spray x 4	Heavy Metal – little effect of biweekly sprays	North
		<b>Collate/Florel</b>	Not responsive at 500 ppm spray x 4	Heavy Metal – biweekly sprays had no effect plant height, but plants were thinner	North
		<b>Dazide/B-Nine</b>	Not responsive 5,000 ppm spray x 2	Shenandoah – not responsive	South
			5,000 ppm spray x 4	Heavy Metal – little effect of biweekly sprays	North
		<b>Dazide/B-Nine + Citadel/Cycocel Tank Mix</b>	5,000 + 1,500 ppm spray x 2	Shenandoah – moderate response to biweekly sprays	South
			Not responsive at 3,000 + 1,500 ppm spray x 4	Heavy Metal – biweekly sprays had no effect plant height	North
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize</b> (drenches only)	80 ppm spray x 1	Shenandoah – moderate response	South
			Less than 60 ppm spray x 4	Heavy Metal – biweekly sprays caused excessive growth reduction with little height control; Plants were very thin; Reduce frequency of application	North
			5 to 18 ppm drench x 1	Apache Rose and Cheyenne Sky – 5 ppm drench; Heavy Metal – 12 to 18 ppm drenches are more effective; Drench volume and mg a.i. affected by container size	
		<b>Concise/Sumagic</b>	Not responsive at 60 ppm spray x 1	Shenandoah – not responsive	South
			15 ppm spray x 4	Heavy Metal – biweekly sprays caused excessive growth reduction with little height control; Plants were very thin; Reduce frequency of application	North
			1 to 2 ppm drench x 1	Apache Rose and Cheyenne Sky – apply 1 ppm drench x 1; Heavy Metal – 2 ppm drenches are more effective; Drench volume and mg a.i. affected by container size	

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION	
<i>Panicum virgatum</i> (Switchgrass) <i>continued</i>	To control plant growth <i>continued</i>	Topflor	60 ppm spray x 1	Shenandoah – moderate response	South	
			10 to 15 ppm drench x 1	Drenches are more effective than sprays; Drench volume and mg a.i. affected by container size	North	
	To increase tillering	<b>Configure</b>	Not responsive at 500 ppm spray x 4	Heavy Metal – not responsive to biweekly sprays; Plants much thinner than untreated	Branching	
<i>Papaver orientale</i> (Oriental Poppy)	To control plant growth	<b>Dazide/B-Nine</b>	2,500 ppm spray x 2 to 3	Weekly sprays	North	
			Tank mix	Tank mix spray of 2,000 ppm daminozide + 3 ppm uniconazole x 1		
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O</b>	160 ppm spray x 1	Royal Wedding – growth reduction was moderate and short term; Princess Victoria – not responsive under nursery conditions	South	
		<b>Concise/Sumagic</b>	30 to 45 ppm spray x 1	Royal Wedding and Princess Victoria – moderate growth reduction under nursery conditions	South	
<i>Penstemon barbatus</i> (Beardlip Penstemon, Bearded Tongue)  <i>Penstemon digitalis</i>  <i>Penstemon x mexicali hybrids</i>	To control plant growth	<b>Collate/Florel</b>	500 ppm spray x 1	Pike's Peak Purple – moderate control of plant height, increased branching but delayed flowering by 7 days	South	
			1,500 to 2,500 ppm spray x 1	Husker Red, Firebird, Carillo series, Pinacolada	Unspecified	
			5,000 ppm spray x 1	Pike's Peak Purple – moderate height control, but reduced flowering	South	
		<b>Dazide/B-Nine</b>	2,500 ppm spray x 1 to 3	Pensham Laura, Red Riding Hood or Rock Candy series may require multiple applications; Effective on Midnight Masquerade	North	
			Tank Mix	Rock Candy series – Tank mix spray of 2,000 ppm daminozide + 3 ppm uniconazole x 1 to 2		
		<b>Dazide/B-Nine + Citadel/Cycozel Tank Mix</b>	2,500 + 1,000 ppm spray x 2	Multiple applications required for hybrids	Unspecified	
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize (drenches only)</b>	Less than 160 ppm spray x 1	Husker Red – excessive growth regulation with 160 ppm spray x 1; Pike's Peak Purple – moderate height control of with 80 ppm spray x 1	South	
			Less than 8 ppm drench x 1	Husker Red – excessive growth regulation with 8 ppm drench x 1; Drench applied at 10 fl. oz. per trade gallon pot. Drench volume and mg a.i. will vary with container size.		
			10 to 16 ppm liner soak x 1	Laura – moderate growth regulation with liner soak; May need additional control		
			2 ppm liner drench x 1	Red Rocks or Pike's Peak Purple – good growth regulation with 2 ppm liner drench at 0.3 fl. oz. per liner in 72-cell tray		
			5 to 30 ppm spray x 1 to 2	Midnight Masquerade – 5 to 10 ppm; Pensham Laura or Red Riding Hood – 20 to 30 ppm sprays; May require multiple applications		North
			5 to 15 ppm spray x 1	Husker Red or Firebird – 5 to 10 ppm x 1; Pinacolada 15 ppm x 1		Unspecified
			2 to 3 ppm drench x 1	Pinacolada; Drench volume and mg a.i. vary with container size		
			<b>Concise/Sumagic</b>	5 ppm spray x 1 to 2		Pensham Laura or Red Riding Hood – may require multiple applications
		30 ppm spray x 1		Pike's Peak Purple – good growth regulation	South	
		5 to 10 ppm spray x 1 to 3		Multiple applications required for hybrids	Unspecified	
		To increase basal branching	<b>Configure</b>	600 ppm spray x 1	Husker Red and vernalized Prairie Dusk – increased basal branching; unpinched Pike's Peak Purple – increased lateral branching and number of flower stalks; Red Rocks – increased lateral branching	Branching

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Perovskia atriplicifolia</i> (Russian Sage)	To control plant growth	Abide/A-Rest	25 to 100 ppm spray x 3	Weekly 25 to 50 ppm sprays. Apply 50 ppm sprays early in production and 100 ppm sprays later under better growing conditions; Multiple applications may be required; Excellent control with three 100 ppm sprays at 10 day intervals	North
			5,000 ppm spray x 2	Apply at 10- to 14-day intervals; Slight delay in flowering	South
		Dazide/B-Nine	3,750 to 5,000 ppm spray x 2 to 3	Apply 3,750 ppm sprays early in production and 5,000 ppm sprays later under better growing conditions; Multiple applications at 10-day intervals	North
			2,000 to 5,000 ppm spray x 1	Blue Steel – apply 2,500 to 5,000 ppm as needed	Unspecified
			Tank Mix	Tank mix spray of 2,500 ppm daminozide + 3 ppm uniconazole x 1 to 3	North
		Citadel/Cycocel	1,250 to 1,500 ppm spray x 3	Good control with three 1,500 ppm sprays at 10-day intervals or weekly 1,250 ppm sprays	North
		Dazide/B-Nine + Citadel/Cycocel Tank Mix	5,000 + 1,500 ppm spray x 1	Good control; Multiple applications may be necessary	South
			2,500 + 1,000 ppm spray x 2 to 3	Weekly sprays	North
		Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize (drenches only)	30 to 40 ppm spray x 1	Longin – required higher rate of 80 ppm sprays; May require multiple applications	South
			2 ppm liner soak x 1	Good control	
			30 to 45 ppm spray x 2 to 3	Three 30 ppm sprays at 10-day intervals gave excellent control	North
			6 ppm drench x 1	Drench volume and mg a.i. will vary with container size	
		Concise/Sumagic	15 to 30 ppm spray x 1 to 2	Good control; Multiple spray applications may be necessary	South
			1 ppm liner soak x 1	Good control	
			5 to 15 ppm spray x 2 to 3	Apply 5 ppm sprays early in production and 10 ppm sprays later under better growing conditions; Multiple applications may be required; 15 ppm spray x 3 at 10-day intervals gave excessive growth regulation, reduce rate or frequency of application	North
		Topflor	5 to 20 ppm spray x 1 to 2	Multiple applications may be required	Unspecified
			35 to 45 ppm spray x 1	Multiple applications may be required	South
		Concise/Sumagic	45 ppm spray x 1	Red Dragon – good control	
			0.5 ppm drench x 1	Red Dragon – good control; Drench applied as 10 fl. oz. per trade gallon pot; Drench volume and mg a.i. will vary with container size	
		<i>Phlox paniculata</i> (Garden Phlox)	To control plant growth	Abide/A-Rest	Not responsive at 100 ppm spray x 4
Not responsive at 500 ppm spray x 1	Starfire liners – treated just after removal of cuttings from mist were not responsive to sprays; No effect on finished plants				South
Collate/Florel	500 or 1,000 ppm spray x 1 to 3			Mt. Fuji – biweekly sprays provided no growth control nor increased branching, but increased the number of inflorescences per pot	North



CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<b><i>Phlox paniculata</i></b> (Garden Phlox) <i>continued</i>	To control plant growth <i>continued</i>	<b>Dazide</b> /B-Nine	5,000 ppm spray x 2	Blue Boy, Bright Eyes and David – moderate response; Charles Curtis – not responsive; Apply at 10- to 14-day intervals	South
			2,500 to 3,750 ppm spray x 2 to 3	To control plant growth, begin applications early in crop cycle as stems are rapidly elongating; Mt. Fuji – not responsive to 5,000 ppm spray x 4 at 2-week intervals	North
			Tank Mix	Tank mix spray of 2,500 ppm daminozide + 3 to 5 ppm uniconazole x 1 to 3; Opening Act – responsive	North
		<b>Citadel</b> /Cycocel	Not responsive at 4,000 ppm spray x 1	Blue Boy and Charles Curtis – not responsive	South
			750 to 1,250 ppm spray x 2 to 3	Apply 750 ppm early in production and 1,000 ppm later under better growing conditions; Multiple applications may be required; Weekly sprays of 1,250 ppm; Mt. Fuji was stunted with 4 applications of 1,500 ppm at 2-week intervals	North
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	5,000 + 4,000 ppm spray x 1	Blue Boy and Charles Curtis – good control; Multiple applications required; David – not responsive	South
			5,000 + 1,500 ppm spray x 1	Label rate: Blue Boy and Charles Curtis; Multiple applications may be required (max 3) (Cycocel)	Unspecified
		<b>Piccolo</b> / <b>Piccolo 10 XC</b> /Bonzi/ Pac O/Downsize (drenches only)	Not responsive at 160 ppm spray x 1	Blue Boy – not responsive to spray	South
			4 ppm liner soak x 1	Blue Boy and Bright Eyes – moderate growth control of with liner soak	
			45 to 60 ppm spray x 2 to 3	Begin applications early in crop cycle as stems are rapidly elongating; Weekly 45 ppm sprays as necessary; Mt. Fuji – good control of with 60 ppm spray x 4 at 2-week intervals	North
			10 ppm drench x 1	Control with single drench; Drench volume and mg a.i. vary with container size	
			3 to 4 ppm drench x 1	Peacock – drench volume and mg a.i. vary with container size	Unspecified
			45 ppm spray x 1 to 3	Multiple spray applications may be necessary	
			10 ppm drench x 1	Drench volume and mg a.i. vary with container size	
		<b>Concise</b> /Sumagic	60 ppm spray x 1	David – moderate control; Blue Boy and Charles Curtis – not responsive to sprays	South
			2 ppm liner soak x 1	Blue Boy, Bright Eyes and David – moderate growth control with liner soaks	
			10 ppm spray x 1	Opening Act	Unspecified
			5 to 15 ppm spray x 2 to 3	Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required; Weekly 10 ppm sprays; Mt. Fuji – stunted with 15 ppm spray x 4 at 2-week intervals; Cloudburst tall cushion phlox and Kung Fuchsia – apply 10 ppm spray x 1	North
		Topflor	75 ppm spray x 1	David – moderate growth control; Multiple applications may be required	South
		To increase lateral branching	<b>Configure</b>	600 ppm spray x 1 to 2 on liners and finished plants	Single spray on finished plants: Franz Schubert – increased number of shoots; David, Laura – not responsive; This rate was our screening rate; Higher rates or multiple applications may be effective; On liners: Bright Eyes treated twice (26 days after sticking and 5 days after transplant) had increased lateral branches with no reduction in growth or flowering

