

MAGAZINE • SINCE 1937

# GROWERTALKS



PLANT GROWTH  
REGULATORS  
FOR ANNUALS

2015

By Brian E. Whipker, North Carolina State University



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# Branching Out with Collate

By Brian E. Whipker, North Carolina State University

**Collate (ethephon) is a cost-effective option for improving plant structure, preventing early flowering and controlling excessive plant growth.**

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 concentrated (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, flower inhibition, increase in

axillary shoot development and height control. Dr. Peter Konjonian conducted extensive research trials in the 1990s, which lead to many of the current greenhouse uses of ethephon.

Currently, Collate is only labeled for application as a foliar spray, but recent work has found that ethephon has a significant amount of substrate activity. A supplemental label for Collate allowing substrate drenches has been applied for and is pending approval. Below are the results of some studies determining the efficacy of Collate drenches.

## Collate on vegetative annuals

**Materials and Methods** | Recent work at North Carolina State University tested Collate drenches on Petunia Vista Bubblegum and Double Peppermint grown from 84-count plugs transplanted into 5-in. pots. Collate drenches were

applied at 125, 250 or 500 ppm at 3 fl. oz. per pot three weeks after potting. Plants were assessed for growth and branching two weeks after treatment and again at flowering.

At two weeks after treatment, greater petunia plant diameter control occurred as Collate rate increased. Shoot number at two weeks after treatment increased slightly with Vista Bubblegum with 125 or 250 ppm drenches (Figure 1), but the increase in shoot number wasn't significant with Double Peppermint. For final assessments of both cultivars, the high rate of Collate (the 500 ppm drench) caused excessive growth reductions and two-week delays in flowering and a target rate of 125 to 250 ppm should be tested by growers.

In a separate trial, Americana Dark Red cutting geraniums grown from 84-count plugs were transplanted into 6-in. pots >>>



Figure 1. Petunia Vista Bubblegum (left to right): Untreated or treated with Collate drenches at 0, 125, 250 or 500 ppm (3 fl. oz. per 5-in. pot). A) Plants at 2 weeks after treatment; B) Plants at time of flowering (6 weeks after treatment).

in February and treated with Collate drenches at 0, 125, 250 or 500 ppm (4 fl. oz. per 6-in. pot) three weeks after potting. At time of bloom, greater plant height and diameter control occurred as the Collate rate increased (Figure 2). Shoot number increased with Collate use. Shoot number increased with increasing rate with 6.8 shoots per untreated plant, 8.2 shoots

with 125 ppm treated plants and was maximized at 250 ppm with 10.2 shoots per plant. There was no further effect with the 500 ppm drench. Flowering was delayed only three days with the 250 ppm Collate drench.

In summary, Collate substrate drenches were effective in controlling excessive growth of both petunias and geraniums.

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. **GT**



Figure 2. Americana Dark Red Geranium (left to right): Untreated or treated with Collate drenches at 0, 125, 250 or 500 ppm (4 fl. oz. per 6-in. pot).

## Collate Additional Product Information

**Protective equipment and REI.** | Collate is a minor eye and skin irritant. Thus, because of this, 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.

**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 spray solution. The idea endpoint pH for a Collate solution is ~4.5 to 5.0.

**Temperatures.** | In addition, Collate activity is linked to active plant growth. Applications made when temperatures are below 60F (15.5C) or higher than 95F (35C) will be less effective.

**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. For prevention of early flowering, it should be noted that the last application should be made 6 to 8 weeks prior to the intended sales date. Late 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 7 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 water-stressed plants.

**Optimal concentrations.** | For most plants, spray rates are typically at 500 ppm. Complete spray coverage is required because Collate isn't translocated in 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 less, in the range of 125 to 250 ppm.

**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.



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## **collate**<sup>®</sup>

\*Same active ingredient as Florel<sup>®</sup>

Collate<sup>®</sup> promotes increased lateral branching, reduces plant height and delays flowering in a wide range of ornamental crops. In addition, it has been proven effective in controlling stem topple in daffodils and hyacinth.

## **concise**<sup>®</sup>

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## **dazide**<sup>®</sup>

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Fresco<sup>®</sup> is a proven plant growth regulator for the reduction of lower leaf yellowing in lilies. By making plants more presentable, Fresco helps growers produce even greater number of top-quality plants.

## **piccolo**<sup>®</sup>

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# Wide Assortment of Available PGRs

By Brian E. Whipker, North Carolina University & Joyce G. Latimer, Virginia Tech

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). Below

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 are not 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.

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

Chemical	Products
Ancymidol	Abide, A-Rest
Chlormequat chloride	Citadel, Cycocel
Daminozide	Dazide, B-Nine
Dikegulac sodium	Augeo
Ethephon	Collate, Florel
Fluprimidol	Topflor
Paclobutrazol	Piccolo, Piccolo 10 XC, Bonzi, Paczol, Downsize (drenches only)
Uniconazole	Concise, Sumagic
Benzyladenine (BA)	Configure
Gibberellin (GA <sub>3</sub> )	Florgib, ProGibb T&O
BA+GA <sub>4</sub> +7	Fresco, Fascination

## 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.

## Dikegulac sodium

(Commercial name: Augeo)

Augeo is registered for greenhouse and nursery use. Augeo temporarily stops shoot elongation, thereby promoting lateral branching. It's thus a pinching agent for ornamental crops including azaleas, bougainvillea, clerodendron, fuchsia, grape ivy, geranium, lantana, lipstick vine, verbena and some of the herbaceous perennials. Some phytotoxicity and distorted growth can occur with Augeo, so sufficient time is required to allow new plant growth to cover any damaged leaves. >>>

**Table 2. Comparing Attributes of Plant Growth Regulators**

ATTRIBUTES	PLANT GROWTH REGULATOR							
	Chemical	Ancymidol	Chlormequat chloride	Daminozide	Daminozide+ Chlormequat chloride	Ethephon	Flurprimidol	Paclobutrazol
Trade name(s)	Abide, A-Rest	Citadel, Cycocel	Dazide, B-Nine	—	Collate, Florel	Topflor	Piccolo, Piccolo 10 XC, Bonzi, Downsize, Paczol	Concise, Sumagic
Active ingredient (%)	0.0264%	11.8%	85%	—	21.7%/3.9%	0.38%	0.4% 4% (Piccolo 10 XC)	0.055%
Activity level	++	+	+	++	+	+++	+++	+++
Multiple applications needed	++	+++	+++	++	++	+	+	+
Application type <sup>1</sup>								
Foliar spray	yes	yes	yes	yes	yes	yes	yes <sup>1</sup>	yes
Substrate drench	yes	yes	no	no	no	yes	yes	yes
Dips	plugs/liners	plugs/liners	cuttings	-	plugs/liners	bulbs, plugs/liners	bulbs, plugs/liners	bulbs, plugs/liners
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
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
Drench (mg active ingredient per pot)	0.15-4.0 (1.25 to 33.8 ppm)	177-355 (1,500 to 3,000 ppm)	—	—	6-30 (50 to 250 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

-- = Not applicable.

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

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

<sup>2</sup> Not yet available

## Ethephon phosphonic acid (Commercial names: Collate and Florel)

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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. Drenches are also effective. See page 3 for the latest research on using drenches.

## Flurprimidol (Commercial name: Topflor)

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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.

## Paclobutrazol (Commercial names: Piccolo, Piccolo 10 XC, Bonzi, Downsize [labeled for drench applications only] and Paczol)

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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)

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Uniconazole is applied as a foliar spray or as a substrate drench. 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.

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.

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

## Benzyladenine (Commercial name: Configure)

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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 does not readily move within the plant, therefore complete coverage is required.

## Gibberellins (Commercial names: Florgib and ProGibb T&O)

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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.

## Benzyladenine + Gibberellin Combinations (Commercial names: Fresco and Fascination)

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







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# Additional Benefits of PGRs

By 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).

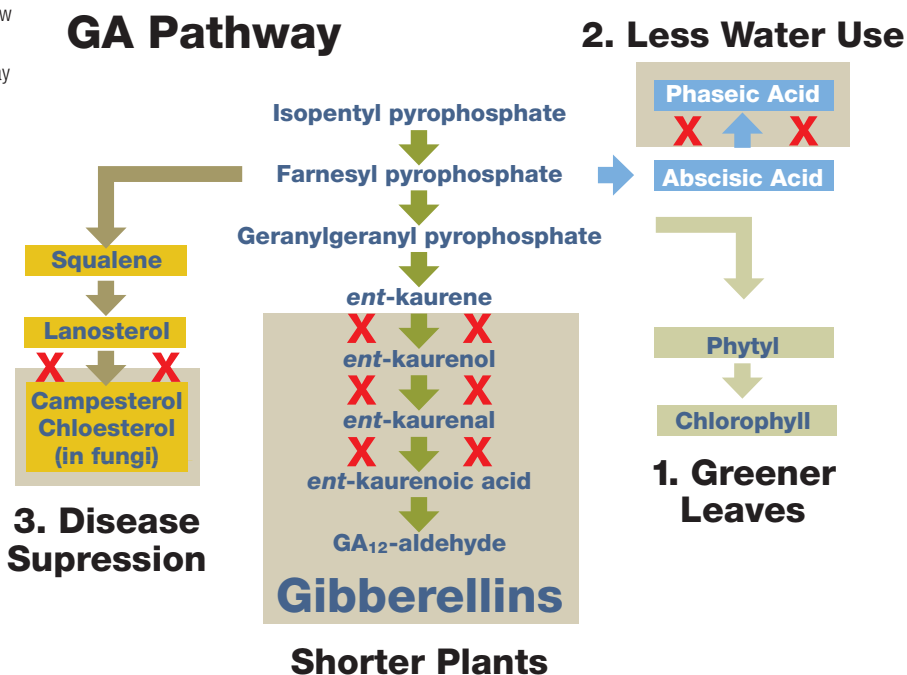
This illustration will explain how the GA pathway is blocked and how additional chlorophyll is produced. The GA pathway is a series of biochemical reactions in the leaf, which results in the production

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.

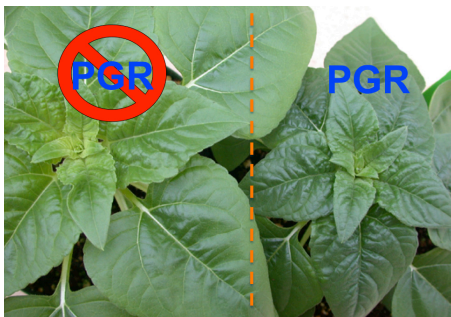


Figure 2. The plant on the left did not have a PGR application, while the plant on the right did. The use of anti-GA PGRs resulted in darker green plants.

## Paclobutazol Effect on Total Water Use by Zinnia

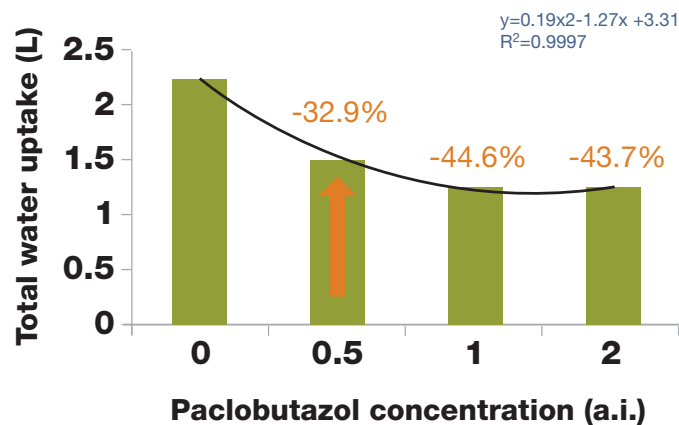


Figure 3. Data from a recent study at North Carolina State University in which the use of 1 mg a.i. paclobutrazol drenches resulted in zinnia plants requiring 33% less water over the production season as compared with the untreated control.

Data source: Ahmad, Whipker and Dole, NCSU

## 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.

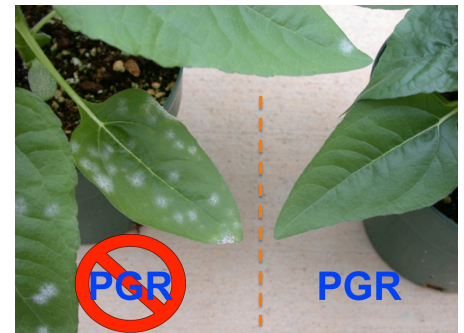


Figure 4. Based on a height control experiment, one can clearly see powdery mildew starting to infect the untreated plant on the left, while the plant on the right had been given a PGR drench about 4 weeks prior to this date and a powdery mildew infection had been reduced. PGRs will not provide season-long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

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. **GT**

# Growth Regulators for Floricultural Crops in Greenhouses

By Brian E. Whipker, Department of Horticultural Science, North Carolina State University

This table lists labeled rates of plant growth regulators (PGRs) for greenhouse crops, as well as recommendations based on research at North Carolina State University and recommendations by suppliers. Read the label for a complete listing of precautions. The degree of control can vary depending on a number of factors, including plant type, cultivar, stage of development, fertilization program, growing temperatures and crop spacing. When using a PGR for the first time, it's good to test the rate on a few plants prior to treating the entire crop. Keep accurate records and adjust rates for your location. Also keep in mind as a general rule,

sunbelt growers should consider the upper half of the rate range, while northern growers—especially under lower light conditions—should begin trials at the lower end of the rate range. Additional information about plant growth regulators is available at [www.pgrinfo.com](http://www.pgrinfo.com).

General recommendations: Plug culture and flat culture have different recommended rates. The rates in this table include recommendations for both plug (lower rates) and flat culture (higher rates). Apply ALL foliar sprays of plant growth regulators using 0.5 gal. per 100 sq. ft. of bench area.

## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
ABUTILON	To control plant growth	Citadel/Cycocel	750 to 1,500 ppm spray	
		Dazide/B-Nine	2,500 ppm spray	Rate for use on plugs.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	5 ppm spray	Can be applied once plant fills the pot, 2 to 3 weeks after transplanting.
	To increase branching	Florel/Collate	250 to 500 ppm spray	Applied 2 weeks after transplanting. Follow with a pinch if needed.
ACHILLEA	To control plant growth	Dazide/B-Nine	2,500 ppm spray	One or 2 sprays may be needed to keep plants more compact.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol/Downsize	0.5 to 1 ppm drench	Apply to moderately moist substrate.
ACHMELLA OLERAEA	To control plant growth	Piccolo/Piccolo 10 XC/ Bonzi/Paczol	15 ppm spray	Apply 2 weeks after transplant. Repeat a week later or a week after pinch if needed.
AGASTACHE	To control plant growth	Citadel+Dazide/Cycocel+B-Nine	3,000 ppm + 1,500 ppm spray	Rates for compact genetics needing slight growth control.
AGERATUM	To control plant growth	Abide/A-Rest	7 to 26 ppm spray	
		Dazide/B-Nine	2,500 to 5,000 ppm spray	One or 2 sprays may be needed to keep plants more compact.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	15 to 45 ppm spray	High rates of Piccolo 10 XC may delay flowering. Late applications and overdosing may cause slow growth on transplantation. This can be avoided by using multiple applications of 25% to 50% of the specified rate and monitoring plant growth.
		Citadel/Chlormequat E-Pro/ Cyclocel	800 to 1,500 ppm spray	
		Concise/Sumagic	2 to 30 ppm spray	Cultivar response rates vary. Use lower rates to hold plants.
		Topflor	20 to 60 ppm spray	Based on NC State University trials. Adjust rates for other locations.
AGERATUM,Plugs	To control plant growth	Piccolo/Piccolo 10 XC/ Bonzi/Paczol	5 to 10 ppm spray	Timing of application should normally begin at the 1 to 2 true leaf stage.

**Disclaimer:** The information and listed table rates of plant growth regulators are current as of January 2015. They are based on label rates, research-based articles from North Carolina State University, other university researchers and recommendations by suppliers. These recommendations may not be appropriate for all conditions and locations and may not comply with laws and regulations in every state. Individuals who use agricultural chemicals are responsible for ensuring that the intended use complies with current regulations and conforms to the product label. Be sure to obtain current information about usage regulations and examine a current product label before purchasing or applying any chemical. The use of brand trade names and any mention or listing of commercial products or services in this publication does not imply endorsement by Ball Publishing, the author, or North Carolina State University, nor discrimination against similar products or services not mentioned.

## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
ALCEA ROSEA	To control plant growth	Piccolo/Piccolo 10 XC/ Bonzi/Paczol	30 to 50 ppm spray	
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol/ Downsize	0.12 to 0.24 mg a.i. (1 to 2 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	
ALTERNANTHERA (Joseph's coat)	To control plant growth	Abide/A-Rest	25 to 132 ppm spray	
			0.25 to 0.5 mg a.i. (2 to 4 ppm) for a 6-in. pot (1 to 2 fl. oz./gal. of drench solution: apply 4 fl. oz./6-in. pot)	Drench volumes and mg a.i. vary with pot size.
		Citadel/Chlormequat E-Pro/ Cycocel	Spray	Apply only if needed. Not recommended on some cultivars due to potential phytotoxicity.
		Dazide/B-Nine	5,000 ppm spray	
		Florel/Collate	500 ppm spray	To keep plants more compact. Based on Texas A&M University trials.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol/Downsize	30 to 45 ppm spray 4 ppm drench	Rate for <i>Alternanthera dentata</i> . To keep plants more compact. Apply to moderately moist substrate
ALYSSUM	To control plant growth	Piccolo/Piccolo 10 XC/ Bonzi/Paczol	40 to 60 ppm spray	
		Concise/Sumagic	5 to 25 ppm spray	
		Dazide/B-Nine	2,500 ppm spray	
ALYSSUM, Plugs	To control plant growth	Piccolo/Piccolo 10 XC/ Bonzi/Paczol	10 to 20 ppm spray (0.32 to 0.64 fl. oz./gal.)	Timing of application should normally begin at the 1 to 2 true leaf stage.
AMARYLLIS	To control plant growth	Piccolo/Piccolo 10 XC/ Bonzi/Paczol	23.66 mg a.i. (200 ppm) drench for a 6-in. pot (6.4 fl. oz./gal. of drench solution; apply 4 fl. oz./6-in. pot)	Drench volumes and mg a.i. vary with pot size.
			100 ppm bulb soak	
ANAGALLIS	To control plant growth	Piccolo/Piccolo 10 XC/ Bonzi/Paczol/Downsize	0.5 ppm drench	To keep plants more compact. Apply to moderately moist substrate.
ANEMONE	To control plant growth	Piccolo/Piccolo 10 XC/ Bonzi/Paczol/Downsize	2 ppm drench	Rates for Mona Lisa series. Apply about 6 weeks after transplant when the foliage has covered the pot and the first visible flower bud is showing. Rates up to 4 ppm can be used after conducting your own trial. Apply one week earlier during warm weather if needed.
ANGELONIA	To control plant growth	Citadel + Dazide/Cycocel + B-Nine	1,500 to 3,000 ppm Dazide/B-Nine + 750 to 1,000 ppm Citadel/Cycocel applied as a tank-mix spray	At planting, soft pinch to promote lateral shoot development.
		Citadel/Cycocel	1,500 ppm spray	
		Concise/Sumagic	10 to 20 ppm spray	Based on NC State University trials.
		Dazide/B-Nine	3,000 ppm spray	
		Florel/Collate	Spray	Not recommended.
		Topflor	45 to 60 ppm spray	Based on NC State University trials.
AQUILEGIA	To control plant growth	Dazide/B-Nine	3,000 to 5,000 ppm spray	

## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
ARGYRANTHEMUM	To control plant growth	Citadel/Cycocel	750 to 1,500 ppm spray	
		Citadel+Dazide/Cycocel+B-Nine	750 to 1,000 ppm + 1,000 to 2000 ppm spray	Rates for compact genetics needing slight growth control.
		Concise/Sumagic	3 to 40 ppm spray	Based on NC State University trials conducted during late spring. Trial rates of 3 to 5 ppm for compact genetics.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	5 to 10 ppm spray	Rates for compact genetics needing slight growth control.
			1 to 5 ppm drench	Rates for compact genetics needing slight growth control.
		Dazide/B-Nine	1,500 to 2,500 ppm spray	
	Topflor	50 to 75 ppm spray	Based on NC State University trials conducted during late spring. Slight phytotoxicity occurred with rates greater than 40 ppm, but damage was quickly hidden by new leaf growth.	
To induce basal branching	Collate/Flore!l	500 ppm spray	Apply one week after establishment.	
ASCLEPIAS	To control plant growth	Piccolo/Piccolo 10 XC/ Bonzi/Paczol	30 to 60 ppm spray	
ASTERNOVI-BELGII (Perennial)	To control plant growth	Concise/Sumagic	80 to 160 ppm spray	
		Dazide/B-Nine	1,500 to 5,000 ppm spray	
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	160 ppm spray	Use lower rates of 5 to 10 ppm later in the season.
12 to 16 ppm drench				
ASTER, Bedding Plant (Callistephus chinensis)	To control plant growth	Abide/A-Rest	7 to 26 ppm spray	
		Dazide/B-Nine	2,500 to 5,000 ppm spray	
ASTER, Cut (Callistephus chinensis)	To promote stem elongation and break dormancy	Florgib/ProGibb T&O	50 to 100 ppm spray	Make one to three applications during the early vegetative period at 2- to 3-week intervals. Apply when plants are 2 to 6 in. tall.
ASTERISCUS MARITIMUS (Compact Gold Coin)	To control plant growth	Dazide/B-Nine	750 to 1,500 ppm spray	
		Citadel/Cycocel	800 to 1,500 ppm spray	
		None	None	Plants grown with good light and optimal growing conditions generally do not need PGRs.
ASTILBE	To control plant growth	Concise/Sumagic	25 ppm drench	Apply just prior to flower stem elongation.
		Dazide/B-Nine	5,000 ppm spray	1 or 2 sprays can be used to keep plants more compact. Begin once flower stalks show color. 1 to 2 week delay in flowering possible.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	30 ppm drench	Apply just prior to flower stem elongation.
AZALEA	To control plant growth	Abide/A-Rest	26 ppm spray	
		Concise	5 to 15 ppm spray	Apply as a uniform spray at a volume of 1.5 qt. per 100 sq. ft. of bench area approximately 4 to 6 weeks after the final pinch. Shorter-growing cultivars (Gloria, Solitaire): use 10 ppm. If a second application is required 2 to 3 weeks later, use 5 to 10 ppm. Taller-growing cultivars (Prize): use 10 ppm. If a second application is required 2 to 3 weeks later, use 10 to 15 ppm.
	To promote flower initiation	Dazide/B-Nine	1,500 to 2,500 ppm spray	Apply solution when new growth from final pinch is 1 to 2 in. long.
		Citadel/Chlormequat E-Pro/ Cycocel	1,000 to 4,000 ppm spray	Optimum rates are generally between 1,000 and 2,000 ppm. Two to six multiple sprays may be needed. Make first application when new growth is approximately 2 in. long.

## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
AZALEA <i>continued</i>	To prevent flower bud initiation during vegetative growth	GibGro	130 to 850 ppm spray	Apply two to three sprays at 2- to 3-week intervals.
		<b>Florgib/ProGibb T&amp;O</b>	100 to 750 ppm spray	Apply a first application beginning 2 to 3 weeks after pinching. Weekly applications can continue for 1 to 2 additional weeks, for a maximum of three total applications.
	For partial or full substitution of cold treatment	GibGro	265 to 1,055 ppm spray	Spray timing, concentration and number of applications vary with cultivar, as well as intended degree of cold substitution. Consult label for exact recommendations. Not labeled for California.
		<b>Florgib/ProGibb T&amp;O</b>	250 to 500 ppm spray	Spray timing, concentration and number of applications vary with cultivar, as well as intended degree of cold substitution. Consult label for exact recommendations.
	To promote lateral shoot growth on vegetative plants	Off-Shoot-0	Use a 3 to 5% solution in greenhouses; use a 5 to 7% solution outdoors. Apply as a foliar spray.	Efficacy is related to relative humidity and temperature. Spray a few plants to check activity prior to treating the entire crop; effect should be visible in about 1 hr. Be certain chemical covers shoot tip. Ineffective if microscopic flower buds are present.
	To increase lateral branching	Augeo	3,125 to 6,250 ppm spray	
		<b>Florel/Collate</b>	2,500 to 5,000 ppm spray	
	To control plant growth, reduce bypass shoot elongation and promote flower bud initiation	<b>Piccolo/Piccolo 10 XC/Bonzi/Paczol</b>	100 to 200 ppm spray	To control plant growth and promote flower bud initiation, apply after final shaping when new growth is 1.5 to 2 in. long. To reduce bypass shoot development, apply after bud set when bypass shoots are barely visible, or about 5 to 7 weeks prior to cooling.
		<b>Piccolo/Piccolo 10 XC/Bonzi/Paczol/ Downsize</b>	0.59 to 1.77 mg a.i. (5 to 15 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot)	Drench volumes mg a.i. vary with pot size.
	To control plant growth	<b>Concise/Sumagic</b>	10 to 15 ppm spray	Apply at 1.5 qt per 100 sq. ft. of bench area.
BACOPA(SUTERA)	To control plant growth	<b>Dazide/B-Nine</b>	750 to 1,500 ppm spray	At planting, soft pinch to promote lateral shoot development. Initially try with lower rate.
		<b>Piccolo</b>	4 to 8 ppm liner root soak	Irrigation of the liners occurred within 24 hours prior to application, which results in a moderately dry substrate (the stage the plants would be watered but not wilted). Soak for a minimum of 30 to 60 seconds. Transplant after 3-hour waiting period. Rates based on Michigan State University trials.
		<b>Piccolo/Piccolo 10 XC/Bonzi/Paczol</b>	1 to 2 ppm drench	
		<b>Florel/Collate</b>	150 to 200 ppm spray	Early spray will increase branching and reduce early flowering.
	To increase lateral branching	<b>Florel/Collate</b>	150 to 200 ppm spray	
BEDDINGPLANTS (Not specifically listed in this table)	To control plant growth	<b>Abide/A-Rest</b>	6 to 66 ppm spray; use 15 ppm spray as a base rate and adjust as needed	
			0.06 to 0.12 mg a.i. drench for a 4-in. pot; apply 2 fl. oz./4-in. pot)	Drench volumes and mg a.i. vary with pot size.
		<b>Citadel + Dazide/Cycocel + B-Nine</b>	800 to 5,000 ppm + 1,000 to 1,500 ppm Cycocel applied as a tank-mix spray	Use the highest rate of Cycocel that doesn't cause excessive leaf yellowing, and then adjust the B-Nine/Dazide rate up and down within the labeled range to attain the desired level of height control.
		<b>Piccolo/Bonzi/Paczol</b>	5 to 90 ppm spray. Use 30 ppm spray as a base rate and adjust as needed.	Conduct trials on a small number of plants, adjusting the rates as needed for desired final plant height and duration of height control. Not recommended for use on fibrous begonia or vinca.

## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
BEDDINGPLANTS (Not specifically listed in this table) <i>continued</i>	To control plant growth	Piccolo/Bonzi/Paczol/ Downsize	0.118 mg a.i. drench for a 6-in. pot; apply 4 fl. oz./6-in. pot)	Drench applications are recommended only for bedding plants in 6-in. or larger containers. Not recommended for use on fibrous begonia or vinca.
		Citadel/Cycocel	800 to 1,500 ppm spray	Conduct trials on a small number of plants, adjusting the rates as needed for desired final plant height and duration of height control.
		Concise/Sumagic	1 to 50 ppm spray	Conduct trials on a small number of plants, adjusting the rates as needed for desired final plant height and duration of height control. Apply spray as elongation begins (plant height about 2 to 4 in.).
			0.1 to 2 ppm drench	
	Piccolo 10 XC	15 to 30 ppm spray	General starting point for conducting trials for plants not specifically on the label. Use lowest rate in the Northern Belt Region and the upper rate in the Sunbelt Region.	
		1 ppm drench	General starting point for conducting trials for plants not specifically on the label.	
	To promote plant growth and overcome over-application of gibberellin-inhibiting PGRs	Florgib/ProGibb T&O	1 to 25 ppm spray	Conduct trials on a small number of plants initially using 1 ppm unless previous experience warrants higher use rates. Following assessment of plant response, and if desired results were not evident, reapplication or an increase in rate may be warranted. Consult the label for additional precautions.
		Fascination	1 to 25 ppm spray	Conduct trials on a small number of plants initially using 1 ppm unless previous experience warrants higher use rates. Following assessment of plant response, and if desired results were not evident, reapplication or an increase in rate may be warranted. The most common rates for use are 3 to 5 ppm. SEE LABEL FOR ADDITIONAL PRECAUTIONS BEFORE USE.
	To induce lateral or basal branching	Configure	50 to 500 ppm spray	The supplemental label allows legal use on greenhouse-grown plants not specifically listed on the original label. See label for trialing suggestions and precautions.
	BEDDINGPLANT PLUGS (Not specifically listed in this table)	To control plant growth	Abide/A-Rest	3 to 35 ppm spray
Drench plug flats with a 0.5 to 1 ppm solution				For uniform application, use a subirrigation delivery system. Plug trays should not be excessively dry prior to the subirrigation treatment. Plants should develop one to two true leaves prior to first application.
Dazide/B-Nine		1,500 to 2,500 ppm spray	Conduct trials on a small number of plants, adjusting the rate as needed for desired final plant height and duration of height control. Can be used at the beginning of the true first leaf stage through the finishing stage.	
Citadel + Dazide/Cycocel + B-Nine		800 to 5,000 ppm Dazide/B-Nine + 1,000 to 1,500 ppm Citadel/Cycocel applied as a tank-mix spray	Use the highest rate of Citadel/Cycocel that doesn't cause excessive leaf yellowing and then adjust the B-Nine/Dazide rate up and down within the labeled range to attain desired level of height control.	
Piccolo/Piccolo 10 XC/ Bonzi/Paczol		1 to 20 ppm spray. Use 5 ppm spray as a base rate and adjust as needed.	Conduct trials on a small number of plants, adjusting the rate as needed for desired final plant height and duration of height control. Plants should develop one to two true leaves prior to first application.	
Cycocel		400 to 1,500 ppm spray	Conduct trials on a small number of plants, adjusting the rates as needed for desired final plant height and duration of height control.	
Concise/Sumagic		0.5 to 10 ppm spray	Conduct trials on a small number of plants, adjusting the rates as needed for desired final plant height and duration of height control. Plugs can be especially sensitive to Concise/Sumagic.	



## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
BEGONIA, Hiemalis (Elatior)	To control plant growth	Citadel/Cycocel	500 to 1,000 ppm spray	Applied 1 week after short days begin in summer or when short days begin in winter. Late applications can result in insufficient flower stalk elongation.
	To increase lateral branching	Augeo	781 to 1,562 ppm spray	
BEGONIA, Seed (Wax)	To control plant growth	Abide/A-Rest	3 to 15 ppm spray	Use lower half of rate range for plugs and upper range for finishing plants.
		Dazide/B-Nine	2,500 to 5,000 ppm spray	
		Flore/Collate	500 ppm spray	Apply to increase lateral branching, prevent flower initiation and development, and inhibit internode elongation.
		Concise/Sumagic	Sprays	Not registered for use. Can result in excessive control.
		Piccolo/Piccolo 10 XC/Bonzi/Paczol	Sprays	Not registered for use. Can result in excessive control.
		Topflor	Sprays	Not registered for use. Can result in excessive control.
		Citadel/Cycocel	500 ppm spray	
		Citadel + Dazide/Cycocel + B-Nine	1,000 to 1,250 ppm Dazide/B-Nine +800 to 1,250 ppm Citadel/Cycocel applied as a tank-mix spray	
BEGONIA, Tuberous	To control plant growth	Citadel/Cycocel	250 to 500 ppm spray	Rate can be used on Stage 4 plugs or beginning 2 weeks after transplanting.
		Citadel/Cycocel	1,000 ppm spray	Rate for actively growing plants.
		Dazide/B-Nine	2,500 ppm spray	Rate for actively growing plants.
BEGONIA, Vegetative	To control plant growth	Citadel/Cycocel	750 to 1,000 ppm spray	
BEGONIA, Vegetative (Dragon Wing)	To control plant growth	Piccolo/Piccolo 10 XC/Bonzi/Paczol	3 to 5 ppm spray	For 4-in. pots, apply a weekly 3 ppm spray starting 2 weeks after transplanting for 3 weeks. For 6-in. pots, use 5 ppm starting 2 weeks after transplant. A second and third application may be useful.
BELLIS	To control plant growth	Dazide/B-Nine	2,500 ppm spray	If needed.
		Concise/Sumagic	5 ppm spray	If needed.
BIDENS	To control plant growth	Dazide/B-Nine	1,500 to 2,500 ppm spray	At planting, soft pinch to promote lateral shoot development.
		Concise/Sumagic	1 to 5 ppm spray	Rates for genetics needing slight growth control.
			0.25 ppm drench	Rates for genetics needing slight growth control.
	To increase lateral branching	Flore/Collate	300 to 500 ppm spray	
BOUGAINVILLEA	To control plant growth	Abide/A-Rest	50 ppm drench	
		Piccolo/Piccolo 10 XC/Bonzi/Paczol	25 to 100 ppm drench	
	To increase lateral branching	Augeo	400 to 1,600 ppm spray	Cultivar response rates vary. Conduct your own trials to determine suitability and appropriate timing.
			1,600 ppm drench	Cultivar response rates vary. Conduct your own trials to determine suitability and appropriate timing.
BRACHYSCOME	To control plant growth	Flore/Collate	500 to 1,000 ppm spray	To keep plants more compact. Based on Texas A&M University trials.
		Dazide/B-Nine	2,500 to 5,000 ppm spray	

## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
BRACTEANTHA, BRACTEATA	To control plant growth	Dazide/B-Nine	2,500 ppm spray	
		Piccolo/Bonzi/Paczol	20 to 30 ppm spray	
			1 ppm drench	
	Concise/Sumagic	10 to 20 ppm spray		
	To increase lateral branching	Flore/Collate	300 to 500 ppm	
BROMELIAD	To promote flower initiation	Flore/Collate	2,471 ppm spray	Cultivar response rates vary. Conduct your own trials to determine suitability and appropriate timing.
BROWALLIA	To control plant growth	Dazide/B-Nine	2,500 to 5,000 ppm spray	
BULBCROPS(Not specifically listed in this table)	To control plant growth	Abide/A-Rest	25 to 50 ppm spray	
			0.25 mg a.i. (2 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot)	Drench volumes and mg a.i. vary with pot size.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	100 ppm spray	Conduct trials on a small number of plants, adjusting the rate as needed for desired final plant height and duration of height control.
			1.183 mg a.i. (10 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot)	Drench volumes and mg a.i. vary with pot size.
			20 ppm bulb soak	Soak for 15 min. Conduct trials on a small number of bulbs, adjusting the rate and soaking period (up to 1 hour) as needed for desired final plant height.
		Concise/Sumagic	2.5 to 20 ppm spray	Conduct trials on a small number of plants, adjusting the rate as needed for desired final plant height and length of height control.
	1 to 3 ppm drench		Drench volumes and mg a.i. vary with pot size. Application should be made when newly emerged shoots are 1 to 2 in. tall.	
	1 to 10 ppm bulb soak		Soak for 1 to 5 min. Conduct trials on a small number of bulbs, adjusting the rate and soaking period as needed for desired final plant height.	
	To promote plant growth and overcome over-application of gibberellin-inhibiting PGRs.	Fascination	1 to 25 ppm spray	Conduct trials on a small number of plants initially using 1 ppm, unless previous experience warrants higher use rates. Following assessment of plant response, and if desired results were not evident, reapplication or an increase in rate may be warranted. The most common rates for use are 3 to 5 ppm. SEE LABEL FOR ADDITIONAL PRECAUTIONS BEFORE USE.
	CALADIUM	To control plant growth	Dazide/B-Nine	2,500 to 5,000 ppm spray
Piccolo/Bonzi/Paczol/ Downsize			100 to 200 ppm spray (3.2 to 6.4 fl oz/gal)	Make first spray application when plants are 2 to 4 in. tall.
			0.24 to 1.77 mg a.i. (5 to 15 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot)	Make first application when plants are 1 to 2 in. tall. Drench volumes and mg a.i. vary with pot size.
Piccolo/Bonzi/Paczol			60 ppm tuber soak	Soak tubers for 30 min. prior to planting.
Piccolo 10 XC			100 to 200 ppm spray	Spray applications of Piccolo 10 XC are the least desirable method for controlling bulb plant height and must be applied sequentially to maximize uniformity of the crop. Begin spray applications when plants reach a height of 2 to 4 in.
			2 to 16 ppm drench	Drench volume varies with pot size. Begin drench applications when plants reach a height of 1 to 2 in.
Topflor	0.5 to 2 mg a.i. drench for a 6-in. pot	Based on NC State University trials. Adjust rates for other locations. Use lower rates for less vigorous cultivars.		

## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
CALCEOLARIA	To control plant growth	Citadel/Cycocel	400 to 800 ppm spray	Used to control internode length. Apply 400 ppm when flower buds are 1-in. in diameter. Repeat 2 weeks later if needed.
		Dazide/B-Nine	1,000 to 1,500 ppm spray	Used to control internode length.
CALENDULA	To control plant growth	Dazide/B-Nine	2,500 to 5,000 ppm spray	Can be used when the visible flower bud is pea sized. Rates of 3,500 ppm be used 4 to 5 weeks after germination (when 3 to 4 mature leaves formed).
			2,500 to 5,000 ppm spray	Plugs: Use 2,500 ppm with Stage 1 and 5,000 ppm with Stages 2 or 3.
		Concise/Sumagic	1 ppm spray	Plugs: Use at Stages 2 or 3.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	4 ppm spray	Plugs: Use at Stages 2 or 3.
CALIBRACHOA	To control plant growth	Dazide/B-Nine	2,500 to 5,000 ppm spray	At planting, soft pinch to promote lateral shoot development. Multiple applications may be required.
		Citadel + Dazide/Cycocel + B-Nine	2,500 ppm Dazide + 500 to 1,500 ppm Citadel applied as a tank-mix spray	
		Concise/Sumagic	10 to 25 ppm spray	Try lower rate initially. Apply 2 weeks after transplanting.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	3 to 50 ppm spray	Use rates of 3 to 5 ppm for compact genetics needing slight growth control.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol/Downsize	3 to 8 ppm drench	Rates for compact genetics needing slight growth control. Begin with 1 to 2 ppm to determine suitable rates.
		Flore/Collate	300 to 500 ppm spray	Early spray will increase branching and reduce early flowering.
		Topflor	5 to 10 ppm spray	
CALLA LILY (Zantedeschia)	To control plant growth	Piccolo/Piccolo 10 XC/ Bonzi/Paczol/Downsize	0.59 to 1.77 mg a.i. (5 to 15 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	See CALADIUM.
		Piccolo/Bonzi/Paczol	20 ppm rhizome/tuber soak	Soak the rhizomes/tubers for 15 min. prior to planting.
		Concise/Sumagic	1 to 2 mg a.i. drench (8.45 to 16.9 ppm); apply 4 fl. oz./6-in. pot)	Optimal rate based on NC State University trials. Adjust rate for plant vigor. Drench volumes and mg a.i. vary with pot size.
		Topflor	1 to 2.25 mg a.i. drench for a 6-in. pot	Based on NC State University trials. Adjust rates for other locations.
	To promote flowering	Florgib/ProGibb T&O	500 ppm rhizome/tuber soak	Soak the rhizomes or tubers for 10 min. prior to planting. See label for details.
CAMPANULA	To control plant growth	Dazide/B-Nine	2,500 to 5,000 ppm spray	Use at visible bud.
		Topflor	10 to 30 ppm spray	Use at visible bud.
CANNA LILY	To control plant growth	Topflor	50 to 80 ppm spray	
CELOSIA	To control plant growth	Abide/A-Rest	7 to 26 ppm spray	
		Dazide/B-Nine	2,500 to 5,000 ppm spray	
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	15 to 45 ppm spray	
		Citadel/Chlormequat E-Pro/ Cyclocel	800 to 1,500 ppm spray	
		Concise/Sumagic	10 to 20 ppm spray	
		Topflor	10 to 40 ppm spray	Based on NC State University trials. Adjust rates for other locations.
CELOSIA, Plugs	To control plant growth	Piccolo/Piccolo 10 XC/ Bonzi/Paczol	5 to 10 ppm spray	Timing of application should normally begin at the 1 to 2 true leaf stage.

## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
CENTAUREA	To control plant growth	Abide/A-Rest	10 to 15 ppm spray	
		Dazide/B-Nine	2,500 to 5,000 ppm spray	
CENTRADENIA HYBRID	To control plant growth	None	None	Plants grown with good light and optimal growing conditions generally do not need PGRs.
CHRISTMAS CACTUS (Schlumbergera spp.)	To increase branching under vegetative conditions	Configure	100 ppm spray	After planting when new vegetative growth begins, uniformly apply 1 to 2 quarts of finished spray solution to 100 sq. ft. of area.
	To increase the number of flower buds under reproductive conditions	Configure	100 to 200 ppm spray	Apply as a uniform foliar spray after the start of short days following leveling, or when flower buds become visible. See the label for specific guidelines based on lighted or natural-season growth plants.
CHRYSANTHEMUM, Cut	To reduce "neck" stretching	Dazide/B-Nine	2,500 ppm spray	Spray upper foliage 5 weeks after start of short-day treatment.
	To elongate peduncles of pompom-type mums	Florgib/ProGibb T&O	25 to 60 ppm spray	Use a single application 4 to 5 weeks after initiation of short days. Direct spray solution towards the flower buds. See label for precautions.
CHRYSANTHEMUM, Perennial	To control plant growth	Piccolo/Piccolo 10 XC/Bonzi/Paczol	50 to 200 ppm spray	
		Piccolo/Piccolo 10 XC/Bonzi/Paczol/Downsize	0.12 to 0.48 mg a.i. (1 to 4 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	
CHRYSANTHEMUM, Potted	To control plant growth	Abide/A-Rest	25 to 50 ppm spray	
			0.25 to 0.5 mg a.i. drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Apply when plants are 2 to 6 in. in height (about 2 weeks after pinch). Drench rates and application volumes vary with pot size.
		Dazide/B-Nine	1,000 ppm preplant foliar dip	Rooted cuttings can be dipped in solution to thoroughly wet leaves and stems and then potted. Allow foliage to dry before watering in. For unrooted cuttings, dip stems in solution, remove to flat, cover to prevent dehydration and hold overnight under cool conditions. Stick the next day.
			2,500 to 5,000 ppm spray	Spray when new growth from pinch is 1 to 2 in. long. Some varieties may require another application 3 weeks later.
		Piccolo/Piccolo 10 XC/Bonzi/Paczol	50 to 200 ppm spray	Applications should begin when axillary shoots are 2 to 3 in. long. Sprays can be applied earlier to vigorous cultivars if additional control is desired. Sequential applications of lower rates generally provide more uniformly shaped plants than single-spray applications. Uniform application of both sprays and drenches is critical for uniform crop development.
		Piccolo/Piccolo 10 XC/Bonzi/Paczol/Downsize	0.118 to 0.473 mg a.i. (1 to 4 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Drench volumes and mg a.i. vary with pot size. Begin when the axillary shoots are 2 to 3 in. long. Uniform application is required.
		Concise	5 to 10 ppm dip treatment on cuttings	Apply when the lateral shoots are 1.5 to 2.0 in. tall (about 7 to 14 days after pinching). Test for cultivar sensitivity. Multiple applications of the lower label rate may elicit a more satisfactory response and/or increasing the spray volume from 2 qts/100 sq. ft. to 3 qts/100 sq. ft. For Florida only: use a foliar spray concentration between 5 to 10 ppm (1.3 to 2.56 fl. oz./gal). For medium to tall cultivars, increase the spray volume to 3 qts/100 sq. ft.
			2.5 to 10 ppm spray	Apply as a dip treatment on unrooted cuttings followed by a foliar spray in the low rate range. On rooted cuttings, use a solution of 2.5 ppm or less, followed by a foliar spray in the low rate range.

## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
<b>CHRYSANTHEMUM</b> , Potted <i>continued</i>	To control plant growth	<b>Concise/Sumagic</b>	2.5 to 10 ppm spray	
		Topflor	7.5 to 25 ppm spray	Based on NC State University trials. Adjust rates for other locations. Use lower rates for less vigorous cultivars.
<b>CHRYSANTHEMUM</b> , Garden	To control plant growth	<b>Concise</b>	5 to 10 ppm dip treatment on cuttings	Apply when the lateral shoots are 1.5 to 2.0 in. tall (about 7 to 14 days after pinching). Test for cultivar sensitivity. Multiple applications of the lower label rate may elicit a more satisfactory response and/or increasing the spray volume from 2 qts/100 sq. ft. to 3 qts/100 sq. ft. For Florida only: use a foliar spray concentration between 5 to 10 ppm (1.3 to 2.56 fl. oz./gal). For medium to tall cultivars, increase the spray volume to 3 qts/100 sq. ft.
		<b>Concise/Sumagic</b>	2.5 to 10 ppm spray	
	To increase lateral branching	<b>Florel/Collate</b>	500 ppm spray	Florel and Collate applications will provide some growth retardant effects and delay flowering. Read the label for restrictions on timing of applications.
<b>CHRYSOCEPHALUM APICULATUM</b>	To control plant growth	<b>Dazide/B-Nine</b>	2,500 ppm spray	Plants pinched and grown with good light and optimal growing conditions generally do not need PGRs.
<b>CLARKIA(Godetia)</b>	To control plant growth	<b>Concise/Sumagic</b>	15 to 25 ppm drench	Trial rates for cultivar response. Rates based on older cultivars.
		<b>Dazide/B-Nine</b>	3,000 ppm foliar spray	Trial rates for cultivar response. Rates based on older cultivars.
		<b>Piccolo/Piccolo 10 XC/Bonzi/Paczol</b>	20 to 30 ppm drench	Trial rates for cultivar response. Rates based on older cultivars.
<b>CLEMATIS</b>	To control plant growth	<b>Abide/A-Rest</b>	25 to 132 ppm spray	
			0.25 to 0.5 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Drench volumes and mg a.i. vary with pot size.
<b>CLEOME</b>	To control plant growth	<b>Abide/A-Rest</b>	7 to 26 ppm spray	
		<b>Citadel/Chlormequat E-Pro/Cyclocel</b>	800 to 1,500 ppm spray	
		<b>Dazide/B-Nine</b>	4,000 to 5,000 ppm spray	Multiple applications may be required. Make them at 7- to 10-day intervals.
		<b>Piccolo/Piccolo 10 XC/Bonzi/Paczol</b>	20 to 30 ppm spray	Multiple applications may be required. Make them at 7- to 10-day intervals.
<b>CLERODENDRUM</b>	To control plant growth	<b>Abide/A-Rest</b>	50 ppm spray	
			0.9 mg a.i. drench	
		<b>Piccolo/Piccolo 10 XC/Bonzi/Paczol</b>	100 ppm drench	
			0.5 mg a.i. drench	
	To increase lateral branching	<b>Augeo</b>	1,042 to 2,083 ppm spray	
<b>COLEUSPLUGS, Seed</b>	To control plant growth	<b>Piccolo/Piccolo 10 XC/Bonzi/Paczol</b>	5 to 10 ppm spray	Timing of application should normally begin at the 1 to 2 true leaf stage.
<b>COLEUS, Seed</b>	To control plant growth	<b>Dazide/B-Nine</b>	2,500 to 5,000 ppm spray	
		<b>Piccolo/Piccolo 10 XC/Bonzi/Paczol</b>	15 to 30 ppm spray	
		<b>Citadel/Chlormequat E-Pro/Cyclocel</b>	400 to 3,000 ppm spray	
		<b>Concise/Sumagic</b>	10 to 20 ppm spray	
		Topflor	20 to 40 ppm spray	Based on NC State University trials. Adjust rates for other locations.

## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
COLEUS, Vegetative	To control plant growth	Citadel + Dazide/Cycocel + B-Nine	2,500 to 4,000 ppm + 1,000 to 1,500 ppm Cycocel applied as a tank-mix spray	See General Recommendations. Scheduling the crop to avoid excessive stretch is the most effective means of controlling growth.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	5 to 30 ppm spray	
			1 to 2 ppm drench	
		Citadel/Chlormequat E-Pro/ Cyclocel	800 to 1,500 ppm spray	
		Concise/Sumagic	5 to 20 ppm spray	Use rates of 5 to 10 ppm for compact genetics needing slight growth control.
		Collate/Florel	500 ppm spray	
COLUMBINE	To control plant growth	Abide/A-Rest	65 to 132 ppm spray	
			0.25 to 0.5 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Drench volumes and mg a.i. vary with pot size.
CONEFLOWER (Echinacea spp.)	To control plant growth	Concise/Sumagic	30 to 40 ppm spray	
	To increase branching	Configure	300 to 900 ppm spray	Apply after plant establishment and resumption of growth (i.e., approximately 2 weeks after potting). Apply in a uniform spray volume of 2 qts/100 sq. ft. of area. Application timing and rate may vary with cultivar.
CONSOLIDA (Larkspur)	To control plant growth	Abide/A-Rest	35 to 132 ppm spray	
			0.25 to 0.5 mg a.i. drench for a 6-in. pot (1 to 2 fl. oz./gal of drench solution; apply 4 fl. oz./6-in. pot)	Drench volumes and mg a.i. vary with pot size.
		Concise/Sumagic	5 ppm drench	
		Dazide/B-Nine	2,500 to 5,000 ppm spray	
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	30 to 60 ppm spray	
CONSOLIDA, Cut (Larkspur)	To promote growth and stem elongation	Florgib/ProGibb T&O	50 to 100 ppm spray	Apply when plants are 4- to 8-in. tall. Apply at 2- to 3-week intervals. See label for precautions.
COREOPSIS	To control plant growth	Concise/Sumagic	2 to 4 ppm spray	Rates for compact genetics needing slight growth control.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	3 to 100 ppm spray	Use rates of 3 to 6 ppm for compact genetics needing slight growth control.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol/Downsize	0.59 to 1.18 mg a.i. (5 to 10 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Rates for vigorous genetics needing moderate growth control.
		Topflor	2 to 4 ppm spray	Rates for compact genetics needing slight growth control.
CORNFLOWER (Centaurea)	To control plant growth	Abide/A-Rest	7 to 26 ppm spray	
		Dazide/B-Nine	2,500 to 5,000 ppm spray	
COSMOS	To control plant growth	Dazide/B-Nine	2,500 to 5,000 ppm spray	
CROSSANDRA	To control plant growth	Dazide/B-Nine	2,500 to 5,000 ppm spray	Apply after pinch when new growth is 2-in. long.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	50 ppm spray	Apply 2 weeks after pinch.
CUPHEA	To control plant growth	Dazide/B-Nine	1,500 to 2,500 ppm spray	PGRs not required on compact cultivars.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	1 to 5 ppm spray	Initially, test on a few plants to determine rate for optimum control. Cuphea is sensitive to excessive rates.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol/Downsize	0.25 to 2 ppm drench	Use rates of 0.25 to 0.5 ppm for compact genetics needing slight growth control. Use 2 ppm for vigorous cultivars grown in the south.

## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
DAFFODIL	To control plant growth	<b>Piccolo/Piccolo 10 XC/ Bonzi/Paczol/Downsize</b>	2.37 to 4.73 mg a.i. (20 to 40 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	See CALADIUM.
		<b>Piccolo/Piccolo 10 XC/ Bonzi/Paczol</b>	80 ppm bulb soak	Soak bulbs for 1 hr. prior to planting. Ten minute soaks of 400 ppm provided excellent results in NC State University trials.
		<b>Flore/Collate</b>	2,000 ppm spray	Controls plant height and stem topple. Apply when shoots are 3 to 4 in. tall. See label for cultivar differences in rates.
DAHLIA, Bedding Plant	To control plant growth	<b>Abide/A-Rest</b>	7 to 26 ppm spray	
		<b>Dazide/B-Nine</b>	2,500 to 5,000 ppm spray	
		<b>Citadel + Dazide/Cycocel + B-Nine</b>	2,500 to 4,000 ppm + 1,000 to 1,500 ppm Cycocel applied as a tank-mix spray	
		<b>Piccolo/Piccolo 10 XC/ Bonzi/Paczol</b>	15 to 45 ppm spray	
		<b>Citadel/Chlormequat E-Pro/ Cyclocel</b>	800 to 1,500 ppm spray	
		<b>Concise/Sumagic</b>	10 to 20 ppm spray	
DAHLIA PLUGS, Bedding Plant	To control plant growth	<b>Piccolo/Piccolo 10 XC/ Bonzi/Paczol</b>	5 to 10 ppm spray	Timing of application should normally begin at the 1 to 2 true leaf stage.
DAHLIA, Tuberous	To control plant growth	<b>Abide/A-Rest</b>	0.25 to 0.5 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Drench volumes and mg a.i. vary with pot size.
		<b>Piccolo/Piccolo 10 XC/ Bonzi/Paczol/Downsize</b>	1.18 to 4.73 mg a.i. (10 to 40 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	
		<b>Piccolo/Piccolo 10 XC/ Bonzi/Paczol</b>	Greater than 40 ppm tuber soak	Soak tubers for 20 min. prior to planting.
		<b>Concise/Sumagic</b>	0.25 to 0.5 mg a.i. drench (2.1 to 4.2 ppm); apply 4 fl. oz./6-in. pot	Optimal rate based on NC State University trials. Adjust rate for plant vigor. Drench volumes and mg a.i. vary with pot size.
		<b>Topflor</b>	0.25 to 2 mg a.i. (2.1 to 16.9 ppm) drench for a 6-in. pot	Based on NC State University trials. Adjust rates for other locations. Use lower rates for less vigorous cultivars.
DELPHINIUM	To control plant growth		35 to 132 ppm spray	
		<b>Abide/A-Rest</b>	0.25 to 0.5 mg a.i. drench for a 6-in. pot (1 to 2 fl. oz./gal of drench solution; apply 4 fl. oz./6-in. pot)	Drench volumes and mg a.i. vary with pot size.
		<b>Concise/Sumagic</b>	5 ppm drench	
		<b>Dazide/B-Nine</b>	2,500 to 5,000 ppm spray	
		<b>Piccolo/Piccolo 10 XC/ Bonzi/Paczol</b>	30 to 60 ppm spray	
DELPHINIUM, Cut	To promote plant growth and stem elongation	<b>Florgib/ProGibb T&amp;O</b>	50 to 100 ppm spray	Apply when plants are 4 to 8 in. tall. More than one application is possible at 2- to 3-week intervals. See label for precautions.
DIANTHUS, Bedding Plant	To control plant growth	<b>Abide/A-Rest</b>	7 to 26 ppm spray	
		<b>Dazide/B-Nine</b>	2,500 to 5,000 ppm spray	
		<b>Piccolo/Piccolo 10 XC/ Bonzi/Paczol</b>	5 to 60 ppm spray	Cultivar response rates vary. Conduct your own trials to determine suitability and appropriate timing. Some series recommend the use of 5 to 8 ppm sprays.
		<b>Citadel/Chlormequat E-Pro/ Cyclocel</b>	800 to 1,500 ppm spray	
		<b>Concise/Sumagic</b>	3 to 5 ppm spray	

## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
DIANTHUSPLUGS, Bedding plant	To control plant growth	Piccolo/Piccolo 10 XC/ Bonzi/Paczol	10 to 20 ppm spray	Timing of application should normally begin at the 1 to 2 true leaf stage.
DIANTHUS, Cut	To promote plant growth and stem elongation	Florgib/ProGibb T&O	50 to 100 ppm spray	Apply when plants are 4 to 8 in. tall. More than one application is possible at 2- to 3-week intervals. See label for precautions.
DIANTHUS, Pot	To control plant growth	Concise/Sumagic	15 ppm spray	
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	15 ppm spray	
DIASCIA Hybrid	To control plant growth	Dazide/B-Nine	1,250 to 5,000 ppm	At planting, soft pinch to promote lateral shoot development. Use higher rates on vigorous cultivars.
		Concise/Sumagic	5 to 15 ppm spray	Use lower rates to ensure taller flower spikes.
		Florel/Collate	200 to 500 ppm spray	Use 2 weeks after pinch.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	30 ppm spray 1 to 2 ppm drench	
DIASCIA, Seed	To control plant growth	Abide/A-Rest	20 ppm spray	Start application 7 to 10 days after transplant. Repeat 7 days later.
		Concise/Sumagic	5 to 10 ppm spray	To hold plants under warm conditions. Use caution, plants very responsive.
		Dazide/B-Nine	3,000 to 5,000 ppm spray	Start application 7 to 10 days after transplant.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	10 to 20 ppm spray	To hold plants under warm conditions. Use caution, plants very responsive.
DICENTRA SPECTABILIS (Bleeding Heart)	To control plant growth	Abide/A-Rest	65 to 132 ppm spray	
			0.25 to 0.5 mg a.i. drench for a 6-in. pot; apply 4 fl. oz./6-in. pot)	Drench volumes and mg a.i. vary with pot size.
		Dazide/B-Nine	2,500 to 5,000 ppm spray	Apply as new sprouts emerge from the pot. Repeat if needed due to non-uniform emergence.
DICHONDRA ARGENTEA	To control plant growth	Citadel+Dazide/Cycocel+B-Nine	1,000 ppm + 5,000 ppm spray	Also increases branching and improves silver color.
		Dazide/B-Nine	5,000 ppm spray	Also increases branching and improves silver color. Apply 2 weeks after transplanting.
DIGITALIS	To control plant growth	Piccolo/Piccolo 10 XC/ Bonzi/Paczol	80 to 160 ppm spray	
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol/Downsize	0.24 to 0.48 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	
DOROTHEANTHUS BELLIDIFORMIS	To control plant growth	None	None	Plants pinched and grown with good light and optimal growing conditions generally do not need PGRs.
DRACAENA	To control plant growth	Abide/A-Rest	25 to 132 ppm spray	
			0.25 to 0.5 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Drench volumes and mg a.i. vary with pot size.
DUSTY MILLER (Seneciocineraria)	To control plant growth	Dazide/B-Nine	2,500 to 5,000 ppm spray	
		Concise/Sumagic	30 ppm spray	
EASTER LILY (See Lily, Easter)				



## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
ECHEVERIA spp	To induce offsets and induce flower development	<b>Configure</b>	100 to 400 ppm spray	Based on NC State University trials when applied 2 weeks after potting. A slight increase in offsets occurred along with the induction of flowering.
EGGPLANT	To control plant growth	Sumagic	2 to 10 ppm spray	See label for application suggestions and precautions. Make initial foliar applications when 2 to 4 true leaves are present. Apply uniformly as a foliar spray using 2 qt/100 sq. ft. Sequential applications at lower recommended rates will generally provide more growth control than a single high rate application. First-time users should apply the lowest recommended rate in order to determine optimal rate for individual cultivars under local environmental conditions. If additional growth control is required, a sequential spray application at the lowest recommended rate should be made 7 to 14 days after the initial application. If multiple applications are made to the transplants, the total amount of Sumagic applied may not exceed that from a single application of a 10 ppm spray. The final application may not occur later than 14 days after the 2 to 4 true leaf stage.
ERYSIMUM	To control plant growth	None	None	Plants grown with good light and optimal growing conditions generally do not need PGRs.
EUPATORIUM	To control plant growth	<b>Piccolo/Piccolo 10 XC/ Bonzi/Paczol</b>	>240 ppm spray	
		<b>Piccolo/Piccolo 10 XC/ Bonzi/Paczol/Downsize</b>	0.96 to 1.18 mg a.i. (8 to 10 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	
EUPHORBIA HYPERICIFOLIA HYBRID	To control plant growth	<b>Dazide/B-Nine</b>	2,500 ppm spray	Plant growth slow early on. Apply PGRs if control is needed.
		<b>Citadel+Dazide/Cycocel+B-Nine</b>	750 ppm + 2,500 ppm spray	
		<b>Florel/Collate</b>	Spray	Not recommended.
		<b>Piccolo/Piccolo 10 XC/ Bonzi/Paczol</b>	0.5 to 2 ppm drench	Can be applied 3 to 4 weeks before finish, using the lower rate in the North and higher rate in the South.
EVOLVULUS	To control plant growth	None	None	Plants grown with good light and optimal growing conditions generally do not need PGRs.
EXACUM	To control plant growth	<b>Dazide/B-Nine</b>	2,500 to 5,000 ppm spray	
		<b>Piccolo/Piccolo 10 XC/ Bonzi/Paczol</b>	75 ppm spray	
			0.25 to 0.75 mg a.i. drench for a 6-in. pot	
		Topflor	25 to 50 ppm spray	Based on NC State University trials. Adjust rates for other locations.
0.01 to 0.03 mg a.i. (0.08 to 0.25 ppm) drench for a 6-in. pot	Based on NC State University trials. Adjust rates for other locations. Exacum is very responsive to Topflor drenches, so start trials with lower rates.			
FATSHEDERA	To control plant growth	<b>Abide/A-Rest</b>	65 to 132 ppm spray	
			0.25 to 0.5 mg a.i. drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Drench volumes and mg a.i. vary with pot size.
FELICIA	To control plant growth	<b>Citadel+Dazide/Cycocel+B-Nine</b>	1,000 to 1,500 ppm + 2,500 to 4,000 ppm spray	Pinch plant as needed to improve shape.
		<b>Citadel/Cycocel</b>	1,500 ppm spray	Applied to pinched plants.

## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
FLOWERING/ FOLIAGEPLANTS, Herbaceous Species (Not specifically listed in this table)	To control plant growth	Abide/A-Rest	20 to 50 ppm spray	Recommended starting rate for an Abide/A-Rest spray on a new herbaceous flowering or foliage species is 33 ppm (16 fl. oz./gal).
			0.125 to 0.25 mg a.i. (1 to 2 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Drench volumes and mg a.i. vary with pot size.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	30 ppm spray	Conduct trials on a small number of plants, adjusting the rate as needed for desired final plant height and length of height control.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol/Downsize	0.118 mg a.i. (1 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Drench volumes and mg a.i. vary with pot size. Conduct trials on a small number of plants.
		Citadel/Cycocel	800 to 3,000 ppm spray	Optimum rate depends on species, desired amount of height control and environmental conditions. The suggested initial rate for small-scale trials is 1,250 ppm. Example: herbaceous species known to respond to Cycocel are—Achimenes, Aster, Astilbe, Begonia (hiemalis), Begonia (tuberous), Calceolaria, Carnation, Chrysanthemum, Columbine, Easter lily, <b>Gynura aurantiaca</b> , Ivy, Kalanchoe, <b>Lilium spp.</b> , Morning glory, Pachystachys, <b>Pilea spp.</b> , Pentas, <b>Salvia spp.</b> , Schefflera, <b>Sedum spp.</b> and Sunflower.
	2,000 to 4,000 ppm drench		Drench volumes vary with pot size. See label for recommended volumes. Herbaceous species known to respond to Cycocel are listed above.	
	Concise/Sumagic	5 to 40 ppm spray	Conduct trials on a small number of plants, adjusting the rate as needed for desired final plant height and length of height control.	
		0.1 to 1 ppm drench	Drench volumes and mg a.i. vary with pot size.	
	To promote plant growth and overcome over-applications of gibberellin- inhibiting PGRs	Florgib/ProGibb T&O	1 to 25 ppm spray	Conduct trials on a small number of plants initially using 1 ppm, unless previous experience warrants higher use rates. Following assessment of plant response, and if desired results are not evident, reapplication or an increase in rates may be warranted. Consult the label for additional precautions.
		Fascination	1 to 25 ppm spray	Conduct trials on a small number of plants initially using 1 ppm, unless previous experience warrants higher use rates. Following assessment of plant response, and if desired results were not evident, reapplication or an increase in rate may be warranted. The most common rates for use are 3 to 5 ppm. SEE LABEL FOR ADDITIONAL PRECAUTIONS BEFORE USE.
To induce lateral or basal branching	Configure	50 to 500 ppm spray	The supplemental label allows legal use on greenhouse grown plants not specifically listed on the original label. See label for trialing suggestions and precautions.	
FLOWERING/ FOLIAGEPLANTS, Woody Species (Not specifically listed in this table)	To control plant growth	Abide/A-Rest	50 ppm spray	
			0.25 mg a.i. (2 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Drench volumes and mg a.i. vary with pot size.
		Dazide/B-Nine	2,500 to 7,500 ppm spray	Two or more applications may be necessary if new growth begins to stretch or for enhanced coloration.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	50 ppm spray	Conduct trials on a small number of plants, adjusting the rate as needed for desired final plant height and length of height control.
Piccolo/Piccolo 10 XC/ Bonzi/Paczol/Downsize	0.237 mg a.i. drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Drench volumes and mg a.i. vary with pot size.		

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FLOWERING/ FOLIAGEPLANTS, Woody Species (Not specifically listed in this table) <i>continued</i>	To control plant growth	Citadel/Cyocel	800 to 3,000 ppm spray	Optimum rate depends on species, desired amount of height control and environmental conditions. The suggested initial rate for small-scale trials is 1,250 ppm. Example: woody species known to respond to Cyocel are—Barleria cristata, Bougainvillea, Camellia, Gardenia, Fuchsia, Hollies, Hydrangea, Lantana, Pseuderanthemum lactifolia, Rhododendron and Roses (potted).
			2,000 to 4,000 ppm drench	Drench volumes vary with pot size. See label for recommended volumes. Woody species known to respond to Cyocel are listed above.
		Concise/Sumagic	20 to 50 ppm spray	Conduct trials on a small number of plants, adjusting the rate as needed for desired final plant height and length of height control.
			0.5 to 2 ppm drench	Drench volumes and mg a.i. vary with pot size.
FREESIA	To control plant growth	Abide/A-Rest	100 to 200 ppm corm soak	Soak corms in the solution for 1 hour before planting. Cultivar response varies, so conduct your own trials.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol/Downsize	0.22 to 0.48 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	To increase lateral branching.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	50 to 200 ppm corm soak	Soak corms in the solution for 1 hour before planting. Cultivar response varies, so conduct your own trials.
FUCHSIA	To control plant growth	Abide/A-Rest	25 to 75 ppm spray	May also increase flowering.
		Dazide/B-Nine	1,250 to 2,500 ppm spray	
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	5 to 10 ppm spray	Make applications prior to visible bud to avoid delay.
		Concise/Sumagic	2 to 5 ppm spray	Make applications prior to visible bud to avoid delay.
	To increase lateral branching	Augeo	781 to 2,343 ppm spray	
		Florel/Collate	500 ppm spray	Florel and Collate applications will provide some growth retardant effects and delay flowering. Read the label for restrictions on timing of applications.
	To promote stem elongation for topiary	Florgib/ProGibb T&O	200 to 400 ppm spray	For use on upright growing cultivars used for topiary. Weekly sprays can be used, maximum 3 applications.
GARDENIA	To control plant growth	Abide/A-Rest	50 ppm spray	
			0.25 mg a.i. (2 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Drench volumes and mg a.i. vary with pot size.
		Dazide/B-Nine	5,000 ppm spray	Spray when plants are at two-thirds final market size.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	12 ppm drench	Flower delay possible. Apply prior to floral initiation (short days) or 6 weeks after pinching.
		Topflor	100 to 200 ppm spray	Apply prior to floral initiation (short days) or 6 weeks after pinching.
	To increase lateral branching	Augeo	2,343 to 4,687 ppm spray	
GAURA	To control plant growth	Dazide/B-Nine	3,000 to 4,000 ppm spray	
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	30 to 50 ppm spray	
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol/Downsize	3.54 mg a.i. (30 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	
		Concise/Sumagic	10 to 30 ppm spray	

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GAZANIA	To control plant growth	Citadel/Chlormequat E-Pro/Cyclocel	1,500 ppm spray	Make applications prior to visible bud to avoid delay.
		Dazide/B-Nine	2,500 ppm spray	Make applications prior to visible bud to avoid delay.
GERANIUM	To control plant growth	Abide/A-Rest	26 to 66 ppm spray	See AGERATUM.
		Piccolo/Bonzi/Paczol	5 to 30 ppm spray	Apply to zonal geraniums when new growth is 1.5 to 2 in. long. Apply to seed geraniums approximately 2 to 4 weeks after transplanting.
		Concise	3 to 8 ppm spray	Use lower rates for less vigorous plants and higher rates for more vigorous growing plants. Flower delay on some cultivars can occur when using rates >6 ppm.
		Citadel/Chlormequat E-Pro/Cyclocel	800 to 1,500 ppm spray	Make first application 2 to 4 weeks after planting plugs or rooted cuttings (after stems have started elongating). Multiple applications may be needed.
		Piccolo 10 XC	10 to 30 ppm spray	See Piccolo remarks for GERANIUM. Early applications may require lower rates to avoid overdosing. Piccolo 10 XC will reduce late stretch when applied as the flower stems begins to elongate.
		Concise/Sumagic	3 to 6 ppm spray for cutting geraniums and 2 to 4 ppm spray for seed geraniums	
		Topflor	15 to 25 ppm spray	Apply to zonal geraniums when new growth is 1.5 to 2 in. long.
	To promote earlier flowering in seed geraniums	Citadel/Chlormequat E-Pro/Cyclocel	1,500 ppm spray	Make two applications at 35 and 42 days after seeding. Treated plants should flower earlier and be more compact and more well-branched than untreated plants.
		Florgib/ProGibb	5 to 15 ppm spray (0.02 to 0.06 fl. oz./gal)	Make a single foliar application when first flower bud set is noted. Spray the entire plant until runoff. See label for precautions.
	To increase flower number and size in cutting geranium	Florgib/ProGibb T&O	1 to 5 ppm spray	Make a single foliar application when first flower bud set is noted. Spray the entire plant until runoff. See label for precautions.
	To increase lateral branching	Florel/Collate	300 to 500 ppm spray	Labeled for zonal and ivy geraniums. Use the lower concentration for ivy geraniums. Florel and Collate will also provide some growth retardant effect and delay flowering. Read the label for restrictions on timing of applications.
	GERANIUM, IVY	To control plant growth	Citadel/Chlormequat E-Pro/Cyclocel	750 to 1,500 ppm spray
To increase branching		Augeo	1,562 ppm spray	Labeled for ivy geraniums only.
		Florel/Collate	200 to 300 ppm spray	
GERANIUM, Seed	To promote earlier flowering	Citadel	1,500 ppm spray	See label. Make two spray applications at 35 and 42 days after seeding. Plants flower quicker, are compact and have increased lateral breaks.
	To control plant growth	Concise	2 to 4 ppm spray	Apply when plant height is approximately 4 in. tall.
GERBERADAISSY	To control plant growth	Abide/A-Rest	25 to 132 ppm spray	Do not apply when flower stems are visible.
			0.25 to 0.5 mg a.i. drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Drench volumes and mg a.i. vary with pot size. Do not apply when flower stems are visible.
		Dazide/B-Nine	1,200 to 5,000 ppm spray	Do not apply when flower stems are visible. Apply lower rate at 10 to 14 interval if needed.