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Phlox subulata</i> (Thrift, Moss Pink, Creeping Phlox)	To control plant growth	<b>Abide/A-Rest</b>	Less than 100 ppm spray x 6	Emerald Blue – excessive growth reduction; Reduce rate or frequency	North
		<b>Dazide/B-Nine</b>	Not responsive at 5,000 ppm spray x 2	Apple Blossom – not responsive	South
			2,500 to 5,000 ppm spray x 6	Emerald Blue – good control with weekly applications	North
		<b>Citadel/Cycocel</b>	1,500 ppm spray x 6	Emerald Blue – stunted; Reduce rate or frequency	North
		<b>Dazide/B-Nine + Citadel/Cycocel Tank Mix</b>	5,000 + 1,500 ppm spray x 1	Apple Blossom – moderate control	South
			2,500 + 1,000 ppm spray x 1 to 2		Unspecified
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O</b>	120 ppm spray x 1	Apple Blossom – moderate control; Multiple applications may be required	South
			Less than 90 ppm spray x 6	Emerald Blue– excessive growth reduction; Reduce rate or frequency	North
		<b>Concise/Sumagic</b>	15 ppm spray x 1	Apple Blossom – good control	South
			5 to 15 ppm spray x 2 to 3	Emerald Blue – stunted with 15 ppm spray x 6 weekly; Reduce rate or frequency	North
	Topflor	30 ppm spray x 1	Apple Blossom – good control	South	
<i>Platycodon grandiflorus</i> (Balloon Flower)	To control plant growth	<b>Abide/A-Rest</b>	25 to 100 ppm spray x 1 to 4	25 to 50 ppm sprays applied once or twice at weekly intervals; Sentimental Blue – excellent growth control with 100 ppm spray x 4 at 2-week intervals	North
		<b>Collate/Florel</b>	500 ppm spray x 4	Sentimental Blue – biweekly sprays reduced growth with slight delay in flowering	North
		<b>Dazide/B-Nine</b>	2,500 to 3,750 ppm spray x 1 to 3	2,500 ppm sprays once or twice 14-days apart; Apply lower rates early in production and higher rates later under better growing conditions; Sentimental Blue – excessive growth reduction with 5,000 ppm spray x 4 at 2-week intervals; reduce rate or frequency	North
			Tank Mix	Tank mix spray of 2,000 ppm daminozide + 3 ppm uniconazole x 1 to 2	
			1,000 ppm spray x 1 to 3	Miss Tilly – multiple applications as needed to control plant habit; Higher rates may burn leaf edges; Begin applications 2 to 3 weeks after transplant	Unspecified
		<b>Citadel/Cycocel</b>	750 to 1,500 ppm spray x 1		South
			1,500 ppm spray x 4	Sentimental Blue – good growth control with 4 applications at 2-week intervals	North
		<b>Dazide/B-Nine + Citadel/Cycocel Tank Mix</b>	3,000 + 1,500 ppm spray x 4	Sentimental Blue – excessive growth reduction with 4 applications at 2-week intervals; Reduce frequency or rate	North
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize (drenches only)</b>	30 to 60 ppm spray x 1 to 4	30 ppm sprays applied once or twice at weekly intervals; Sentimental Blue – excellent growth control with 60 ppm spray x 4 at 2-week intervals	North
			4 ppm drench x 1	Good control with a single drench; Drench volume and mg a.i. will vary with container size	
		<b>Concise/Sumagic</b>	5 ppm spray x 1 to 2	Weekly sprays; Sentimental Blue – excessive growth reduction with 15 ppm spray x 4 at 2-week intervals, reduce frequency or rate	North
	Induce lateral or basal branching	<b>Configure</b>	Phyto on liners	Single foliar spray at 300 ppm resulted in significant phytotoxicity to liners	Branching

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Polemonium caeruleum</i>  <i>Poleminium reptans</i> (Jacob's Ladder)	To control plant growth	<b>Dazide</b> /B-Nine	2,500 to 3,750 ppm spray x 2 to 3	Apply lower rates early in production and higher rates later under better growing conditions; Weekly applications of 2,500 ppm	North
			Tank Mix	Heavenly Blue – excellent growth control with a tank mix spray of 1,250 ppm daminozide + 3.75 ppm uniconazole x 3 at weekly intervals	
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	2,500 + 1,500 ppm spray x 1	Label rate (Cycocel)	Unspecified
		<b>Piccolo/Piccolo 10 XC</b> /Bonzi/Pac O	30 ppm spray x 2 to 3	Weekly sprays	North
		<b>Concise</b> /Sumagic	5 to 8 ppm sprays x 2 to 3	Weekly sprays	North
		Topflor	6 ppm drench x 1	Drench volume and mg a.i. will vary with container size	North
<i>Primula forbesii</i> (Baby Primrose)	To control plant growth	<b>Citadel</b> /Cycocel	500 ppm spray x 2	Fragrant Luolan and Red Star – Apply at time of visual emergence of inflorescence and 20 days later.	Unspecified
		<b>Concise</b> /Sumagic	25 ppm spray x 2	Fragrant Luolan and Red Star – Apply at time of visual emergence of inflorescence and 20 days later.	Unspecified
<i>Primula polyanthus</i> (Polyanthus Primrose)	To control plant growth	<b>Concise</b> /Sumagic	5 ppm spray x 2 to 3	Weekly sprays	North
<i>Rosa</i> (Rose)	To control plant growth	<b>Piccolo/Piccolo 10 XC</b> /Bonzi/Pac O	60 ppm sprays x 2 to 6	Knock Out – Multiple applications required	North
			45 to 60 ppm spray x 1	Knock Out roses had short-term response to sprays; Multiple spray applications required	South
		<b>Concise</b> /Sumagic	0.25 ppm drench x 1	Knock Out roses – Drench controlled growth through 6 weeks after treatment, reduced height 35% without reducing width; Drench applied at 10 fl. oz. per trade gal. pot; Drench volume and mg a.i. will vary with container size	
	Induce lateral or basal branching		<b>Configure</b>	100 ppm spray x 2 or more	Foliar spray 2 to 32 times; slight increase in branching and increase in the length of the side branches. Subsequent flowering was increased; effect was better than pinching
<i>Rosmarinus officinalis</i> (Rosemary)	To control plant growth	<b>Dazide</b> /B-Nine	2,500 ppm spray x 2 to 3	Weekly sprays	North
			5,000 ppm spray x 2	Hill Hardy – moderate growth control	South
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	2,000 + 1,000 ppm spray x 2 to 3	Weekly sprays	North
		<b>Piccolo/Piccolo 10 XC</b> /Bonzi/Pac O	30 ppm spray x 2 to 3	Weekly sprays	North
		<b>Concise</b> /Sumagic	5 ppm spray x 2 to 3	Weekly sprays	North
	To increase lateral or branching	<b>Collate</b> /Floreel	Not responsive at 500 ppm spray x 1 on liners	Hill Hardy – liners treated 2 weeks after removal from mist; Liners not responsive to spray; No significant increase in branching on liners or finished plants	Branching
		<b>Configure</b>	300 ppm spray x 2 on liners	Applied approximately 28 days after sticking, moderately rooted, increased numbers of shoots and branches and shoot growth of liners	Branching

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Rudbeckia fulgida</i> var. <i>sullivantii</i> Goldsturm (Orange Coneflower, Black-eyed Susan)	To control plant growth; begin applications as flower stalks near leaf canopy as they bolt rapidly	<b>Abide/A-Rest</b>	50 ppm spray x 2 to 3	Begin applications as flower stalks near leaf canopy, as they bolt rapidly; 6 weekly 100 ppm sprays stunted plants; Reduce rate or frequency	North
		<b>Collate/Florel</b>	Not responsive at 500 ppm spray x 1	No growth control and no flowering data	South
		<b>Dazide/B-Nine</b>	2,000 to 5,000 ppm spray x 2 to 6	Apply 2 to 3 weekly applications of 3,750 ppm spray; Apply lower rates (3,750 ppm) early in production and higher rates later under better growing conditions; Good control with 5,000 ppm x 6 at weekly intervals	North
			Tank Mix	Tank mix spray of 2,500 ppm daminozide + 5 ppm uniconazole x 2 to 3 at weekly intervals	
		<b>Citadel/Cycocel</b>	Not responsive at 4,000 ppm spray x 1	Not responsive	South
			1,000 to 1,500 ppm spray x 2 to 3	Apply 1,000 ppm early in production and 1,250 ppm later under better growing conditions; Multiple applications may be required; Excellent control with 1,500 ppm sprays x 6 at weekly intervals	North
		<b>Dazide/B-Nine + Citadel/Cycocel Tank Mix</b>	1,250 to 2,500 + 1,000 to 1,250 ppm spray x 2 to 3	Apply 1,250 + 750 ppm early in production and 2,500 + 1,250 ppm x 2 to 3 weekly later under better growing conditions	North
		<b>Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize (drenches only)</b>	80 to 120 ppm spray x 1	Multiple applications may be necessary	South
			10 to 45 ppm spray x 2 to 3	Goldsturm – apply 10 ppm early in production and 20 ppm later under better growing conditions; Multiple applications may be required; Weekly 45 ppm sprays as necessary	North
			20 to 30 ppm spray x 1	Goldsturm	Unspecified
			6 to 10 ppm drench x 1	Drench volume and mg a.i. will vary with container size	North
		<b>Concise/Sumagic</b>	30 ppm spray x 1	Good control	South
			1 ppm liner soak x 1	Good control	
			2 ppm drench x 1	Good control; Drench applied as 2 fl. oz. per qt. pot; Drench volume and mg a.i. will vary with container size	
	5 to 10 ppm spray x 2 to 3		Goldsturm – apply 2 to 3 weekly sprays; 15 ppm x 6 weekly sprays caused excessive growth reduction; Reduce rate or frequency	North	
Induce lateral or basal branching on liners	<b>Configure</b>	300 ppm spray x 1	Single foliar spray increased basal branching with significant early phytotoxicity	Branching	
		600 ppm spray x 1 on liners	Viette's Little Suzie – no increase in branching, but decreased plant width		
<i>Rudbeckia hirta</i> (Black-eyed Susan)	To control plant growth; apply PGRs just after bloom initiation, but before bud has formed to reduce flower delay	<b>Dazide/B-Nine</b>	2,500 to 5,000 ppm spray x 1	Denver Daisy – apply just after bloom initiation, but before bud has formed to reduce flower delay	Unspecified
			2,500 to 5,000 ppm spray x 1	Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required	North
		<b>Citadel/Cycocel</b>	Phyto at 1,500 ppm spray x 1	Indian Summer – excessive phytotoxicity	South
		<b>Dazide/B-Nine + Citadel/Cycocel Tank Mix</b>	Phyto at 5,000 + 1,500 ppm spray x 1	Indian Summer – excessive phytotoxicity	South

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<b><i>Rudbeckia hirta</i></b> (Black-eyed Susan) <i>continued</i>	To control plant growth; apply PGRs just after bloom initiation, but before bud has formed to reduce flower delay <i>continued</i>	<b>Piccolo/Piccolo 10 XC</b> /Bonzi/Pac O/Downsize (drenches only)	160 ppm spray x 1	Indian Summer – little control; Multiple applications or higher rates required	South
			30 ppm spray x 1	Denver Daisy – apply just after bloom initiation, but before bud has formed to reduce flower delay	Unspecified
		1 to 5 ppm drench x 1	Denver Daisy – apply drench at 4 to 6 weeks after transplant; Drench volume and mg a.i. vary with container size		
		<b>Concise</b> /Sumagic	10 ppm spray x 1	Denver Daisy	Unspecified
	25 ppm spray x 1		Good control under outdoor conditions	South	
	To increase basal branching	<b>Configure</b>	200 ppm spray x 1	Denver Daisy, spray to glisten	Branching
	Not responsive to 50 to 1,600 ppm spray x 1		Single foliar spray applied 4 weeks after potting controlled plant height but did not affect branching; 800 or 1,600 ppm caused phytotoxicity		
<b><i>Salvia farinacea Hybrids</i></b> (Mealy Cup Sage)	To control plant growth	<b>Dazide</b> /B-Nine	2,500 ppm spray x 1	Spray day after sticking. Follow with tank mix if necessary and repeat daminozide at weeks 4 and 5 if needed	Unspecified
			Tank mix	Tank mix spray of 2,500 ppm daminozide + 10 ppm ancymidol x 1 if needed after daminozide application	
	Induce lateral or basal branching	<b>Configure</b>	250 ppm spray x 1	Controlled height and increased branching	Branching
<b><i>Salvia guaranitica</i></b> (Anise sage)	To control plant growth	<b>Concise</b> /Sumagic	30 ppm spray x 1 at transplant	Black and Blue – very responsive to foliar spray immediately after transplant	South
			1 ppm liner soak or drench x 1	Black and Blue – very responsive to liner soak or drench (0.3 oz. per 72-size cell) before transplant	
<b><i>Salvia leucantha</i></b> (Velvet Sage, Mexican Sage)	To control plant growth	<b>Dazide</b> /B-Nine	5,000 ppm spray x 3	Apply at 10- to 14-day intervals	South
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	5,000 + 1,500 ppm spray x 1	Multiple applications may be necessary	South
			2,500 ppm spray x 2 to 3	Apply at weekly intervals as needed	North
		<b>Citadel</b> /Cycocel	2,250 ppm spray x 1		South
		<b>Piccolo/Piccolo 10 XC</b> /Bonzi/Pac O	60 ppm spray x 1		South
		<b>Concise</b> /Sumagic	30 ppm spray x 1	No landscape persistence	South
		Topflor	30 ppm spray x 1		South
<b><i>Salvia x sylvestris</i></b>  <b><i>Salvia nemorosa</i></b>  <b><i>Salvia hybrids</i></b> (Meadow Sage)  <b><i>Salvia officinalis</i></b> (Garden sage)	To control plant growth	<b>Abide</b> /A-Rest	25 to 100 ppm spray x 2 to 6	2 to 3 sprays at 25 to 50 ppm; Good control of growth of Blue Queen with 100 ppm x 6 weekly	North
			1 to 2 ppm drench x 1	Drench volume and mg a.i. vary with container size	Unspecified
		<b>Collate</b> /Florel	Not responsive at 400 ppm spray x 4	May Night – all sprays phytotoxic; Did not reduce flower buds; Reduced growth	North
			125 to 500 ppm spray x 1 or 2 on liners and finished plants	Aurea liners – just after removal from mist with 125 to 500 ppm sprays gave no growth control; There were no persistent effects on finished plants. Biweekly 500 ppm sprays gave moderate growth control and increased number of inflorescences of May Night	South

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Salvia x sylvestris</i> <i>Salvia nemorosa</i> <i>Salvia hybrids</i> (Meadow Sage) <i>Salvia officinalis</i> (Garden sage) <i>continued</i>	To control plant growth <i>continued</i>	Dazide/B-Nine	5,000 ppm spray x 2	Indigo Spires – not responsive; Blue Queen – stunted with delayed flowering; May Night – controlled growth and increased flower number	South
			2,500 to 5,000 ppm spray x 2 to 3	Daminozide Is very effective on salvia; Apply 2,500 ppm sprays 2 to 3 times weekly; Apply low rates early in production and 5,000 ppm later under better growing conditions; Blue Queen – stunted with 5,000 ppm sprays x 6 weekly; reduce rate or frequency	North
			1,500 to 3,750 ppm spray x 1 to 3	Salvatore Blue and New Dimensions series – 1,500 to 2,000 ppm sprays; Bordeaux and Color Spires – 2,500 ppm sprays; S. officinalis Aurea – 2,500 to 3,750 ppm sprays; Multiple applications may be required	Unspecified
			Tank Mix	Tank mix spray of 2,000 daminozide + 3 ppm uniconazole x 2 to 3	
		Citadel/Cycocel	750 to 1,500 ppm spray x 2 to 6	Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required; Blue Queen – good control of growth with 1,500 ppm sprays x 6 weekly	North
		Piccolo/Piccolo 10 XC/Bonzi/Pac O/Downsize (drenches only)	80 ppm spray x 1	Cultivar differences: Blue Queen – good control with single spray at 80 ppm; Indigo Spires – not responsive at 60 ppm x 1; Blue Hill and May Night – not responsive at 160 x 1	South
			30 ppm spray x 2 to 3	Weekly sprays as necessary; Blue Queen – not responsive to 90 ppm spray x 6 weekly	North
			2 to 6+ ppm drench x 1	As needed; Drench volume and mg a.i. will vary with container size	Unspecified
			40 to 60 ppm spray x 1	40 to 60 ppm spray is the label rate.	
		Concise/Sumagic	10 to 60 ppm spray x 1	Single application 10 ppm spray early in production; Indigo Spires – very responsive at 15 ppm, but may require multiple applications; Blue Queen – good control with 60 ppm spray x 1; May Night – not responsive to 20 ppm spray x 1	South
	5 to 15 ppm spray x 2 to 6		Color Spires – 5 to 7 ppm spray x 1; Blue Queen – excellent control of growth with 15 ppm spray x 6 weekly; Apply 5 ppm early in production and 10 ppm later under better growing conditions; Multiple applications may be required	North	
	To increase lateral branching	Configure	300 ppm spray x 1 or 2 on liners	May Night liners – single or multiple foliar sprays applied after removal from mist increased basal branching; Apply after liners are well rooted	Branching
			400 ppm spray x 1 on finished plants	Branching increased with single spray 2 weeks after potting; Flowering delayed with higher rates	
	<i>Scabiosa columbaria</i> (Pincushion Flower)	To control plant growth; apply PGRs as flower stalk starts to elongate or if rosette appears to be elongating with flowers	Abide/A-Rest	25 to 50 ppm spray x 2 to 3	Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required; Butterfly Blue – not responsive to 100 ppm sprays x 4 at 2-week intervals
1 to 2 ppm drench x 1				Drench volume and mg a.i. vary with container size	Unspecified
Collate/Florel			Not responsive at 400 ppm spray x 4	Giant Blue – All sprays phytotoxic; Butterfly Blue – not responsive to 500 ppm sprays x 4 at 2 week intervals	North
			500 ppm spray x 2	Butterfly Blue – moderate growth control and slightly delayed flowering	South
Dazide/B-Nine			5,000 ppm spray x 3 to 4	Butterfly Blue – good growth control; Pink Mist – moderate control of overwintered plants	South
			2,500 to 5,000 ppm spray x 2 to 3	Weekly 2,500 ppm sprays; Apply 2,500 ppm early in production and 3,750 ppm later under better growing conditions; Multiple applications may be required; Butterfly Blue – good control with 5,000 ppm sprays x 4 at 2-week intervals	North

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<b>Scabiosa columbaria</b> (Pincushion Flower) <i>continued</i>	To control plant growth; apply PGRs as flower stalk starts to elongate or if rosette appears to be elongating with flowers <i>continued</i>	<b>Citadel/Cycozel</b>	Not responsive at 1,500 ppm spray x 1	Pink Mist not responsive	South
		<b>Dazide/B-Nine + Citadel/Cycozel Tank Mix</b>	5,000 + 1,500 ppm spray x 1	Butterfly Blue – moderate control; Pink Mist – little control of overwintered plants; Test multiple applications	South
			2,500 to 4,000 + 1,000 to 1,500 ppm spray	Scabiosa – responsive to tank mix	Unspecified
		<b>Piccolo/Piccolo 10 XC/Bonzi/ Pac O/Downsize (drenches only)</b>	60 ppm spray x 1	Pink Mist – moderate control	South
			30 ppm spray x 2 to 3	Weekly applications; Butterfly Blue – stunted with 60 ppm sprays x 4 at 2-week intervals; reduce rate or frequency	North
		<b>Concise/Sumagic</b>	3 ppm drench x 1	Drench volume and mg a.i. vary with container size	Unspecified
			20 to 30 ppm spray x 1	Butterfly Blue – good growth regulation with 20 ppm x 1; Pink Mist – required higher rates or multiple applications	South
			5 to 10 ppm spray x 2 to 3	Weekly sprays at 5 ppm; Butterfly Blue – stunted with 15 ppm sprays x 4 at 2-week intervals; reduce rate or frequency	North
		Topflor	30 to 45 ppm spray x 1	Pink Mist – moderate control; Test multiple applications as necessary; High rates (60 to 75 ppm) reduced flowering	South
	Induce lateral or basal branching	<b>Configure</b>	Not responsive at 50 to 800 ppm spray x 1	Single foliar spray applied 2 weeks after potting had no effect on branching	Branching
<b>Scutellaria hybrid</b> (Skullcap)	Induce lateral or basal branching	<b>Configure</b>	Not responsive to 50 to 800 ppm spray x 1	Not responsive to single foliar spray applied 2 weeks after potting	Branching
<b>Sedum x Autumn Joy</b> (Sedum)	To control plant growth	<b>Abide/A-Rest</b>	Not responsive at 100 ppm spray x 4	Autumn Joy – not responsive to 4 sprays at 2-week intervals	North
		<b>Collate/Florel</b>	500 ppm spray x 4	Autumn Joy – moderate growth control with biweekly sprays	North
		<b>Dazide/B-Nine</b>	5,000 ppm spray x 2	Autumn Joy – moderate growth control; Apply at 10- to 14-day intervals	South
			2,500 to 5,000 ppm spray x 2 to 4	2 to 3 weekly sprays at 2,500 ppm; Autumn Joy – good growth control with 5,000 ppm sprays x 4 at 2-week intervals	North
			Tank Mix	Tank mix spray of 2,000 ppm daminozide + 15 ppm paclobutrazol as needed	
		<b>Citadel/Cycozel</b>	Not responsive at 4,000 ppm spray x 1	Autumn Joy – not responsive	South
			Not responsive at 1,500 ppm spray x 4	Autumn Joy – not responsive to 4 sprays at 2-week intervals	North
		<b>Collate/Florel</b>	300 to 500 ppm spray x 1	To help control growth and increase branching or delay flowering	Unspecified
		<b>Dazide/B-Nine + Citadel/Cycozel Tank Mix</b>	5,000 + 1,500 ppm spray x 1	Autumn Joy – moderate growth control; Multiple applications may be required	South
			2,000 + 1,000 ppm spray x 2 to 3	Weekly applications	North
2,500 to 3,500 + 750 to 1,000 ppm spray	Tank mix will help control growth; multiple applications may be required		Unspecified		

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Sedum x Autumn Joy</i> (Sedum) <i>continued</i>	To control plant growth <i>continued</i>	<b>Piccolo/Piccolo 10 XC</b> /Bonzi/Pac O/Downsize (drenches only)	80 to 160 ppm spray x 1 to 2	Autumn Joy – good growth control with a single 80 ppm spray; Matrona – requires multiple applications at higher rates	South
			Less than 10 ppm drench x 1	Autumn Joy – stunted with 10 ppm drench at 2 fl. oz. per quart pot; Drench volume and mg a.i. vary with container size	
			30 to 60 ppm spray x 2 to 4	2 to 9 weekly 30 ppm sprays; Autumn Joy – excellent control with 60 ppm sprays x 4 at 2-week intervals	North
			6 to 10 ppm drench x 1	Drench volume and mg a.i. vary with container size	
	To increase lateral branching	<b>Concise</b> /Sumagic	15 to 45 ppm spray x 1	Autumn Joy – rates higher than 30 ppm caused persistent reductions in plant growth in the landscape; Matrona – requires higher rates and/or multiple applications	South
			5 to 15 ppm spray x 2 to 4	2 to 3 weekly 5 ppm sprays; Autumn Joy – excellent control with 15 ppm sprays x 4 at 2-week intervals	North
		Topflor	37 to 60 ppm spray x 1	Autumn Joy – good growth control with a single 37 ppm spray; may require multiple applications; Matrona height was not reduced with a single 120-ppm spray, but width was reduced with a single 60-ppm spray	South
		<b>Configure</b>	600 ppm spray x 2 on liners	On liners: Autumn Joy treated twice (18 days after sticking and 5 days after transplant) had double the number of shoots and 3 times as many lateral branches with no reduction in growth	Branching
<b>Collate</b> /Florel	500 ppm spray x 1 on liners	Increased branching	Branching		
<i>Sedum spurium</i>	To control plant growth	<b>Piccolo/Piccolo 10 XC</b> /Bonzi/Pac O	10 to 20 ppm spray x 2 to 3	Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required	North
		<b>Concise</b> /Sumagic	5 to 10 ppm spray x 2 to 3	Apply lower rates early in production and higher rates later under better growing conditions; Multiple applications may be required	North
<i>Sempervivum</i> (Hens and Chicks)	To increase number of offsets	<b>Configure</b>	200 to 400 ppm spray x 1	Increased offsets; Did not affect subsequent rooting of offsets; Cultivars varied in the number of offsets produced	Branching
<i>Sorghastrum nutans</i> (Indiangrass)	To control plant growth	<b>Dazide</b> /B-Nine	5,000 ppm spray x 2	Indian Steel – moderate growth control	South
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	5,000 + 1,500 ppm spray x 2	Indian Steel – good height control	South
		<b>Piccolo/Piccolo 10 XC</b> /Bonzi/Pac O	160 ppm spray x 1	Indian Steel – moderate growth control	South
		<b>Concise</b> /Sumagic	45 ppm spray x 1	Indian Steel – moderate growth control; May require multiple applications	South
<i>Stokesia laevis</i> (Stokes Aster)	To control plant growth	<b>Abide</b> /A-Rest	100 ppm spray x 4	Klaus Jelitto – biweekly sprays gave excellent growth control	North
		<b>Collate</b> /Florel	500 ppm spray x 4	Klaus Jelitto – biweekly sprays gave excellent growth control and plants appear more well branched	North
		<b>Citadel</b> /Cycocel	1,500 ppm spray x 4	Klaus Jelitto – moderate growth control	North
		<b>Dazide</b> /B-Nine	5,000 ppm spray x 2	Purple Parasols and Klaus Jelitto – responsive; Apply at 10- to 14-day intervals	South
			5,000 ppm spray x 4	Klaus Jelitto – biweekly sprays gave excellent growth control	North
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	5,000 + 1,500 to 2,250 ppm spray x 1	Purple Parasols and Klaus Jelitto – responsive; May require multiple applications	South
			2,000 + 1,000 ppm spray x 1	Multiple cultivars	North



CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION	
<b><i>Stokesia laevis</i></b> (Stokes Aster) <i>continued</i>	To control plant growth <i>continued</i>	<b>Piccolo/Piccolo 10 XC</b> /Bonzi/ Pac O/Downsize (drenches only)	40 to 80 ppm spray x 1	Purple Parasols – good control	South	
			Not responsive at 40 to 80 ppm spray x 1	Klaus Jelitto – not responsive at 80 ppm spray x 1		
			Not responsive to 2 ppm drench x 1	Klaus Jelitto – not responsive to drench applied at 2 fl. oz. per quart pot; Drench volume and mg a.i. vary with container size		
				Less than 60 ppm spray x 4	Klaus Jelitto – biweekly sprays gave excessive growth reduction; Reduce frequency	North
		<b>Concise</b> /Sumagic		Less than 60 ppm spray x 1	Silver Moon – Excessive control at 60 ppm; Purple Parasols and Klaus Jelitto – not responsive at this rate	South
			Less than 15 ppm spray x 4	Klaus Jelitto – biweekly sprays gave excessive growth reduction; Reduce frequency	North	
	To induce lateral branching	<b>Configure</b>	Not responsive at 600 ppm spray x 1	Silver Moon – not responsive; This rate was our screening rate; Higher rates may be effective	Branching	
<b><i>Tradescantia virginiana</i></b> (Virginia Spiderwort)	To control plant growth	<b>Dazide</b> /B-Nine	5,000 ppm spray x 2	Red Cloud and Blue Stone – moderate growth control; Multiple applications necessary	South	
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	5,000 + 1,500 ppm spray x 2	Red Cloud – moderate growth control; Blue Stone – not responsive to single spray; Multiple applications necessary	South	
		<b>Piccolo/Piccolo 10 XC</b> /Bonzi/Pac O	40 to 80 ppm spray x 1	Red Cloud – use higher rate	South	
		<b>Concise</b> /Sumagic	15 to 30 ppm spray x 1	Red Cloud – Use higher rate	South	
		Topflor	15 to 45 ppm spray x 1	Red Cloud – responsive to low rate; Blue Stone – use higher rate	South	
<b><i>Verbena bonariensis</i></b> (Tall Verbena, Brazilian Verbena)	To control plant growth	<b>Dazide</b> /B-Nine	2,500 to 5,000 ppm spray x 1	Buenos Aires – additional sprays may be required	Unspecified	
		<b>Piccolo/Piccolo 10 XC</b> /Bonzi/ Pac O/Downsize (drenches only)	80 ppm spray x 1	Lollipop – moderate height control with single treatment	South	
			10 ppm drench x 1	Drench at 2 fl. oz. per quart pot; Drench volume and mg a.i. will vary with container size		
	To induce lateral branching	<b>Collate</b> /Florel	500 ppm spray x 1 on liners	Lollipop – spray applied 2 days after removal of cuttings from mist; Increased lateral branching (3.5 times) of liners with moderate growth regulation; No persistent effect on finished plants	Branching	
<b>Configure</b>		300 ppm spray x 2 on liners	Lollipop – increased lateral branching (2.5 times) of liners; First spray applied 13 days after sticking, second spray 14 days later; No persistent effect on finished plants	Branching		
<b><i>Verbena canadensis</i></b> (Clump Verbena)	To control plant growth	<b>Collate</b> /Florel	500 ppm spray x 1 to 2	Homestead Purple and Taylortown Red – moderate growth reduction; May delay flowering	South	
			Not responsive at 5,000 ppm spray x 2	Homestead Purple – not responsive	South	
		<b>Dazide</b> /B-Nine	2,500 ppm spray x 1 to 2	Multiple applications may be necessary	North	
			<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	5,000 + 1,500 ppm spray x 1	Homestead Purple – good control, but multiple applications may be required	South
		2,000 + 1,000 ppm spray x 2 to 3		Weekly sprays as necessary	North	
		<b>Piccolo/Piccolo 10 XC</b> /Bonzi/ Pac O/Downsize (drenches only)	45 ppm spray x 2 to 3	Weekly sprays as necessary	North	
			3 to 5 ppm drench x 1	Drench volume and mg a.i. will vary with container size		
	120 to 160 ppm spray x 1	Multiple applications may be necessary	Unspecified			

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Verbena canadensis</i> (Clump Verbena) <i>continued</i>	To control plant growth <i>continued</i>	<b>Concise</b> /Sumagic	15 to 60 ppm spray x 1	Homestead Purple – 15 ppm spray x 1 had very short-term effect; Multiple applications required; Homestead Red Carpet – 60-ppm spray x 1 gave moderate control, but 60 ppm spray x 2 caused stunting	South
			8 ppm drench x 1	Homestead Red Carpet – moderate control; Test higher rates; Drench applied at 10 fl. oz. per trade gal. pot, drench volume and mg a.i. will vary with container size	
			2 ppm liner soak x 1	Homestead Red Carpet – moderate control; Test higher rates	
	Induce lateral or basal branching	<b>Configure</b>	250 to 1,000 ppm spray x 1	Single foliar sprays immediately after pinching increased lateral branching; 1,000 ppm reduced shoot elongation	Branching
<i>Verbena rigida</i> (Upright Verbena, Tuberous Vervain)	To control plant growth	<b>Dazide</b> /B-Nine	2,000 to 2,500 ppm spray x 1	Santos Purple – multiple applications may be necessary	Unspecified
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	2,000 + 750 ppm spray x 1	Santos Purple – multiple applications may be necessary;	Unspecified
	To induce lateral branching	Atrimmec	800 ppm spray x 1	Increased branching; Little height control	Branching
		<b>Configure</b>	600 ppm spray x 1	Increased number of shoots and branches	Branching
		<b>Collate</b> /Florel	Not responsive at 500 ppm spray x 2	Higher rates reduced height slightly, but there was no increased branching	Branching
<i>Veronica spicata</i> (Spike speedwell)  <i>Veronica longifolia</i> (Speedwell)  <i>Veronica hybrids</i>	To control plant growth	<b>Abide</b> /A-Rest	25 to 100 ppm spray x 2 to 4	One or two weekly sprays at 25 ppm; Apply 50 ppm early in production and 75 ppm later under better growing conditions; Multiple applications may be required; Blue – 100-ppm sprays x 3 at 10-day intervals gave excellent control	North
			5,000 ppm spray x 2	Red Fox – good control	South
		<b>Dazide</b> /B-Nine	2,500 to 5,000 ppm spray x 1 to 4	1 or 2 weekly 2,500 ppm sprays as necessary; Blue – 5,000 ppm sprays x 3 at 10-day intervals gave moderate control; Blue Bouquet – excellent control with 5,000 ppm sprays x 4 weekly	North
			2,000 to 3,000 ppm spray	Red Fox – effective	Unspecified
		<b>Citadel</b> /Cycocel	Not responsive at 4,000 ppm spray x 1	Red Fox – not responsive	South
			1,500 ppm spray x 3 to 4	Blue Bouquet – 1,500 ppm sprays x 4 weekly sprays gave good control, Blue – no control with 1,500 ppm sprays x 3 at 10-day intervals	North
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	5,000 + 1,500 ppm sprays x 2	Red Fox – responsive	South
			2,000 + 1,000 ppm spray x 1 to 2	Weekly sprays	North
			2,500 + 1,000 ppm spray	Red Fox – effective	Unspecified
		<b>Piccolo</b> / <b>Piccolo 10 XC</b> /Bonzi/ Pac O/Downsize (drenches only)	Less than 40 ppm spray x 1	Red Fox – sensitive, test lower rates; First Love – sensitive, test lower rates	South
			30 ppm spray x 1 to 2	Weekly sprays; Blue – not responsive to 60 ppm sprays x 3 at 10-day intervals; Blue Bouquet – severely stunted by 90-ppm sprays x 4 weekly	North

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION		
<i>Veronica spicata</i> (Spike speedwell)  <i>Veronica longifolia</i> (Speedwell)  <i>Veronica hybrids</i> <i>continued</i>	To control plant growth <i>continued</i>	<b>Piccolo/Piccolo 10 XC</b> /Bonzi/Pac O/Downsize (drenches only) <i>continued</i>	Not responsive at 80 ppm spray x 1	Pink Panther – not responsive to spray	South		
			Less than 4 ppm drench x 1	Pink Panther – use lower drench rates; Drench applied at 10 fl. oz. per trade gallon pot; Drench volume and mg a.i. will vary with container size			
			2 to 3 ppm liner soak x 1	Pink Panther – moderate growth control with liner soak			
					15 to 30 ppm spray	Red Fox – 15 to 20 ppm spray; Multiple spray applications may be necessary	Unspecified
					2 to 6 ppm drench x 1	As needed; Drench volume and mg a.i. vary with container size	
				<b>Concise</b> /Sumagic	10 ppm spray x 1	Red Fox – very sensitive	South
					6 to 8 ppm spray x 1 to 2	Mona Lisa Smile and Magic Show – effective rates; Blue and Blue Bouquet – severely stunted by multiple applications at 15 ppm spray	North
	To increase lateral branching	<b>Collate</b> /Florel	125 to 500 ppm spray x 1 on liners	Treatments applied the day after removal of cuttings from mist. Goodness Grows liners – no height control of liners or finished plants, but liners had 4 times the number of basal branches with 500 ppm spray x 1; No effect on finished plants.  First Love – liners not responsive to 125 to 500 ppm sprays x 1, but finished plants had 3 times the number of leaders and a greater number of lateral branches	Branching		
			500 ppm spray x 4	Icicle – biweekly sprays did not significantly affect height, but increased branching and flowering. Blue Bouquet – 750 ppm spray x 4 weekly caused excessive growth reduction and delayed flowering			
			<b>Configure</b>	500 ppm spray x 4	Icicle – biweekly sprays increased branching with moderate reduction in plant height	Branching	
		600 ppm spray x 1 on liners		First Love – increased number of branches on liners; No effect on finished plants			
		300 ppm spray x 2 on liners		Goodness Grows – treated twice (approximately 28 days after sticking and 2 weeks later) had 4 times the number of lateral branches; Shoot height was slightly reduced on liners; No effect on finished plants			
		<i>Veronica x Sunny Border Blue</i> (Hybrid Speedwell)	To control plant growth	<b>Dazide</b> /B-Nine	5,000 ppm spray x 2	Multiple applications required; Apply at 10- to 14-day intervals	South
	Tank mix				Tank mix spray of 2,500 ppm daminozide + 20 ppm paclobutrazol x 1 to 2 gave good control		
<b>Citadel</b> /Cycocel	750 to 1,000 ppm spray x 1			Higher rates cause persistent delay of growth in the landscape	South		
<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	5,000 + 1,500 ppm spray x 1			Good control; Multiple applications may be required	South		
<b>Piccolo/Piccolo 10 XC</b> /Bonzi/Pac O	20 ppm spray x 1			Very sensitive	South		
<b>Concise</b> /Sumagic	10 ppm spray x 1			Very sensitive; Persistent reductions in plant growth continue in the landscape at 15 ppm	South		
	Less than 1 ppm drench x 1			Drench applied at 4 fl. oz. per qt. pot; Drench volume and mg a.i. will vary with container size			
	<b>Topflor</b>		30 ppm spray x 1	Moderate control; Multiple applications may be required	South		
To increase lateral branching	<b>Collate</b> /Florel		500 ppm spray x 1 on liners	No effect on growth or branching of liners or finished plants	Branching		
			400 ppm spray x 4	Sunny Border Blue stock plants – weekly sprays reduced growth and flower buds, but increased branching; Higher rates were phytotoxic			

CROP	PURPOSE	PRODUCT	APPLICATION RATE (PPM) X NUMBER OF APPLICATIONS*	PRECAUTIONS OR REMARKS	REGION
<i>Vinca major</i> (Greater periwinkle)	To control plant growth	<b>Dazide</b> /B-Nine	2,500 ppm spray x 1 to 2	Variegata – multiple applications may be required	North
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	2,500 + 1,000 ppm spray x 1	Apply to liners when removed from mist	
		<b>Concise</b> /Sumagic	5 to 6 ppm sprays x 1 to 2	Variegata – apply 2 to 3 ppm sprays when plants come off mist; Apply higher rates to finish plants; Multiple applications may be required	
	To increase lateral branching	<b>Collate</b> /Floreil	500 to 1,000 ppm sprays x 1	For increased branching on finished plants	Branching
<i>Vinca minor</i> (Lesser Periwinkle)	To control plant growth	<b>Dazide</b> /B-Nine	2,500 to 5,000 ppm spray x 2	5,000 ppm spray x 2 gave excessive reductions under nursery conditions; Reduce rate or frequency	South
			2,500 ppm spray x 1	May require multiple applications	North
		<b>Dazide</b> /B-Nine + <b>Citadel</b> /Cycocel Tank Mix	5,000 + 1,500 ppm spray x 1	Moderate reductions under nursery conditions; May require multiple applications	South
		<b>Piccolo/Piccolo 10 XC</b> /Bonzi/Pac O	40 ppm spray x 1	Moderate effect under nursery conditions; May require multiple applications	South
		<b>Concise</b> /Sumagic	15 ppm spray x 1	Moderate effect under nursery conditions; May require multiple applications	South
			5 to 6 ppm spray x 1	May require multiple applications	North
	To increase lateral branching	<b>Collate</b> /Floreil	500 to 1,000 ppm spray x 1	For increased branching of finished plants	Branching
		<b>Configure</b>	Not responsive at 1,200 ppm spray x 1	Sterling Silver – not responsive	Branching



# PGR Mixing Tool: PGR Mix Master Update

By Brian Whipker, North Carolina State University

A new 2.0 version of the PGR Mix Master app has been created by Dr. Brian Krug in partnership with Fine Americas. This free mobile app is web-based and can be used for calculating PGR mixing rates. PGR Mix Master can be used on any mobile device, computer or tablet with web access. It calculates PGR mixing rates for sprays and drenches for most of the common chemicals available for ornamentals.