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GLADIOLUS	To control plant growth	<b>Abide/A-Rest</b>	1.5 mg drench per 0.5 gal. pot	For container-grown plants.
		<b>Piccolo/Piccolo 10 XC/ Bonzi/Paczol</b>	2.5 to 5.0 mg drench per 0.5 gal. pot	For container-grown plants.
GLOXINIA (Sinningia speciosa)	To control peduncle length	<b>Dazide/B-Nine</b>	1,250 ppm spray	PGRs may not be required on compact cultivars. Make first application when the leaves reach the side of the pot. A repeat application can be made 7 to 10 days later if needed. Flower streaking can develop if PGR applied when the buds show color. Phytotoxicity may occur at rates >1,250 ppm.
		<b>Piccolo/Piccolo 10 XC/ Bonzi/Paczol</b>	30 ppm spray	Can be applied when buds grow above the foliage.
			4 to 8 ppm drenches	For elongation control late in the season (10 weeks after transplant).
GOMPHRENA	To control plant growth	<b>Dazide/B-Nine</b>	2,500 to 5,000 ppm spray	
		<b>Citadel/Chlormequat E-Pro/ Cyclocel</b>	800 to 1,500 ppm spray	
GOODENIA	To control plant growth	None	None	Plants grown with good light and optimal growing conditions generally do not need PGRs.
GRAPE IVY	To increase lateral branching	Augeo	781 to 1,562 ppm spray	
GROUNDCHERRY	To control plant growth	<b>Concise/Sumagic</b>	2 to 10 ppm spray	See precautions listed with EGGPLANT.
GYPSOPHILA	To accelerate plant growth, increase stem and flower number and increase flower uniformity	<b>Florgib/ProGibb T&amp;O</b>	150 to 500 ppm spray	Make 3 to 4 foliar applications after 4 weeks of new growth has occurred after pinching. Use 2-week intervals between sprays. See label for precautions.
HELENIUM AMARUM	To control plant growth	<b>Dazide/B-Nine</b>	5,000 ppm spray	Apply after plant established (2 weeks after transplant).
HELICHRYSUM PETIOLARE/ H. ITALICUM (Licorice plant)	To control plant growth	<b>Piccolo/Piccolo 10 XC/ Bonzi/Paczol</b>	1 ppm drench	Plants grown with good light and optimal growing conditions generally do not need PGRs.
	To increase lateral branching	<b>Florel/Collate</b>	300 to 500 ppm spray	Make first application after 2 weeks. Repeat in 2 weeks if needed (with larger pots).
HELICONIA	To control plant growth	<b>Piccolo/Piccolo 10 XC/ Bonzi/Paczol</b>	15 to 30 ppm spray	Apply when axillary shoots are 4 to 6-in. high after removal of primary shoot (2 to 3 months after planting). Cultivar variation possible, so conduct your own trials to determine optimal rates.
			0.375 mg a.i. drench / 6-in. pot	Apply when axillary shoots are 4 to 6-in. high after removal of primary shoot (2 to 3 months after planting). Cultivar variation possible, so conduct your own trials to determine optimal rates.
HELIOTROPIUM ARBORESCENS	To control plant growth	<b>Citadel/Chlormequat E-Pro/ Cyclocel</b>	500 ppm spray	Rate for compact genetics needing slight growth control.
		<b>Citadel+Dazide/Cycocel+B-Nine</b>	750 to 1,000 ppm + 1,500 to 3,000 ppm spray	Rate for compact genetics needing slight growth control.
HIBISCUS MOSCHEUTOS	To control plant growth	<b>Citadel/Cycocel</b>	1000 ppm foliar spray	Multiple applications may be required.
		<b>Concise/Sumagic</b>	15 ppm foliar spray	

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HIBISCUS ROSA-SINENSIS	To control plant growth	Dazide/B-Nine	2,500 to 5,000 ppm spray	
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	5 to 150 ppm spray	Application should be made when laterals are 1 to 4 in. long. Single applications control lateral growth for 3 to 6 weeks.
		Concise	10 ppm spray	Apply within 7 days after pruning. Make additional applications as necessary to obtain desired results. Florida only: Use a foliar spray concentration between 5 to 10 ppm and apply a uniform spray volume of 3 qts/100 sq. ft.
		Citadel/Chlormequat E-Pro/ Cyclocel	200 to 600 ppm spray	Multiple applications starting prior to first pinch are recommended. See label for additional precautions. Avoid applications after flower buds are visible.
		Concise/Sumagic	0.025 to 0.2 mg a.i. drench per pot	
HOLLY	To control plant growth	Abide/A-Rest	50 ppm spray	
			0.25 mg a.i. (2 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Drench volumes and mg a.i. vary with pot size.
HOLLYHOCK	To control plant growth	Piccolo/Bonzi/Paczol	30 to 50 ppm spray	
		Concise/Sumagic	5 to 40 ppm spray	
HOSTA	To promote lateral growth on finished plants	Configure	1,000 to 3,000 ppm spray	Apply in a uniform spray volume. Application is most effective when plants are fully established prior to application (i.e. at least 3 to 4 weeks after potting), when there is evidence of surface root development but before flower initiation.
	To increase production of offsets for propagation	Configure	1,000 to 3,000 ppm spray	Apply in a uniform spray volume to fully established, actively growing stock plants. Repeat the application at 30-day intervals during the growing season. Offsets may be harvested at any time. Treatment effects may vary by Hosta cultivar and may respond differently to a given rate. Multiple applications at 30-day intervals using lower rates may be more effective than a single application at a higher rate. Conduct trials on a small number of plants under actual use conditions to establish the proper use rates and timings.
HYACINTH	To reduce stem topple	Flore/Collate	1,000 ppm spray	To reduce stem topple at time of full flower, apply foliar spray before florets have opened.
	To control plant growth	Piccolo/Bonzi/Paczol	100 ppm bulb soak	Ten minute soaks provided excellent results in NC State University trials. Cultivar response varied.
		Concise/Sumagic	20 to 40 ppm bulb soak	Two to ten minute preplant soaks provided excellent results in NC State University trials. Cultivar response varied.
		Topflor	0.5 to 1 mg a.i. (4.2 to 8.45 ppm) drench for a 6-in. pot	Based on NC State University trials. Adjust rates for other locations.
10 to 25 ppm bulb soak	Two to ten minute preplant soaks provided excellent results in NC State University trials. Cultivar response varied.			
HYBRID LILY (See Lily, Hybrid)				
HYDRANGEA	To control plant growth	Abide/A-Rest	50 ppm spray	
			0.25 mg a.i. (2 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Drench volumes and mg a.i. vary with pot size.
		Dazide/B-Nine	1,250 to 7,500 ppm spray	Use lower rate in spring when 4 to 5 pairs of leaves are visible and new growth is starting to unfold, but not later than 4 weeks after initiation of forcing. Use higher rate for summer when regrowth after pinching is 1 to 2 in. long.
		Topflor	100 to 200 ppm spray	

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HYPOESTES	To control plant growth	Chlormequat E-Pro	800 to 1,500 ppm spray	Initially apply after second set of leaves have developed. If needed, reapply 2 weeks later.
		<b>Citadel/Cycocel</b>	400 to 1,500 ppm spray	Initially apply after second set of leaves have developed. If needed, reapply 2 weeks later.
		<b>Dazide/B-Nine</b>	1,000 ppm spray	Initially apply after second set of leaves have developed. If needed, reapply 2 weeks later.
IMPATIENS, Seed	To control plant growth	<b>Abide/A-Rest</b>	10 to 44 ppm spray	
		<b>Piccolo/Piccolo 10 XC/Bonzi/Paczol</b>	10 to 45 ppm spray	
		<b>Concise/Sumagic</b>	5 to 10 ppm spray	
		<b>Topflor</b>	20 to 60 ppm spray	Based on NC State University trials. Adjust rates for other locations.
	To increase branching	<b>Florel/Collate</b>	100 to 300 ppm spray	Use if better branching needed.
IMPATIENSPLUGS, Seed	To control plant growth	<b>Piccolo/Piccolo 10 XC/Bonzi/Paczol</b>	0.5 to 10 ppm spray (0.015 to 0.32 fl. oz./gal)	Timing of application should normally begin at the 1 to 2 true leaf stage.
IMPATIENS, Vegetative	To control plant growth	<b>Piccolo/Bonzi/Paczol</b>	2 to 15 ppm spray	Cultivars' response to PGRs varies, so test a few plants to determine rate for optimum control.
			0.5 to 1 ppm drench	Drench volumes and mg a.i. vary with pot size. See label for recommended volumes.
		<b>Florel/Collate</b>	100 to 300 ppm spray	Will improve branching.
IMPATIENS, Seashell-type	To control plant growth	<b>Piccolo/Bonzi/Paczol</b>	5 to 8 ppm spray	Apply when plants have reached 75% of finished height. Don't apply to plants under stress. Recommendations based on Michigan trials.
IOCHROMA	To control plant growth	<b>Dazide/B-Nine</b>	5,000 ppm spray	
		<b>Piccolo/Piccolo 10 XC/Bonzi/Paczol</b>	2 ppm spray	
IPOMOEA	To control plant growth	<b>Concise/Sumagic</b>	10 to 25 ppm spray	Not needed if optimal scheduling is used. If needed, apply when plants have reached 75% of finished growth. Recommendations based on NC State University trials.
		<b>Dazide/B-Nine</b>	2,500 ppm spray	Apply as needed.
		<b>Florel/Collate</b>	500 to 1,000 ppm spray	Will improve branching and control growth.
		<b>Piccolo/Piccolo 10 XC/Bonzi/Paczol</b>	8 ppm drench	Applied to plugs prior to transplanting.
IRESINEHYBRID	To control plant growth	<b>Citadel+Dazide/Cycocel+B-Nine</b>	1,000 to 1,500 ppm + 2,500 to 4,000 ppm spray	
		<b>Piccolo/Piccolo 10 XC/Bonzi/Paczol</b>	5 to 10 ppm spray	
		<b>Piccolo/Piccolo 10XC/Bonzi/Paczol/Downsize</b>	1 to 3 ppm drench	
JACOBINIA(Pink)	To control plant growth	<b>Piccolo/Piccolo 10 XC/Bonzi/Paczol</b>	5 to 10 ppm spray	
		<b>Piccolo/Piccolo 10 XC/Bonzi/Paczol/Downsize</b>	0.06 to 0.12 mg a.i. (0.5 to 1 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	
JERUSALEM CHERRY (Solanum pseudocapsicum)	To control plant growth	<b>Citadel/Chlormequat E-Pro</b>	800 to 1,500 ppm spray	
		<b>Citadel/Cycocel</b>	400 to 1,500 ppm spray	
	To promote stem elongation for topiary	<b>Florgib/ProGibb T&amp;O</b>	250 ppm spray	For plants grown in 6-in. pots and with 4- to 6-in. of growth, apply 2 foliar sprays 10 days apart to promote stem elongation for topiary plants. Stake plants to support stem.

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CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
KALANCHOE	To control plant growth	Abide/A-Rest	50 ppm spray	Apply when axillary growth begins and repeat 20 to 30 days after short days begin. Trial to determine optimal rates and timing for your location.
		Dazide/B-Nine	2,500 to 5,000 ppm spray	Rates and timing vary with the season and cultivar. Applications typically begin 2 weeks after pinching. Apply sprays every 7 days in the summer, 10 to 15 days in the spring and fall, and 14 to 21 days in the winter. Trial to determine optimal rates and timing for your location.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	2 to 4 ppm spray	Trial to determine optimal rates and timing for your location.
	To increase lateral branching	Augeo	1,042 to 2,343 ppm spray	
	To control peduncle length	Dazide/B-Nine	1,200 to 5,000 ppm spray	Phytotoxicity possible if B-Nine/Dazide accumulates in cupped areas of certain cupped-leaved varieties.
LACHENALIA sp.	To control plant growth	Concise/Sumagic	20 ppm corm soaks	Rates based on trials at Cornell University.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	100 to 200 ppm spray	Rates based on trials at Cornell University.
			1 to 2 mg a.i./pot drench	Rates based on trials at Cornell University.
LAMIUM	To control plant growth	Concise/Sumagic	5 ppm spray	
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	30 ppm spray	
			1 ppm drench	
	To increase lateral branching	Collate/Florel	500 ppm spray	Improves branching and produces compact growth.
LANTANA	To control plant growth	Citadel + Dazide/Cycocel + B-Nine	2,500 to 5,000 ppm + 1,000 to 1,500 ppm Cycocel applied as a tank-mix spray	Cultivar response varies.
		Piccolo/Bonzi/Paczol	20 to 40 ppm spray	
		Concise/Sumagic	10 to 20 ppm spray	
	To increase lateral branching	Augeo	781 to 1,562 ppm spray	
		Florel/Collate	500 ppm spray	Florel and Collate applications will provide some growth retardant effects and delay flowering. Read the label for restrictions on timing of applications.
LAURENTIA AXILLARIS	To control plant growth	Abide/A-Rest	2 to 4 ppm spray	
		Dazide/B-Nine	2,500 ppm spray	
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	1 to 2 ppm drench	
LIATRIS	To control plant growth	Abide/A-Rest	25 to 132 ppm spray	
			0.25 to 0.5 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot)	Drench volumes and mg a.i. vary with pot size.
		Dazide/B-Nine	2,500 to 5,000 ppm spray	
LILY, Easter	To control plant growth	Abide/A-Rest	30 to 132 ppm spray. Use 50 ppm spray as a base rate and adjust as needed.	Apply when newly developing shoots are 2 to 3 in. long; a second application when shoots average 6 in. long may be needed.
			0.25 to 0.5 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Single drench should be applied when shoots average 3 to 5 in. long. Drench volumes and mg a.i. vary with pot size.