(The old version of the PGR Mix Master [version 1.1.2] doesn't work on the newer Apple iPhone OS versions and you should delete the app. The version currently at the app store is the old 1.1.2 version and should not be used.)


The app works best with the Safari web browser. The icons may not appear the same in Chrome. The new app is available for access from the e-GRO website at <http://e-gro.org/mixmaster>.

## Steps for calculating PGR mixing rates

1. When you open the e-GRO website (e-gro.org), the MixMaster App is one of the icons displayed under the top e-GRO banner.
2. To calculate mixing rates, click on the icon to open the app.
3. From the pull-down menu, select the PGR that you'll be using.
4. Click on the unit of measure you want the results to be presented in (U.S. Standard vs. Metric).
5. Enter the volume of solution desired.
6. Enter the ppm concentration of the solution needed.
7. Hit "Calculate" and the app will display the required amount of PGR and water to use for mixing your PGR treatment.

It's that easy. The PGR Mix Master app is a great tool to quickly help you do the mixing math.

## Installing PGR Mix Master on your phone

1. Once the program is opened, at the bottom of your screen will be a box with an up arrow. Press it.
2. Press the "Add to Home Screen" button. (To locate the button, you may need to scroll to the right.)
3. When the new Add to Home screen pops up, click on the "Add" part at the upper right.
4. The PGR Mix Master app should appear on your phone screen for use. 



# Integrated Growth Regulation of Herbaceous Perennials

By Joyce G. Latimer, Virginia Tech

There's a tremendous diversity of herbaceous perennial plant species being grown for both the retail and landscaping sectors of the industry. Growth regulation of these containerized plants is of particular concern. In production settings, as well as in retail locations, herbaceous perennials grown in pots tend to stretch and become leggy or simply overgrow their pots before their scheduled market date. These plants are less marketable and harder to maintain.

Plant growth regulators (PGRs) are chemicals that are designed to affect plant growth and/or development. Most of the PGRs used in the greenhouse or nursery are used to regulate shoot growth of containerized crops by inhibiting the production of gibberellins—the primary plant hormones responsible for cell elongation. Therefore, these growth retardant effects are primarily seen in stem, petiole and flower stalk tissues. Lesser effects are seen in reductions of leaf expansion, resulting in thicker leaves with a darker green color.

PGRs also increase the tolerance of plants to temperature and drought stress, as well as to the stresses of shipping and handling, thereby improving shelf life and extending plant marketability. Other benefits of using these PGRs in plant production include improved plant appearance by maintaining plant size and shape in proportion with the pot, and increased shipping capacity with the smaller plants.

Although there's much scientific information on using PGRs on ornamental plants, it's not an exact science. Achieving the best results with PGRs is a combination of art and science—science tempered with a lot of trial and error, and a good understanding of plant growth and development under your environmental and production conditions.

## Integrated growth regulation

For best results, PGRs should be handled as production tools, like water and fertilizer. PGRs should be an integrated part of your crop production cycle, used in conjunction with a number of non-chemical control options to manipulate plant growth, so well-proportioned, compact plants are produced. Selecting shorter-growing cultivars is often the first step available to growers for reducing the occurrence of overgrown plants. However, customer demand for specific color or growth form characteristics may limit your choices.

More so than with bedding plants, the response of herbaceous perennials to PGRs depends on the species and cultivar selection. However, in general, slow-growing or dwarf cultivars will require less PGRs than more vigorous cultivars. Some plant species or cultivars are responsive to specific PGRs, but not all PGRs. Research your crop, including its responsiveness to PGRs.

Environment and cultural practices can be manipulated in the greenhouse or nursery to reduce plant growth and consequently affect the need for chemical growth regulation. Root restriction can be used to control plant growth by utilizing smaller containers or by increasing the number of

plants per pot. However, this method works well only when other production parameters—such as ample light, i.e., wide spacing and proper nutrition—are provided. Plants grown in small pots at close spacing will require more chemical growth regulation for adequate growth control than those receiving ample light.

Reducing or withholding water or fertilizer is a traditional method of controlling plant growth. Allowing plants to wilt slightly will lead to shorter plants, but excessive stress or drought stress of sensitive crops may have the undesirable effects of reduced plant quality and delayed flowering. Limiting the amount of nitrogen, or using high nitrate and/or low phosphorous fertilizers, may also help control plant height, but tends to produce thin, leggy perennials. Growers who tend to run their plants “dry” and/or “hungry” will need less PGRs to manage plant growth. Never apply PGRs to plants that are wilted, as the risk of phytotoxicity increases with stress.

Growing conditions affect plant height and PGR needs. Higher light quality tends to limit plant elongation, thus resulting in shorter plants. Low-light quality caused by inadequate spacing or crowding of the crop or too many hanging baskets overhead can lead to leggy plants.

Light quantity also affects plant growth. Higher light levels improve plant growth and quality, as well as branching. Spacing will often determine the need for, and amount of, additional chemical control necessary for optimum height control. Lower temperatures can be used to reduce plant growth; this, however, may also reduce development, which can delay flowering, so you may need to adjust your crop schedules to hit your market window. Lower rates of PGRs are required for plants grown under lower temperatures. However, in general, higher rates of PGRs will be needed for plants grown outdoors under nursery conditions than for those grown in the greenhouse.



Good growers use all the tools at their disposal to grow the healthiest and most uniform crops they can.

Pinching can be used to improve the shape of the plant, increase branching and control excessive stretch. However, the labor costs of pinching and the subsequent delay in plant development may not make it an economically feasible option of controlling growth of many crops. The chemical branching enhancer Configure is effective on a wide variety of herbaceous perennials in both plug/liner and finished plant stages. Growers should test multiple applications to improve plant shape and reduce, or eliminate, pinching. To a lesser extent, ethephon (Collate, Florel) has been effective as a branching enhancer for perennial plants, especially in the northern climates.

Optimizing plant growth control requires an understanding of the effects of environmental and cultural conditions on plant growth. Experience and on-site trials will allow you to combine chemical PGRs with a number of non-chemical control options to manipulate plant growth to produce high-quality, compact plants.

The PGR rate table (starting on page 12) contains results of university PGR research, published reports from growers, chemical companies and plant suppliers, as well as label recommendations for herbaceous perennials. These rates should be used as guidelines for your own trials. Adjust the rates based on your location (higher rates in the Sunbelt and lower rates in northern areas), growing conditions and cultural practices, and the vigor of your crop or cultivar. Keep records of your results, including details on the stage of development of the crop, fertilization and irrigation programs, and environmental conditions. These records will improve your ability to get consistent results from crop to crop or year to year.

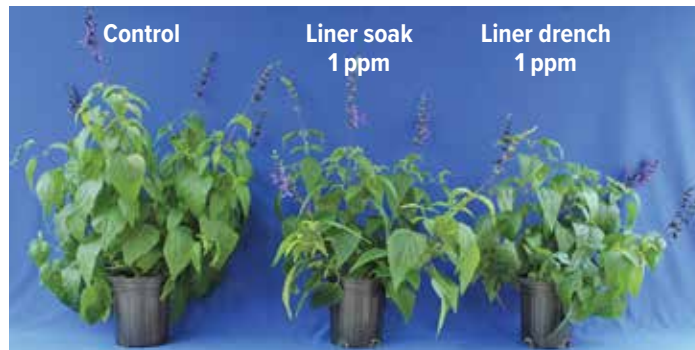
### Applying PGRs to herbaceous perennials

Generally, growth-retarding PGRs should be applied just prior to rapid shoot growth. For most spring-planted perennials, this is one to two weeks after transplanting a plug or liner, where the roots are established and the plant has resumed active growth.

On pinched plants, apply PGRs after the new shoots are visible and starting to elongate. For overwintered perennials, apply PGRs shortly after new shoots emerge (2- to 4-in. tall) or laterals begin to elongate. Under warm spring conditions, especially in a covered cold frame, these shoots can elongate very rapidly.

This is where the art of plant growth regulation is most important—you must learn how your crop grows and when to intervene to obtain the desired results. Remember to note details of crop development in your records of PGR treatments. You must gauge when rapid elongation will likely occur and treat to counter it. Early intervention manages plant growth and quality better than late applications.

Liner soaks or media sprays can be very effective in controlling early growth of vigorous cultivars or providing season-long control. (See labels for application guidelines and test rates suggested in the table starting on page 12.) These



Liner soaks are an effective, but unwieldy, application method for early growth regulation of vigorous crops. Liner drenches can provide comparable control if care is taken to apply an equivalent amount of active ingredient. With *Salvia guaranitica* Black and Blue liners grown in 72-cell size trays, we applied 1 ppm Concise as either a two-minute liner soak in the solution (center) or as a 10-ml drench per cell of this solution (right). Growth regulation was comparable throughout the growing period. Use published liner soak rates as a starting point to determine your liner drench rates.

applications are intended to provide early control; higher rates and/or subsequent spray or drench applications may be necessary for season-long control. Liner soaks can be very effective in controlling the growth of very vigorous plants in mixed containers. The growth retardant effects are very limited to plants that were soaked in the PGR solution.

Many growers, especially northern growers, prefer to use multiple applications of growth retardants to better control plant growth. A single application at a high rate early in the plant production cycle may be excessive if growing conditions aren't as good as expected. An early application at a lower rate provides more flexibility, but the tradeoff is the additional labor involved with multiple applications.

Be aware that excessive rates of many of these PGRs can cause persistent growth reductions in the container or even in the landscape. It's always a good idea to evaluate the long-term effects of your treatments by growing some out for yourself or talking with your customers. In addition, we have more research recommendations on using gibberellin products like Fresco/Fascination to counteract overdoses of growth retardants. These reports are also available here in the reference section. Be careful to avoid late applications, especially of paclobutrazol or uniconazole, as they may delay flower opening.

### Check plants

How well does the PGR really work? The only way to confirm the efficacy of a PGR is to leave a few representative plants untreated for comparison. These "check plants" offer a valuable insight into ways to adjust future PGR applications.

Integrating chemical growth regulators into your production practices will help control undesirable plant stretch and help ensure a well-proportioned, highly marketable crop. 6

# Additional Benefits of PGRs

Brian E. Whipker, North Carolina State University

**Plant growth regulators provide more than just growth control—better water utilization, disease suppression and greener color make PGRs a best management strategy!**

Greenhouse growers use plant growth regulators (PGRs) to control excessive plant growth. But did you know PGRs also provide additional benefits? This article highlights one of the best-kept secrets in floriculture about the additional advantages of using plant growth regulators to improve your crop quality.

So to be clear, the PGRs that I'm referring to are ones with a mode of action that block the biochemical pathway leading to the production of gibberellins (GA) (Figure 1). GA is the hormone that encourages cell elongation. By blocking that pathway, the plants are naturally shorter. The PGRs that block the GA pathway include: ancymidol (Abide/A-Rest), chlormequat chloride (Citadel/Chlormequat E-Pro/Cycocel), daminozide (B-Nine/Dazide), flurprimidol (Topflor), and uniconazole (Concise/Sumagic). Chemicals that have a different mode of action—such as Augeo, Configure, Florel, Collate, Fascination or Fresco—don't have these added attributes so this article doesn't apply to them.

There are three additional benefits of applying PGRs: 1) greener leaves, 2) less water use and 3) greater disease suppression.

## 1. Greener leaves

Have you ever noticed how the plant leaves become greener after you apply a PGR? The darker green color suggests that the plant has a higher chlorophyll content. Why does this occur? There are two reasons.

First of all, with a PGR application, the new plant cells don't expand as much, so they're smaller. Smaller cells mean that the chlorophyll contained in the leaves is more densely packed, which makes the leaves darker green. In addition, applying a PGR—which blocks the GA

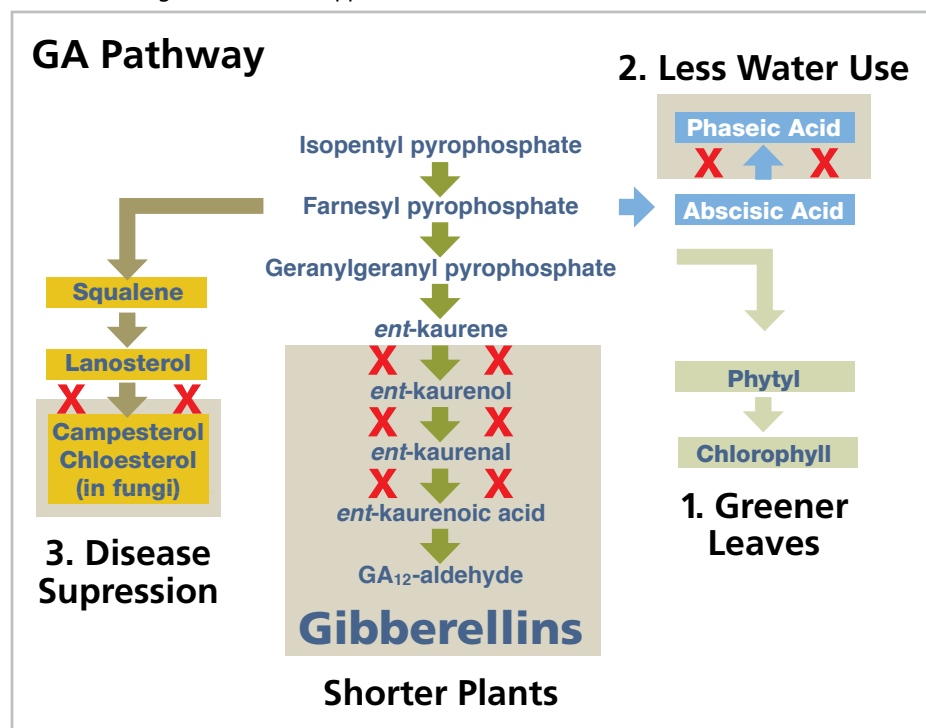
pathway—results in some secondary effects. In this case, an up-regulation, or increase, in the amount of chlorophyll produced by the plant (Figure 1).

This illustration will explain how the GA pathway is blocked and how additional chlorophyll is produced. The GA pathway is a series of biochemical reactions in the leaf, which results in the production of gibberellins. Gibberellins encourage cell expansion. By blocking the pathway, plants are then more compact. That's why we use PGRs to manage growth.

So why do leaves become greener? Let's use the example of a beaver dam to explain it: When beavers build a dam on a creek, they don't totally stop the flow of water; some water still spills over the main part of the dam. That occurs when PGRs are used. You still get some plant growth, just not as much. The other thing that occurs is the water is diverted elsewhere by the beaver dam. The water backs up and then it spills over at some secondary place.

That also occurs with the GA pathway. With the blockage, other secondary biochemical reactions are then increased. One up-regulated reaction is an increase in the production of chlorophyll (Figure 1, see #1). So that's why plants become greener after a PGR application (Figure 2).

Figure 1. An overview of the gibberellin biosynthesis pathway for controlling plant growth, with advantageous secondary benefits of greener leaves, less water use and greater disease suppression noted.





## 2. Water use

Reduced water stress is also a secondary effect when one applies PGRs. It all goes back to the blocked GA pathway and up-regulation of the natural plant hormone abscisic acid (ABA), which helps plants control water loss through their leaves.

On the bottom of plant leaves there are doughnut-like openings in the leaf called stomates, which regulate gas exchange and water loss. An increase in ABA encourages the stomates to close and avoid water loss. Less water loss means it takes more time for the plants to wilt.

Utilizing the illustration of the GA pathway again (Figure 1, see #2), with the blockage of the pathway there's an up-regulation of ABA, which is beneficial to plants. In addition, there's also an up-regulation in the biochemical pathway of chemicals, which block the breakdown of ABA. So this also leads to an increased accumulation of ABA to help the plant better manage water loss. The end result is plants treated with PGRs use less water. In fact, a recent study at North Carolina State University by Ahmad et al. found that water use was 33% less when zinnia plants were treated with 1 mg a.i. drenches of paclobutrazol when compared with the untreated control (Figure 3). Being able to apply a water conservation treatment is an excellent best-management practice.

## 3. Disease reduction

A third attribute of PGRs is disease reduction. This attribute applies to paclobutrazol and flurprimidol and—to a lesser extent—to ancymidol, daminozide or chlormequat. It doesn't apply to uniconazole because of how it's manufactured by selecting for greater PGR activity; that process removes most of the disease reduction ability.

A side effect of the blocked GA pathway is also the blockage of a secondary pathway used by fungi (Figure 1, see #3). Paclobutrazol and flurprimidol act similarly as the mode of action as sterol biosynthesis inhibitor class of fungicides (SBIs). A secondary pathway leading off the GA pathway produces the building blocks used by fungi. Paclobutrazol and flurprimidol block that pathway, so the essential chemicals needed by fungi to grow aren't available. Therefore, the occurrence of disease is reduced (Figure 4).

So in summary, there are a number of biochemical reactions always occurring in plants. With the use of GA-blocking PGRs, there's a resulting up-regulation and down-regulation of a number of other reactions. Of course, plant growth is more compact. Plants are also greener because of an increased concentration of chlorophyll. Plants are healthier because of the ability to reduce foliar diseases.

Finally, plants use less water, which helps avoid drought stress. There are additional benefits besides controlling excessive stretch when it comes to PGRs. This makes the use of PGRs a key component when it comes to best-management practices for floriculture crops. Please keep in mind that no plant growth regulators are labeled for control or suppression of plant diseases. ⑤



Figure 2. The plant on the left did not have a PGR application, while the plant on the right did. The use of anti-GA PGRs resulted in darker green plants.

Figure 3. Data from a recent study at North Carolina State University in which the use of 1 mg a.i. paclobutrazol drenches resulted in zinnia plants requiring 33% less water over the production season as compared with the untreated control.

Data source: Ahmad, Whipker and Dole, NCSU

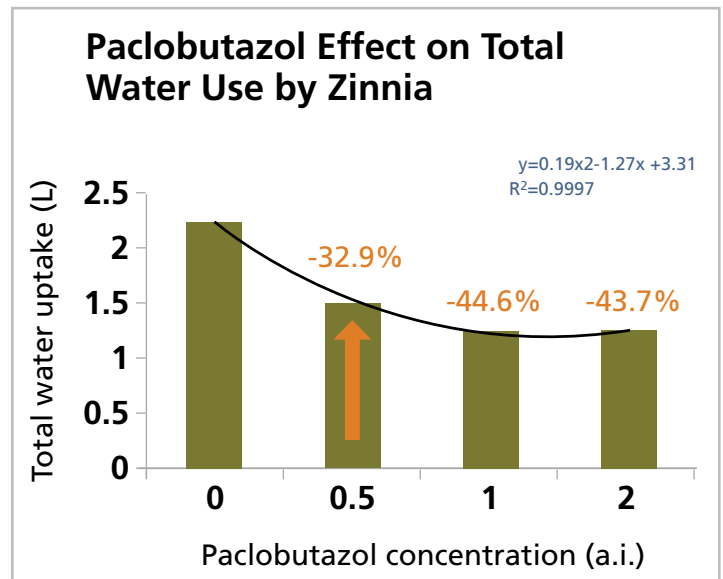


Figure 4. Based on a height control experiment, one can clearly see powdery mildew starting to infect the untreated plant on the left, while the plant on the right had been given a PGR drench about 4 weeks prior to this date and a powdery mildew infection had been reduced. PGRs will not provide season-long protection against foliar diseases, but it turns out they can offer a first line of protection.

# Improving Branching of Gaura with Configure or a Configure + Dazide Tank Mix

By Joyce G. Latimer & Holly L. Scoggins, Virginia Tech

Over the years, we've found that branching of many of the herbaceous perennials can be enhanced with applications of Configure (BA, benzyladenine, Fine Americas, Inc.). One of the more responsive crops has been *Gaura lindheimeri* (wandflower). Gaura Siskiyou Pink is very responsive to Configure (Figure 1).

The growth habit of gaura actually makes these responses easy to see. In this case, two applications of 600 ppm Configure after transplanting (two weeks apart) increased the number of shoots on the plant, the number of branches on those shoots and the number of flowers on those branches. Look at the pot fill!

However, sometimes you just need a little growth regulation in the crop as well. So we looked at a tank mix combination of Configure with Dazide (daminozide, Fine Americas, Inc.) on Gaura Whirling Butterflies, making the applications at stage 3 rooting (just after liners were removed from mist). All growth regulators were applied as a single foliar spray at the label-recommended volume of 1 gal. per 200 sq. ft. using the following rates:

- Untreated control
- 500 ppm Configure
- 2,500 ppm Dazide
- Tank Mix = 500 ppm Configure + 2,500 ppm Dazide

At three weeks after treatment, Configure alone increased the number of branches on the gaura liners, while Dazide alone reduced branching. However, the tank mix restored the number of branches to numbers similar to those of the untreated liners (Figure 2). Note that Configure alone or in the tank mix with Dazide delayed flowering by about 10 days. However, since this

Figure 2. Gaura Whirling Butterflies liners at three weeks after treatment (left to right for each crop): untreated control; 500 ppm Configure; 2,500 ppm Dazide; or a tank mix of 500 ppm Configure + 2,500 ppm Dazide.

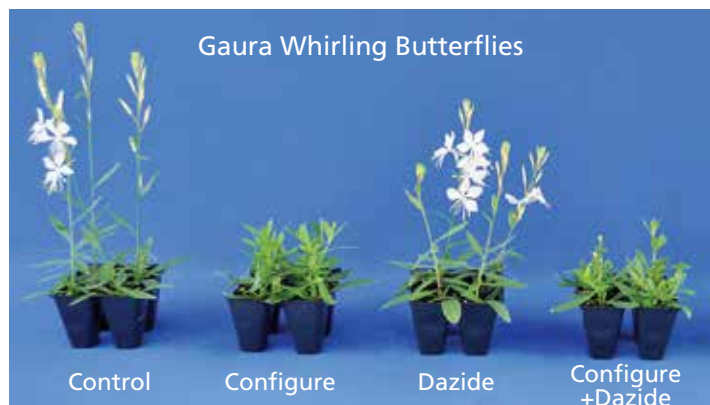


Figure 1. Gaura Siskiyou Pink plants at seven weeks after initial treatment: untreated control (left) or two applications of 600 ppm Configure applied at two and four weeks after planting.

was primarily during the liner rooting phase, it may have been advantageous. Shoot dry weight of the liners was not affected by the growth regulator applications.

Five weeks after potting into quart pots, the finished gaura plants showed no differences in plant height or shoot dry weight, but plants treated with Dazide alone still had the fewest number of branches (10 per plant) and plants treated with Configure alone had the greatest number of branches (20.8 per plant; eight weeks after PGR application).

## Key points for applying Configure

- Make sure that liners are actively growing before the first application.
- Repeat application within one week after potting, but at least two weeks after the first application.
- Use the recommended spray application volume (1 gal. per 200 sq. ft.) to thoroughly wet leaves. Good coverage is critical since Configure is primarily taken up by the leaves.
- Apply Configure foliar sprays when plants are under low stress conditions to enhance uptake.
- Add a good surfactant to your spray solution.
  - The Configure label permits, but does not require, additional surfactants. While we've found excellent results without it, others have successfully used Capsil with Configure. Use a surfactant labeled for your crop and follow label directions.
- Keep records of your applications and results.
  - Always keep notes to aid in improving your results with subsequent crops. Include notes on the environmental conditions as they affect drying time.
- Do not irrigate overhead within four hours of Configure application.
- Combining Configure with growth retardant applications may improve branching and dry weight accumulation of the finished plants without reducing the growth regulation effects of the growth retardants.

Plants should ALWAYS be treated with PGRs under low-stress conditions, but products like Configure are absorbed best under low drying conditions, e.g., early or late in the day, cloudy days or under high humidity. It's very important to be consistent in your applications. Fast-drying conditions reduce uptake and efficacy, which may encourage you to apply higher rates, which may in turn be excessive under long drying conditions. That's why the records are so important! 6

# Better Branching: Building a Better Plant from the Ground Up



 **configure**<sup>®</sup>

The only pure 6-BA plant growth regulator for  
**increased** lateral branching and flowering

Always read and follow label directions.  
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# Evening Out Results with Piccolo 10XC

Brian Whipker, North Carolina State University

One of the most popular plant growth regulators (PGR) used in greenhouse floriculture production is paclobutrazol. Bonzi from Syngenta was the initial paclo registered in the U.S. Fine Americas offers Piccolo and their newer formulation of Piccolo 10XC. For growers who desire a greater degree of control, it's the top PGR in their toolbox.

Growers have made comments that sometimes the results of a paclo application are inconsistent. Below are some methods to use for improving the consistency of your results:

■ **Where does paclo uptake occur?** Paclo is actively taken-up by the plant in the roots, stems and leaves. Uptake is greatest in the roots and stems, and to a lesser extent, the leaves.

■ **Why is there a variation in uptake by the plant?** It's a function of how paclo is transported within the plant. The xylem is the water-conducting cells of plants. It moves water, nutrients and chemicals from the roots to the leaves. Paclo applied to the roots and stems is easily taken up by the plant and transported within the xylem tissue. That's why drench paclo applications are so effective and provide even results.

■ **Why are leaf applications not as effective?** Movement out of leaves relies upon the phloem. The phloem tissues are specialized cells that load and move assimilates (food) produced in the leaves to other parts of the plant. Paclo doesn't readily move into the phloem tissue, therefore, a foliar spray application has less effect than a root-applied drench.

■ **What is the basis of applying foliar sprays as a known volume over a known area?** Recommendations for applying PGRs as foliar sprays have varied over time. Initially, the basis was applying enough solution until the leaf glistens. It has also included applying sufficient volume until it just starts to drip from the leaves. Both of these recommendations are very subjective and varied from grower to grower. Hence, some growers obtained sufficient control of plant growth, while others had too little or too much.

Over time the recommendation has been modified to a more accurate basis of applying foliar sprays as a known volume over a known area. That's why the current labeled recommendation is to apply 1 gal. of spray solution over 200 sq. ft. of bench area. This basis has helped provide more consistent results across crops.

■ **What are the other effects of this spray volume over a known area?** Applying 1 gal. of spray solution over 200 sq. ft. of bench area means that the leaves are wet and there's extra solution that either dribbles down the stem or drips into the substrate. In fact, the recommended rate ranges provided on the paclo label is counting on a small degree of stem and root uptake to control plant growth.

■ **Can spray volume be used as a method of varying the dosage?** Yes, this is the basis of a sprench application (applying 1.5 gal. of spray solution over 200 sq. ft. of bench area). The increased volume of spray that's applied means more of the solution comes in contact with the stems and drips down into the substrate for root uptake.

So this allows growers to mix a paclo solution at one concentration and then vary the amount of spray volume applied over the bench area to custom-

## PGR Activity Influencing Factors



**Chemical  
Species**

**Chemical  
Concentration**

**Cultivar**

**Application Type**

**Application  
Number**

**Irrigation Frequency**

**Light**

**Development Stage**

**Temperature**

**Fertilizer**

**Application Interval**

**Spacing**

Figure 1. Numerous cultural and environmental factors affect the efficacy of a plant growth regulator application. These must be taken into account when you're determining the rate to use on your crop.

ize a dose to a plant's needs. So plants that require less growth control, either because they're slow growing or not a vigorous cultivar, can have less spray volume applied and this will result in less effect.

On the opposite end of the spectrum, a higher volume of water per unit area will provide added control of vigorous cultivars. This is where a grower has the ability to practice the art of PGR applications to customize results.

■ **Why does it appear that my PGR application didn't work?** There are a number of factors that influence the effectiveness of a PGR application. Optimal rates vary of course by the species of plant, by cultivar vigor, timing (late applications may be less effective), fertilization rates (high P and ammoniacal-nitrogen rates stimulate more growth) and environmental conditions (Figure 1).

In fact, for foliar applications of a PGR, any environmental factor that hastens the drying of the leaf surface after a PGR is applied will have a negative impact on uptake. If the leaf dries too quickly, such as making an application in the middle of the day, then less of the PGR will be absorbed by the plant.

Figure 2. All 0.4% paclobutrazol formulations settle over time. Here, a clear separation of the clay-based particles is seen. The active ingredients settle out within a few days, but aren't visible.



Figure 3. Leaving a "check plant" helps you determine the effectiveness of a plant growth regulator treatment.

In an experiment conducted at North Carolina State University, we applied a PGR foliar spray and allowed it to dry normally. The next morning, we lightly rewet the leaf surface by spraying the leaf with clear water until it glistened. (We avoided applying too much water that would have resulted in runoff.) The end result was an additional 10% of growth control occurred. So the application of any PGR foliar spray should be done when the leaves can remain wet for the longest time to obtain optimal results.

■ **Does my paclo settle in the jug?** The answer is yes for all the 0.4% formulations of paclo on the market. The active ingredient (a.i.) in the 0.4% formulations settles out fairly quickly in the jug. If given ample time, the clay particles and xanthan gum used to hold the a.i. in suspension will also settle out to the bottom of the container. (If you place the solution in a clear container, you can observe the clay particle settling after about two months [Figure 2].) That's why all the jugs of the 0.4% formulations state that you need to shake the container vigorously for two minutes. If the jug isn't shaken, then the solution at the top of the jug will contain less paclo and it will be more concentrated at the bottom of the jug. This will have dramatic effects on your results. So remember to shake, not stir, your 0.4% paclo jugs before use.

The exception to the above jug shaking rule is Piccolo 10XC. It's a 4% concentrate that's a microemulsion concentrate (MEC) formulation. The advantage of an MEC formulation is the a.i. stays in solution and doesn't settle out.

■ **How do I know if an application actually worked?** The simple answer is to leave some untreated controls ("check plants" [Figure 3]). Check plants allow you to determine how effective a PGR application was and will provide insights on how you may want to modify your rates.

Paclo is a very effective PGR for greenhouse production of floriculture crops. By following the above tips, it will help you get the most effect out of your PGR applications. 🍷

# Using Dazide and Concise to Control Growth of Hybrid Echinacea

By Mara C. Grossman, Holly L. Scoggins & Joyce G. Latimer, Virginia Tech

Growers and consumers appreciate all of the exciting new flower colors and forms of hybrid echinacea cultivars, however, in production, some hybrids can grow to be overly tall.

In our previous research, we've used different PGRs to control the height of echinacea cultivars. We found that Echinacea Harvest Moon was more compact after spray or drench treatment with Concise (uniconazole) or Piccolo 10 XC (paclobutrazol) or spray applications of Dazide (daminozide). However, while Echinacea Marmalade was shorter in response to spray applications of Dazide, flowering in finished plants was diminished.

In this study, we wanted to determine the effectiveness of a mixed growth regulator approach using Dazide during liner development and Concise after liner transplant in order to meet the goal of compact liners and finished plants without negative effects on flowering.

## Materials & methods

As part of a 20-cultivar evaluation, Echinacea Julia tissue culture plantlets were transplanted into a peat and pine bark substrate and acclimated to greenhouse conditions under a 16-hour photoperiod. To enhance branching, a 300 ppm Concise (benzyladenine) spray was applied to all liners at 40 and 57 days after transplant. Plants were divided into two groups, one control group not treated with growth retardants and one group that received two foliar applications of 2,500 ppm Dazide at six and eight weeks after transplant. Liner growth was assessed at 10 weeks after transplant after which liners were planted into quart containers.

Four weeks after planting, foliar applications of 15 ppm Concise were applied to plants in the growth retardant treatment. The study ended when plants were in flower at nine weeks after planting (19 weeks after initial tissue culture transplant).

## Liner results

Liners were ready for planting to quart containers at 10 weeks after transplant of tissue culture plantlets. At this time, liners



Echinacea Julia liners at 10 weeks after transplant of tissue culture plantlets, untreated on the left or treated twice with 2,500 ppm Dazide on the right.


treated with Dazide were significantly shorter than those without (3.3 in. for Dazide vs. 4.2 in. for untreated plants). Plant width, number of branches and rooting weren't affected by Dazide applications.

## Finished plant results

Finished plants treated with growth retardants were shorter than those without (17.6 in. compared to 22.2 in. for untreated plants). Plant width, days to flower and number of flower stalks weren't affected by growth retardant applications. Although the number of branches was greater in plants without height control treatment (13 branches compared to 10 branches in those treated with growth retardants), all plants were well branched and fully filled the containers.

## Conclusions

Echinacea Julia plants were significantly more compact following growth retardant applications, both as liners and as finished plants. Rooting and flowering weren't affected by PGR treatment.

We followed this PGR protocol on other echinacea hybrid cultivars as well, most with good success. The key to obtaining good height control with PGRs in echinacea is proper timing of the applications. In the liner stage, we applied growth retardants when liners were well rooted and stems were just beginning to elongate. After planting to quart pots, we applied Concise as a foliar spray after flower stalks developed, but prior to their elongation. Although Julia only required one application of Concise, some cultivars required additional applications as flower stems elongated. 



Echinacea Julia finished plants at 9 weeks after planting liners, untreated on the left or treated with Dazide and Concise on the right.

# Enhancing Growth of Sempervivum with Configure

By Brian E. Whipker, North Carolina State University

The popularity of sempervivums (Hens & Chicks) is at an all-time high. At North Carolina State University, we've conducted a number of trials with the goal of improving pot fill.

Configure has the active ingredient benzyladenine. Our research at North Carolina State University focused on determining Configure rates for increasing the number of "chicks" produced by the plant.

The optimal response range for Configure foliar sprays on sempervivum is between 100 and 400 ppm, but it varies by cultivar. For example, with Sempervivum Rubicon Improved, the use of Configure foliar sprays increased the number of offsets (chicks). The sempervivum went from having just 1.0 chick on the untreated control plants to 12.4 when 400 ppm was applied—a 1,240% increase (Figures 1 and 2).

To increase the number of offsets, it's recommended to start trial rates in the 200 to 400 ppm range. By starting with a few plants at this rate it will allow you to find what rate gives you the optimal response as growing conditions and plants can vary. Sempervivum plants didn't respond to rates higher than 400 ppm.

Figure 1. Configure foliar sprays enhance the offset production of sempervivum.

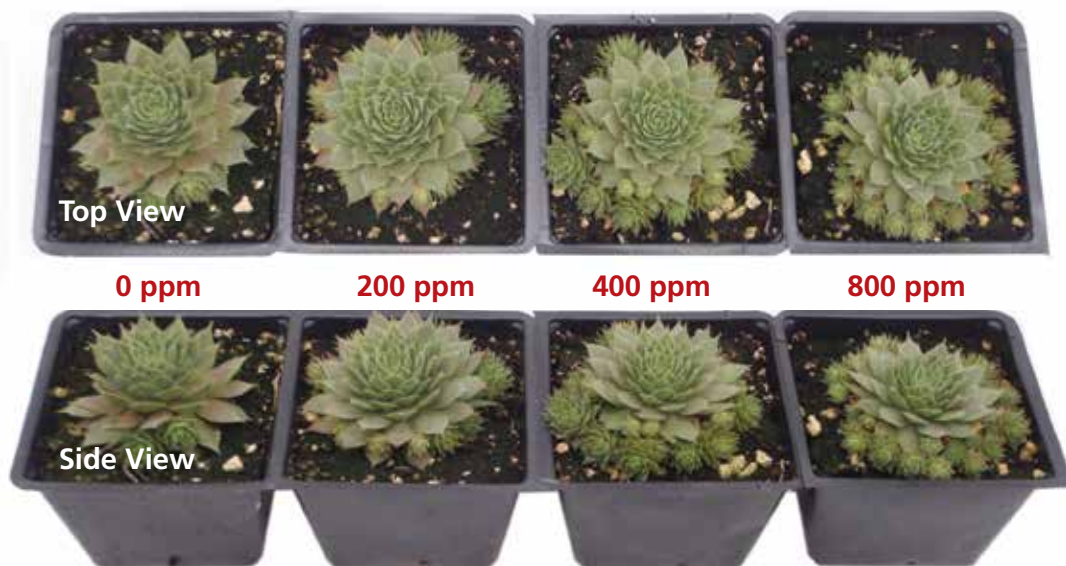


Figure 2. Configure foliar sprays at 400 ppm enhance the production of offsets of Sempervivum.

For sempervivum, here are a few tips to keep in mind to help you succeed:

- The plant has to be physiologically ready to begin offset development. For most plants, shoot development doesn't occur until the root system is established. So after transplanting the

cuttings, apply Configure when the cuttings are well rooted. This will usually be two to four weeks after transplanting.

- Keep in mind, too, that benzyladenine isn't easily translocated within the plant via the phloem, so complete spray coverage is required, especially for pots containing multiple cuttings.

- Benzyladenine doesn't have a long residual activity on the plant leaf surface, with most of the impact occurring within five days of application. Therefore, multiple applications spaced two weeks apart may also improve results.

Configure foliar sprays will help to improve pot fill and offset production of sempervivum plants. Consider establishing a trial in your operation to determine the optimal recipes to follow for your greenhouse. 6

# Fresco Use Tips

By Brian Whipker, North Carolina State University

When one thinks of plant growth regulators (PGRs), the primary focus is on growth control mainly through regulating internode stretch. There are times when additional growth is needed; that's where a growth enhancement PGR, such as Fresco, should be considered.

Fresco is a combination of 1.8% gibberellins A<sub>4</sub>+A<sub>7</sub> [GA<sub>4+7</sub>] and 1.8% benzyladenine [6-BA]. This combination provides stimulation of intermodal elongation with the GA<sub>4+7</sub> and enhancement of axillary shoot growth with the BA. When mixed together, the combination provides a controlled stimulation of enhanced plant growth.

The other labeled option for enhancing plant growth is Florigib 4L. It contains gibberellin A<sub>3</sub> and only the lowest label rates should be trialed and used to avoid excessive stretch. By far, the majority of growers prefer to use Fresco because it enhances elongation and fullness of the plant, while providing a wider window of safety for avoiding overdose applications.

In addition, Fresco can be used to enhance bract development on poinsettias and aid in avoiding lower leaf yellowing on lilies.

With Fresco being an excellent tool in providing growth enhancement and improving postharvest quality, it's a handy addition to have in your PGR toolbox. In order to obtain the most effect from Fresco, below are some application tips to consider.

## Application tips

**Preventing lower leaf yellowing of lilies**—Fresco can be used to avoid lower leaf yellowing and necrosis when applied to lower leaves. It also delays flower senescence when applied to flower buds. Fresco can be used on Easter (*Lilium longiflorum*), LA Hybrid (*L. longiflorum*-*Asiatic* crosses) and oriental lilies, but use rates vary (see Fresco label for rates, timing and precautions before use). Fresco is used as a preventative application and doesn't correct leaf yellowing and flower senescence that's already occurred.

**Bract enhancement of poinsettias**—Fresco foliar sprays can be applied to poinsettias seven to 14 days before anthesis to increase bract size. Fresco may also be used at 3 ppm to promote bract expansion on plants treated with late season foliar applications of anti-GA PGRs (see Fresco label for rates, timing and precautions before use). Bract coloring on some red varieties may appear less intense immediately following a Fresco treatment. However, over time, the bracts should develop a more intense coloration. Use of Fresco may also result in an increase in plant height. Test on a few plants to determine the results. Bracts of white cultivars have been reported to develop a "whiter" appearance, with the use of a late-season application.

**Growth enhancement**—Fresco can be applied as a foliar spray, substrate drench or through chemigation. Typical recommended spray rates are in the range of 1 to 5 ppm. One should begin with the lowest rate, make the application and then wait seven days to determine if the desired level of growth enhancement is achieved. Re-application can be made if additional growth is desired. The goal is to apply only enough Fresco to promote sufficient growth or overcome the PGR effect or lack of growth. Too high of a rate will result in excessive stem or peduncle stretch and a light yellowing of the newly developing leaves. Growers have found that the 1 to 5 ppm range works in most cases, but growers have reported that the response rate can vary significantly by cultivar. So it's best to start

with a small trial to determine optimal rates.

Fresco is the only GA<sub>4+7</sub> and 6-BA product registered for drench applications. Drench applications have become increasingly popular because there's more even distribution of Fresco within the plant and less negative effect on leaf and flower growth.

## Fresco for Overcoming PGR Overdose



Figure 1. Growth enhancement with the use of Fresco foliar sprays on New Guinea impatiens after the plants were stalled with an overdose paclo application





Figure 2. Lower leaf yellowing and necrosis on lilies. An application will help avoid this situation, especially under low light conditions.

### Growth enhancement use tips—Foliar sprays

1. Initially begin with the lower end of the recommended range. The initial rate range for a foliar spray should be between 1 to 3 ppm. Avoid applying >10 ppm or excessive stretch may occur.
2. Complete coverage is required because Fresco applied to the leaves isn't easily transported throughout the plant.
3. Allow up to seven days to determine if plant growth is increased before making a second application. When reapplying, many growers will use half of the initial rate if the plants fail to take off.
4. When using Fresco for the first time, test it on a few plants to determine the results before applying it to your entire crop.
5. Excessive rates will result in undesirable stretch, often requiring an application of an anti-gibberellin plant growth regulator, such as Piccolo 10XC, to check the elongation.
6. Spray applications may cause bleaching of red bracts to a dusty pink coloration.
7. Follow the label recommendations, for it's the law.

### Growth enhancement use tips—Drenches

1. Initially begin with the lower end of the recommended range. The initial rate range for a drench should be between 1 to 3 ppm. Avoid applying >10 ppm or excessive stretch can occur.
2. Apply Fresco drenches with a sufficient volume of water to allow complete coverage of the root system. Make applications to moist, but not wet, substrates. Drench applications provide the benefit of more even uptake by the plant if a

sufficient volume of water is used. The volume of drench applied increases with the pot size. For example, typically 3 fl. oz. of drench solution is added to a 5-in. pot, 4 fl. oz. to a 6-in. pot and 10 fl. oz. to an 8-in. pot.

3. When applied as a drench through sub-irrigation, reduce rates normally used for top-of-the-pot applications by 25% to 50%.
4. Allow up to seven days to determine if plant growth is increased before making a second application. When reapplying, many growers will use half of the initial rate if the plants fail to take off.
5. Excessive rates will result in undesirable stretch, often requiring an application of an anti-gibberellin plant growth regulator, such as Piccolo 10XC, to check the elongation.
6. When using Fresco for the first time, test it on a few plants to determine the results before applying it to your entire crop.
7. Drench applications have been reported to be more effective than spray applications on poinsettias. Spray applications may cause bleaching of red bracts to a dusty pink coloration. If in doubt, test Fresco on a few plants to determine the results before applying it to your entire crop.
8. Drench applications will only work if the plant has adequate roots for Fresco uptake.
9. Follow the label recommendations, for it's the law.

**Timing.** In order to reap the benefits of a Fresco application, application timing is critical. Most applications are targeted at a specific stage of development and number of days in which it's effective or requiring sufficient time to realize results. Those specific timings are outlined on the Fresco label for each use.

**Avoid applications to stressed plants.** Enhanced plant quality will occur if Fresco is used correctly. Avoid applying Fresco to plants that are temperature, water, nutrient or pest stressed. Fresco foliar sprays are best applied in the morning or late afternoon/evening, when leaf drying time will be slower, which allows greater uptake by the plant.

**Optimal concentrations.** Recommended use rates vary from 1 to 3 ppm foliar sprays for enhancing plant growth, 3 ppm for bract expansion, to 10 to 100 ppm, respectively, for avoiding early and late lower leaf yellowing with lilies. Refer to each species listed on the Fresco for specific details. For foliar spray applications, apply 1 gal. of spray solution uniformly over 200 sq. ft. of bench area. Avoid applying more than 15 ml of spray solution per plant.

**Phytotoxicity.** Overdoses of Fresco can result in excessive stretch. Therefore, utilize the lower recommended rate range and test on a few plants to determine the suitability of the rate.

**Protective equipment and REI.** Applicators must wear a long-sleeved shirt and long pants, wear chemical-resistant gloves, protective eyewear, socks and shoes, and chemical-resistant apron when mixing, loading or cleaning equipment. The restricted entry interval (REI) is 4 hours. Ⓢ

# Collate Use Tips

By Brian E. Whipker, North Carolina State University

In greenhouse floriculture production, Florel has been the go-to ethephon formulation for years. It's available as a 3.9% active ingredient solution. Fine Americas introduced Collate in 2013, which is a higher-concentration (21.7%) product. Greenhouse label uses for Collate include inducing flowering of ornamental bromeliads; avoidance of stem topple of potted hyacinths; height control of potted daffodils; and flower inhibition, increase in axillary shoot development and height control in a variety of ornamental crops. In order to get the most out of your Collate applications, below are some use tips to consider.

**Application parameters.** Collate breaks down and becomes inactive with water pH conditions greater than 6.1. While all of the registered ethephon products contain acidifiers, in areas with high levels of alkalinity, the alkalinity will need to be neutralized BEFORE mixing the solution. The ideal endpoint pH for a Collate solution is ~4.5 to 5.0. Be careful to avoid getting the solution pH too low, though—leaf phytotoxicity can occur with ethephon applications when the pH is below 3.

**Temperatures.** In addition, Collate activity is linked to active plant growth.

Applications made when temperatures are below 60F (15.5C) or higher than 80F (27C) will be less effective. Therefore, during times when temperatures are excessive, make applications either early in the morning or late at night.

**Timing.** When used to promote axillary branching, the plants should be well-rooted in the container. Typically, rooting to the side of the pot will occur within two weeks. Applications made before plugs or plants are well-rooted can result in retarded root development and stunted growth.

When used for prevention of early flowering, it should be noted that the last Collate foliar spray application should be made six to eight weeks prior to the intended sales date. Late spray applications will result in flower delay.

Suitable application windows should also be noted with stock plants. Ethylene can inhibit rooting, so applications shouldn't be made within seven days of harvesting cuttings.

**Avoid applications to stressed plants.** When used correctly, Collate applications will result in enhanced plant growth. Because ethylene produced by Collate is a stress enhancer, it's important to have the plants actively growing and not under suboptimal conditions (heat, drought, environmental or disease stress). Lower leaf yellowing typically occurs when Collate is applied to drought-stressed plants.

**Optimal concentrations.** For most plants, Collate spray rates are typically at 500 ppm. Complete spray coverage is required because Collate isn't translo-

cated within the plant. This is especially important for plants such as garden mums. Incomplete spray applications will result in uneven growth and flowering. Research has shown that drench and pre-plant liner soak application rates are lower—in the range of 50 to 250 ppm. At this time, none of the registered ethephon products, including Collate, are labeled for drench applications.

**Phytotoxicity.** Some cultivars have a greater sensitivity to Collate. Cupping and distortion of the young expanding leaves can occur. In addition, over-application can also result in distortion and leaf bleaching.

**Protective equipment and REI.** Collate is acidic, and because of this, it's a minor eye and skin irritant. That's the reason it has a longer REI of 48 hours. In addition, it should be noted that eye protection is required, along with protective gloves, coveralls, apron, shoes and headgear for overhead applications. A box of baking soda should be handy to neutralize the acidity of Collate in case it comes in contact with your skin.

In summary, Collate is effective in controlling excessive growth of many greenhouse plants. Collate is an excellent and cost-effective option for improving plant structure, preventing early flowering and controlling excessive plant growth. It's easy to see why Collate has become an essential component of the floriculture PGR toolbox. 🍷

## Effect of a Collate foliar spray on Coleus Oxford Street



# Dilution Table

## Formulated product per gallon of solution

PPM AI	Abide/ A-Rest (milliliters)	Dazide/ B-Nine (grams)	Citadel/ Cycocel (milliliters)	Collate (milliliters)	Concise/ Sumagic (milliliters)	Piccolo/ Bonzi/Pac O (milliliters)	Piccolo 10 XC (milliliters)	Topflor (milliliters)	Configure (milliliters)	Fresco/ Fascination (milliliters)	Advocate (milliliters)
0.5	7				4	0.5	0.05	0.48			
1	14				8	1	0.1	0.96		0.23	
5	72				38	5	0.5	4.8		1.14	
10	143				76	10	1	9.6		2.27	
25	359				189	25	2.5	23.9		5.68	
30	430				227	30	3	28.7		6.81	
40	573				303	40	4	38.2		9.08	
50	717			0.8	379	50	5	47.8	9	11.35	0.86
100	1433			1.6	758	100	10	95.5	18	22.7	1.73
150				2.3		150	15	143.3	27		2.59
200			6.5	3.1		200	20	191	36		3.46
300			9.7	4.7					54		5.18
400			13	6.2					72		6.91
500			16	7.8					90		8.64
600			19	9.4					108		10.4
800			26	12.5					144		13.8
900			29	14.1					162		15.5
1,000		4.5	32	15.6					180		17.3
1,250		5.6	40	19.5							21.6
1,500		6.8	48	23.5							25.9
2,000		9	64	31.2							34.6
2,500		11.1	80	39.3							43.2
5,000		22.3		79.4							

A syringe is a convenient method for measuring out small volumes of chemical. They can be purchased at most drug stores. Note that on a syringe 1 cc equals 1 ml.

When mixing PGRs, great care needs to be given to accurately measure and apply the chemical. As always, the label contains the legal mixing information.

Foliar sprays require a uniform application to obtain consistent results. For foliar sprays, measure out a known amount of chemical, add it to a known volume of water and apply the spray to a known bench area. Most sprays are applied at 1 gal. per 200 sq. ft. of bench area.

Sprencles are a way of supplying a greater dose of chemical as a foliar spray. Most sprencles are applied at 1.5 gal. per 200 sq. ft. of bench area. This extra volume of water provides control by uptake by the leaves, stems and roots.

Drench applications vary by pot size and desired dose, so refer to the product label for exact mixing instruction. For drench applications, measure out a known amount of chemical, add it to

a known volume of water and apply a known volume of the drench solution to each pot. The volume of drench applied increases with the pot size (specifics are listed on each product label). For example, typically 3 fl. oz. of drench solution is added to a 5-in. pot, 4 fl. oz. to a 6-in. pot and 10 fl. oz. to an 8-in. pot.



# PGRs from fine

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