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LILY, Easter <i>continued</i>	To control plant growth	Concise	3 to 15 ppm spray	Apply when shoots average 3 in. tall. It is best to make only one foliar application per crop.
			0.03 to 0.06 mg a.i. (0.23 to 0.5 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Apply when shoots average 3 in. tall. Use lower rates on cultivars such as Nellie White and higher rates for Ace. For Florida only: use a solution concentration of between 0.05 to 0.12 mg a.i. (0.4 to 1.0 ppm) drench for a 6-in. pot (0.11 to 0.26 fl. oz./gal of drench solution, apply 4 fl. oz./6-in. pot).
		Concise/Sumagic	3 to 15 ppm spray	Apply when shoots average 3 in. tall.
	0.03 to 0.06 mg a.i. (0.25 to 0.5 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot		Drench volumes and mg a.i. vary with pot size.	
	To prevent leaf yellowing	Fresco/Fascination	5 to 10 ppm spray	Apply early season (7 to 10 days PRIOR to visible bud stage) and mid-season (7 to 10 days AFTER visible bud stage). Apply spray only to lower leaves to minimize stem elongation. See label.
	To prevent leaf yellowing and prolong flowering	Fresco/Fascination	100 ppm spray	Apply late season (when first bud reaches at least 3 in. in length) and no more than 14 days prior to placement in a cooler or shipping. Apply to foliar and flower buds. See label.
LILY, Hybrid	To control plant growth	Piccolo/Piccolo 10 XC/Bonzi/Paczol	200 to 500 ppm spray	See CALADIUM.
		Piccolo/Bonzi/Paczol	5 to 30 ppm bulb soak	Soak bulbs in the solution for 15 min. prior to planting.
		Piccolo/Piccolo 10 XC/Bonzi/Paczol/Downsize	0.25 to 0.5 mg a.i. (4 to 30 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Single drench should be applied when shoots average 3 to 5 in. long. Drench volumes and mg a.i. vary with pot size and cultivar.
		Concise	2.5 to 20 ppm spray	Conduct a trial to determine optimal rates for each cultivar and adjust the rate as needed. Spray when shoots average 3 in. tall. If a second application is needed or a split application is made, it should be applied when the shoots average 6 in. tall. Usually two applications of foliar sprays at a lower rate are more effective than one application at a higher rate. Avoid applications after visible bud stage.
			1 to 3 ppm drench	Drench volume varies with pot size. Applications should be made when newly emerged shoots are 1 to 2 in. tall.
			1 to 10 ppm bulb soak	Treatment soak time should range from 1 to 5 minutes. Soak time will vary depending on bulb size, cultivar, and final desired height. Lower rates may require longer soak times (5 to 10 minutes) than higher rates (1 minute).
		Concise/Sumagic	3 to 15 ppm spray	Apply when shoots average 3 in. tall.
	0.03 to 0.06 mg a.i. (0.25 to 0.5 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot		Drench volumes and mg a.i. vary with pot size.	
	Topflor	0.25 to 0.5 mg a.i. (2.1 to 4.2 ppm) drench for a 6-in. pot	Based on NC State University trials. Adjust rates for other locations and plant response.	
	To prevent leaf yellowing	Fresco/Fascination	5 to 10 ppm spray	Apply early season (7 to 10 days PRIOR to visible bud stage) and mid-season (7 to 10 days AFTER visible bud stage). Apply spray only to lower leaves to minimize stem elongation. See label.
To prevent leaf yellowing and prolong flowering	Fresco/Fascination	100 ppm spray	Apply late season (when first bud reaches at least 3 in. in length) and no more than 14 days prior to placement in a cooler or shipping. Apply to foliar and flower buds. See label.	

## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
LILY, Oriental	To control plant growth	Piccolo/Bonzi/Paczol	100 to 200 ppm bulb soak	Ten minute preplant soaks provided excellent results in NC State University trials. Cultivar response varied.
		Concise	2.5 to 10 ppm spray	See Concise label comments for Hybrid lilies.
			1 to 10 ppm bulb soak	See Concise label comments for Hybrid lilies.
		Concise/Sumagic	1 to 10 ppm bulb soak	See Concise label comments for Hybrid lilies. Ten minute preplant soaks of 5 ppm provided excellent results in NC State University trials. Cultivar response varied.
		Piccolo 10 XC	200 to 500 ppm spray	Begin spray applications when plants reach a height of 2 to 4 inches.
	4 to 30 ppm drench		Drench volume varies with pot size. Begin drench applications when plants reach a height of 1 to 2 inches.	
	Topflor	0.5 mg a.i. drench (4.2 ppm); apply 4 fl. oz./6-in. pot	Optimal rate based on NC State University trials. Adjust rate for plant vigor. Drench volumes and mg a.i. vary with pot size.	
25 ppm bulb soak		Ten minute preplant soaks provided excellent results in NC State University trials. Cultivar response varied.		
	To prevent leaf yellowing	Fresco/Fascination	100 ppm spray	Apply early season (7 to 10 days PRIOR or AFTER visible bud stage). Apply spray only to lower leaves to minimize stem elongation. See label.
	To prevent leaf yellowing and prolong flowering	Fresco/Fascination	100 ppm spray	Apply late season (no more than 14 days prior to placement in a cooler or shipping). Apply to foliar and flower buds. See label.
LINARIAHYBRIDA (Babysnapdragon)	To control plant growth	Dazide + Citadel/B-Nine + Cycocel	2,500 ppm Dazide/B-Nine + 300 to 500 ppm Citadel/Cycocel applied as a tank-mix spray	Controlled plant growth, but didn't strengthen stems, as well as paclobutrazol sprays.
		Piccolo/Piccolo 10 XC/Bonzi/Paczol	10 to 30 ppm spray	Use 10 ppm 1 week after transplant. Make a second application of 20 to 30 ppm once the secondary shoots are 2-in. long. Stenghtened stems and improved flower coloration.
LINER DIPS	To control plant growth	Piccolo	0.5 to 8 ppm preplant liner dip	See label: for detailed recommendations for chemical application techniques, adjusting rates for northern or southern locations, and the specific rates for achieving the desired level of activity.
LIPSTICK VINE	To increase lateral branching	Augeo	521 to 1,042 ppm spray	
LISIANTHUS (Eustoma)	To control plant growth	Abide/A-Rest	0.5 mg a.i. drench	Cultivar response varies.
		Concise/Sumagic	5 to 10 ppm spray	Cultivar response varies.
		Dazide/B-Nine	2,500 to 5,000 ppm spray	Cultivar response varies.
		Piccolo/Piccolo 10 XC/Bonzi/Paczol	4 to 16 ppm drench	Cultivar response varies.
LOBELIA	To control plant growth	Dazide/B-Nine	1,500 to 2,500 ppm spray	
		Concise/Sumagic	1 to 10 ppm spray	
		Piccolo/Piccolo 10 XC/Bonzi/Paczol	4 ppm spray	
			1 ppm drench	Can be used 3 to 5 weeks before sale to control stretch.

## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
LOBULARIA	To control plant growth	<b>Piccolo</b>	4 to 8 ppm liner root soak	See BACOPA. Rate based on North Carolina State University trials with Snow Princess.
			75 to 100 ppm spray	Sprays less effective than preplant liner soaks or substrate drenches. Rate based on North Carolina State University trials with Snow Princess.
			2 to 4 ppm drench	Drench volume varies with pot size. Rate based on North Carolina State University trials with Snow Princess.
		<b>Concise</b>	0.5 to 1 ppm liner root soak	See BACOPA. Rate based on North Carolina State University trials with Snow Princess.
			20 to 25 ppm spray	Sprays less effective than preplant liner soaks or substrate drenches. Rate based on North Carolina State University trials with Snow Princess.
			1 to 2 ppm drench	Drench volume varies with pot size. Rate based on North Carolina State University trials with Snow Princess.
Topflor	10 ppm spray			
MANDEVILLA SANDERI (Dipladenia)	To control plant growth	None	None	Plants grown with good light and optimal growing conditions generally do not need PGRs.
MARIGOLD	To control plant growth	<b>Abide/A-Rest</b>	13 to 33 ppm spray	
		<b>Dazide/B-Nine</b>	2,500 to 5,000 ppm spray	
		<b>Piccolo/Piccolo 10 XC/ Bonzi/Paczol</b>	15 to 60 ppm spray	See remarks for AGERATUM. Use 15 to 30 ppm for French type and 30 to 60 ppm for African type (apply at an early stage of plant growth for African type with good stem coverage, especially for vigorous varieties).
		<b>Citadel/Chlormequat E-Pro/ Cycocel</b>	800 to 1,500 ppm spray	
		<b>Concise/Sumagic</b>	10 to 20 ppm spray	
		Topflor	20 to 60 ppm spray	Based on NC State University trials. Adjust rates for other locations.
MARIGOLD, Plugs	To control plant growth	<b>Piccolo/Piccolo 10 XC/ Bonzi/Paczol</b>	5 to 20 ppm spray	Timing of application should normally begin at the 1 to 2 true leaf stage. Use 5 to 10 ppm for French types and 10 to 20 ppm for African types.
MATTHIOLA, Bedding Plant (Stock)	To control plant growth	<b>Dazide + Citadel/B-Nine + Cycocel</b>	800 to 5,000 ppm Dazide/B-Nine + 1,000 to 1,500 ppm Citadel/Cycocel applied as a tank-mix spray	
MATTHIOLA, Cut (Stock)	To promote growth and stem elongation	<b>Florgib/ProGibb T&amp;O</b>	50 to 100 ppm spray	Apply when plants are 4 to 8 in. tall. Apply at 2- to 3- week intervals. See label for precautions.
MELAMPODIUM	To control plant growth	<b>Dazide/B-Nine</b>	2,500 ppm spray	Use when plants reach 75% of marketable size to tone.
MIMULUS	To control plant growth	<b>Dazide/B-Nine</b>	2,500 ppm spray	Use if needed. Delay in flowering possible with multiple applications.
MONARDA	To control plant growth	<b>Piccolo/Piccolo 10 XC/ Bonzi/Paczol</b>	60 to 160 ppm spray	
		<b>Piccolo/Piccolo 10 XC/ Bonzi/Paczol/Downsize</b>	>0.48 mg a.i. (>4 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	
		<b>Concise/Sumagic</b>	15 to 30 ppm spray	
MONSTERA	To control plant growth	<b>Abide/A-Rest</b>	25 to 132 ppm spray	
			0.25 to 0.5 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Drench volumes and mg a.i. vary with pot size.

## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
MONTBRETIA	To control plant growth	Piccolo/Bonzi/Paczol	20 to 30 ppm corm soak	Soak corms in the solution for 15 min. prior to planting.
NARSISSUS	To control plant growth	Flore/Collate	500 to 2,000 ppm spray	For types requiring a vernalization period ( <b>Narcissus hybrids</b> ), apply when new leaves reach 3 to 4 in. of height. For paperwhite narcissus ( <b>Narcissus tazetta</b> ), apply 2,000 ppm when the new leaves are 3- to 4-in. tall. Cultivar response varies, so conduct your own trial to determine suitable concentrations. Results based on Cornell University trials.
NASTURTIIUM	To control plant growth	Citadel/Chlormequat E-Pro/Cyclocel	800 to 1,500 ppm spray	Use only on non-food plants.
NEMESIA	To control plant growth	Dazide/B-Nine	2,500 to 5,000 ppm spray	Use on compact varieties to tone and hold crop.
		Piccolo/Bonzi/Paczol	10 to 20 ppm spray	Based on NC State University trials.
		Flore/Collate	250 to 500 ppm spray	Make final application 4 to 6 weeks before sale.
		Concise/Sumagic	3 to 30 ppm spray	In NC State University trials, 5 ppm worked well on Vanilla Sachet.
		Topflor	2.5 to 5 ppm spray	Recommendation based on NC State University trials with Vanilla Sachet.
NEPHTHYTIS, Green and Green Gold	To control plant growth	Abide/A-Rest	25 to 132 ppm spray	Drench volumes and mg a.i. vary with pot size.
			0.25 to 0.5 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	
NEW GUINEA IMPATIENS	To control plant growth	Piccolo/Piccolo 10 XC/Bonzi/Paczol	0.25 to 15 ppm spray	Apply 2 to 4 weeks after transplanting. Cultivars' response to PGRs varies greatly. Test a few plants to determine rate for optimal control.
		Piccolo/Bonzi/Paczol	0.25 to 2 ppm drench	Drench volumes vary with pot size. See label for recommendations. Cultivars response to PGRs varies greatly. Test a few plants to determine rate for optimal control.
		Flore/Collate	100 to 300 ppm spray	To increase lateral branching and reduce premature flowering, don't apply within 8 weeks of desired flower date.
		Topflor	5 to 15 ppm spray	Apply 2 to 4 weeks after transplanting. Cultivars' response to PGRs varies greatly. Test a few plants to determine rate for optimal control.
NEW GUINEA IMPATIENS, Plugs	To control plant growth	Piccolo 10 XC	0.25 to 5 ppm spray	See Piccolo remarks for AGERATUM, Plugs.
NICOTIANA	To control plant growth	Dazide/B-Nine	2,500 to 5,000 ppm spray	Higher initial rates can be used after the plant becomes established. Use lower rate with multiple applications at 3-week interval.
NOLANAPARADOXA	To control plant growth	Flore/Collate	500 ppm spray	To keep plants more compact. Based on Texas A&M University trials.
OENOTHERA	To control plant growth	Concise/Sumagic	5 to 10 ppm spray	Apply if needed.
ORNAMENTAL CABBAGE and KALE (Non-food)	To control plant growth	Dazide/B-Nine	2,500 to 5,000 ppm spray	Use the higher rates for more vigorous types/cultivars. Multiple applications may be needed. Recommendation based on North Carolina conditions.
		Concise/Sumagic	2.5 to 8 ppm spray	Use higher rates for more vigorous cultivars. Cultivar response can vary. Recommendation based on North Carolina conditions.
ORNAMENTAL PEPPERS (Capsicum) (Non-food)	To control plant growth	Piccolo/Bonzi/Paczol	20 ppm foliar spray	Recommendation based on North Carolina conditions for a moderately vigorous cultivar.
		Concise/Sumagic	5 to 15 ppm spray	

## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
ORNAMENTAL VEGETABLES (Non-food)	To control plant growth	Dazide/B-Nine	2,500 to 5,000 ppm spray	Use the higher rates for more vigorous types/cultivars like kale Red Bor. Multiple applications may be needed. Recommendation based on North Carolina conditions.
		Concise/Sumagic	10 to 25 ppm spray	Use higher rates for more vigorous cultivars. Recommendation based on North Carolina conditions.
ORNITHOGALUM	To increase stem length	Florgib/ProGibb T&O	100 ppm dip	Soak the bulbs for 20 minutes prior to potting.
OSTEOSPERMUM	To control plant growth	Citadel/Cycocel	750 to 1,500 ppm spray	Two applications may be required. Two applications of 1,500 ppm (with the first applied at the start and the second at the end of the vernalization period) provided excellent results in NC State University trials.
			1,500 to 3,000 ppm drench	Drench volumes vary with pot size. See label for recommended volumes.
		Concise/Sumagic	8 ppm spray	Recommendation based on European trials on a cultivar with prostrate growth. Rates less than 24 ppm were not effective in NC State University trials.
			0.25 to 2 ppm drench; apply 3 fl. oz./5-in pot	One application of 1 to 2 ppm (at the start of vernalization) or two applications of 1 ppm (at the start of vernalization) and 0.5 ppm (at the end of the vernalization period) provided excellent results in NC State University trials for 4.5-in. production.
		Dazide/B-Nine	2,500 to 4,000 ppm spray	Can be applied 3 or 4 times (weekly) after pinch.
		Dazide + Citadel/B-Nine + Cycocel	1,500 to 3,000 ppm Dazide/B-Nine + 1,000 to 1,500 ppm Citadel/Cycocel applied as a tank-mix spray	Multiple sprays required. Stop applications after visible bud to avoid flower delay and smaller flowers. Not effective in NC State University trials.
		Piccolo	4 to 8 ppm liner root soak	See BACOPA. Rate based on Michigan State University trials.
		Piccolo/Bonzi/Paczol	27 to 54 ppm drench (8 to 16 mg a.i.) during production	Drench volumes vary with pot size. See label for recommended volumes. (based on NC State University trials)
			2 to 3 ppm drench (0.236 to 0.35 mg a.i.) for holding plants	
		Piccolo/Piccolo 10 XC/Bonzi/Paczol	15 to 30 ppm spray	
		Topflor	20 to 60 ppm spray	
1 to 2 ppm drench; apply 3 fl. oz./5-in pot	One application of 1 to 2 ppm (at the start of vernalization) or two applications of 1 ppm (at the start of vernalization) and 0.5 ppm (at the end of the vernalization period) provided excellent results in NC State University trials for 4.5-in. production.			
OTACANTHUS	To control plant growth	Dazide/B-Nine	2,500 ppm spray	Make first application when new growth appears after pinching. A second application may be used if a second pinch is planned.
OTOMERIA	To control plant growth	Dazide/B-Nine	1,700 ppm spray	Apply 1 to 3 times if needed to tone the plant.
OXALLIS	To control plant growth	Abide/A-Rest	33 ppm spray	To limit petiole stretch.
		Concise/Sumagic	0.1 mg a.i. / 4.5-in. pot drench	
		Piccolo/Piccolo 10 XC/Bonzi/Paczol	1 to 4 ppm sprays	Rates for <i>O. regnellii</i> .
1 to 10 ppm preplant dip	Dip for 5 minutes. Rates for <i>O. regnellii</i> .			

## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
PANSY	To control plant growth	Abide/A-Rest	3 to 15 ppm spray	See AGERATUM.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	5 to 15 ppm spray	Apply when plants are 2 in. in diameter. Use higher rates for higher temperatures and more vigorous cultivars. Late applications may delay flowering.
		Concise/Sumagic	1 to 6 ppm spray	Apply when plants are 3 to 4 in. tall. Use higher rates for higher temperatures and more vigorous cultivars. Late applications may delay flowering.
		Topflor	2.5 to 7.5 ppm spray	Based on NC State University trials. Adjust rates for other locations. Pansies are very responsive to Topflor, so start trials with lower rates.
PANSY PLUGS	To control plant growth	Piccolo/Piccolo 10 XC/ Bonzi/Paczol	1 to 5 ppm spray	Timing of application should normally begin at the 1 to 2 true leaf stage. Pansies are sensitive as plugs, so determine optimal rates.
PENNISETUM GLAUCUM	To control plant growth	Collate/Florel	500 ppm spray	Apply first application 4 weeks after sowing or 1 week after transplant. If needed, a second application can be made 10 to 14 days later. Promotes side shoot production more than providing height control.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	6 to 8 ppm drench	For direct-sown seed, apply paclobutrazol 4 weeks after sowing. A second application possible 10 days later, if needed.
			3 to 5 ppm drench	For plugs, apply 1 week after transplant.
PENNISETUM SETACEUM 'Rubrum'	To control plant growth	Concise/Sumagic	5 ppm spray	First application can be made 21 days after transplanting. Repeat if needed 14 days later.
PENSTEMON HARTWEGII	To control plant growth	Citadel+Dazide/Cycocel+B-Nine	1,000 ppm + 2,500 ppm spray	Rates for moderately vigorous cultivars. Up to 2 sprays may be needed.
		Concise/Sumagic	5 to 10 ppm spray	Rates for moderately vigorous cultivars. Up to 2 sprays may be needed.
		Dazide/B-Nine	2,500 ppm spray	Rates for moderately vigorous cultivars. Up to 2 sprays may be needed.
		Florel/Collate	Spray	Not recommended because of flower delay.
PENTAS	To control plant growth	Abide/A-Rest	2 to 4 ppm spray	
		Citadel/Cycocel	1,000 to 1,500 ppm spray	
		Dazide/B-Nine	2,500 to 5,000 ppm spray	
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	2 to 3 ppm spray	
PEPINO	To control plant growth	Concise/Sumagic	2 to 10 ppm spray	See precautions listed with EGGPLANT.
PEPPER	To control plant growth	Concise/Sumagic	2 to 10 ppm spray	See precautions listed with EGGPLANT.
PERENNIALS (Not specifically listed in this table)	To induce lateral or basal branching	Configure	50 to 500 ppm spray	The supplemental label allows legal use on greenhouse grown plants not specifically listed on the original label. See label for trialing suggestions and precautions.
PERICALLIS (Cineraria)	To control plant growth	Dazide/B-Nine	2,000 ppm spray	Apply every 14 days, if needed.
PERILLA	To control plant growth	Concise/Sumagic	3 to 5 ppm spray	Apply if needed.
		Dazide/B-Nine	2,000 to 4,000 ppm spray	Apply 1 to 3 times as needed.
		Dazide + Citadel/B-Nine + Cycocel	2,500 to 4,000 ppm + 1,000 to 1,500 ppm Citadel/Cycocel applied as a tank-mix spray	
		Piccolo/Bonzi/Paczol	10 to 20 ppm spray	

## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
PETUNIA, Seed	To control plant growth	<b>Abide/A-Rest</b>	10 to 26 ppm spray	See AGERATUM.
		<b>Dazide/B-Nine</b>	2,500 to 5,000 ppm spray	
		<b>Piccolo/Piccolo 10 XC/Bonzi/Paczol</b>	15 to 45 ppm spray	
		<b>Concise/Sumagic</b>	25 to 50 ppm spray	
		<b>Topflor</b>	20 to 60 ppm spray	Based on NC State University trials. Adjust rates for other locations.
PETUNIAPLUGS, Seed	To control plant growth	<b>Piccolo/Piccolo 10 XC/Bonzi/Paczol</b>	5 to 10 ppm spray	Timing of application should normally begin at the 1 to 2 true leaf stage.
PETUNIA, Vegetative	To control plant growth	<b>Abide/A-Rest</b>	10 to 26 ppm spray	Multiple applications may be required.
		<b>Dazide/B-Nine</b>	2,500 to 5,000 ppm spray	
		<b>Dazide + Bonzi/Piccolo/B-Nine/Paczol</b>	2,500 ppm spray + 40 ppm Bonzi/Piccolo/Paczol applied as a tank-mix spray	Recommendation based on NC State University trials.
		<b>Dazide + Topflor/B-Nine</b>	2,500 ppm spray + 15 to 30 ppm Topflor applied as a tank-mix spray	Recommendation based on NC State University trials.
		<b>Piccolo/Bonzi/Paczol</b>	5 to 45 ppm spray	An application at 2 to 4 ppm can be made 1 to 2 weeks after transplanting, followed by a 20 to 30 ppm spray 2 to 3 weeks later. Cultivars' responses to PGRs vary. Test a few plants to determine rate for optimal control. Finished plants can be maintained and have prolonged shelf life when 5 to 10 ppm sprays are applied on full-grown, mature plants. Recommendations based on Michigan conditions.
		<b>Concise/Sumagic</b>	20 to 50 ppm spray	20 ppm worked well in NC State University trials.
		<b>Piccolo</b>	12 ppm liner root soak	See BACOPA. Rate based on Michigan State University trials with petunia multiflora prostrate Wave Purple.
		<b>Topflor</b>	15 to 60 ppm spray	Recommendation based on NC State University trials.
	To increase lateral branching	<b>Florel/Collate</b>	300 to 500 ppm spray	
PHALAENOPSIS Orchids	To increase flower number and earlier flowering	<b>Configure</b>	200 to 400 ppm spray	Apply Configure 1 week after the start of forcing (cooling). Cultivar response varies. Some cultivars are sensitive to Configure and distorted flower stalks may form, so conduct your own trials to determine suitability. Recommendation based on Michigan State University trials.
	To control inflorescence length	<b>Concise/Sumagic</b>	100 to 200 ppm spray	Apply when the flower spike length is 1 in. (3 cm).
		<b>Piccolo/Piccolo 10 XC/Bonzi/Paczol</b>	250 ppm spray	Apply when the flower spike length is 1 in. (3 cm).
PHILODENDRON	To control plant growth/vine control	<b>Abide/A-Rest</b>	25 to 132 ppm spray 0.25 to 0.5 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Drench volumes and mg a.i. vary with pot size.
		<b>Citadel/Cycocel</b>	3,000 ppm spray	
		<b>Dazide/B-Nine</b>	2,500 to 7,500 ppm spray	
PHLOX DRUMMONDII	To control plant growth	<b>Dazide/B-Nine</b>	2,500 to 5,000 ppm spray	
PHLOXMACULATA, (Hybrid)	To control plant growth	<b>Concise/Sumagic</b>	5 to 10 ppm spray	
		<b>Dazide/B-Nine</b>	2,500 to 5,000 ppm spray	
		<b>Topflor</b>	10 to 15 ppm spray	

## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
PILEA	To control plant growth	Abide/A-Rest	25 to 132 ppm spray	Drench volumes and mg a.i. vary with pot size.
			0.25 to 0.5 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	
PLATYCODON	To control plant growth	Abide/A-Rest	100 ppm spray	PGRs usually not required.
		Dazide/B-Nine	1,500 to 5,000 ppm spray	PGRs usually not required. High rates have been reported to cause edge burn.
PLECTRANTHUS	To control plant growth	Dazide + Citadel/B-Nine + Cycocel	1,500 to 2,500 ppm + 750 to 1,000 ppm Citadel/Cycocel applied as a tank-mix spray	Cultivars' responses to PGRs vary. Test a few plants to determine rate for optimal control. See label.
		Piccolo/Bonzi/Paczol	5 to 20 ppm spray	Cultivars' responses to PGRs vary.
PLUMBAGO AURICULATA	To control plant growth	Collate/Florel	1,000 ppm spray	Pinching plants help improve the overall form. In addition, to further enhance secondary shoots, apply PGR 1 week before pinch.
POINSETTIA	To control plant growth	Abide/A-Rest	0.06 to 0.25 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Drench volume and mg a.i. vary with pot size. Start with lower rates.
		Dazide/B-Nine	2,000 to 3,000 ppm spray	Not effective in NC State University studies.
		Dazide + Citadel/B-Nine + Cycocel	800 to 2,500 ppm + 1,000 to 1,500 ppm Citadel/Cycocel applied as a tank-mix spray	Use the higher rates of this tank-mix spray on stock plants and for finishing crops in very warm regions. Outside of very warm areas, use the lower rates. Late applications can delay flowering and reduce bract size.
		Piccolo/Bonzi/Paczol	10 to 30 ppm spray	Use higher rates of 15 to 45 ppm in southern Florida. Applications to slower-growing cultivars in cool climates should begin when axillary shoots are 2 to 3 in. long. For vigorous growing cultivars in warm climates, applications should begin when axillary shoots are 1.5 to 3 in. long. See label for other precautions.
		Piccolo/Bonzi/Paczol/Downsize	0.237 to 0.473 mg a.i. (0.25 to 3 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Drenches generally have less of an effect on bract size than sprays. Drench volume and mg a.i. vary with pot size. Start with lower rates.
		Concise	2.5 to 10 ppm spray	Apply when the lateral shoots are 1.5 to 2.5 in. tall (about 10 to 14 days after pinching). Test for cultivar sensitivity. Multiple applications of the lower label rate may elicit short days. For Florida only: use a foliar spray concentration between 10 to 15 ppm (2.5 to 3.8 fl. oz./gal) and do not apply after October 25.
		Citadel/Chlormequat E-Pro/Cycocel	800 to 1,500 ppm spray	For natural season crops in N.C., don't apply Cycocel after mid-October to November 1. Late applications can reduce bract size and delay flowering.
			3,000 to 4,000 ppm drench	Drench volume varies with pot size. Consult the label for recommended volumes.
		Concise/Sumagic	2.5 to 10 ppm spray	
		Topflor	2.5 to 80 ppm spray	Use lower rates for less vigorous cultivars. SEE LABEL FOR ADDITIONAL RATE RECOMMENDATIONS.
0.03 to 0.5 mg a.i. (0.25 to 4.2 ppm) drench for a 6-in. pot				
To promote plant growth	Fascination	3 ppm spray	Use an early-season application during vegetative growth prior to the start of short days and flower initiation if promoting vegetative growth. SEE LABEL FOR ADDITIONAL PRECAUTIONS BEFORE USE.	
	Fresco/Fascination	3 to 10 ppm spray	Use a late-season application to promote bract expansion. SEE LABEL FOR ADDITIONAL PRECAUTIONS BEFORE USE.	



## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
POINSETTIA, Tree	To control plant growth	<b>Concise</b>	2 to 3 ppm drench for a 6-in. pot	For use in Florida only: Apply when the lateral shoots are 1.5 to 2.5 in. tall (about 10 to 14 days after pinching). Test for cultivar sensitivity. Do not apply after October 25.
PORPHYROCOMA POHLIANA (Brazilian Fireworks)	To improve foliage color and for earlier flowering	<b>Piccolo/Piccolo 10 XC/ Bonzi/Paczol</b>	3 to 5 ppm spray	Height control generally not needed and rates above 5 ppm can cause leaf puckering.
PORTULACA OLERACEA	To control plant growth	<b>Abide/A-Rest</b>	7 to 26 ppm spray	
		<b>Concise/Sumagic</b>	15 to 30 ppm spray	
		<b>Piccolo/Piccolo 10 XC/ Bonzi/Paczol</b>	5 ppm drench	Apply 7 days after transplant. May replace the need to pinch.
		<b>Topflor</b>	30 ppm spray	Apply 7 days after transplant. Repeat 2 weeks later, if needed.
	To increase lateral branching	<b>Citadel/Cyclocel</b>	5,000 ppm spray	Apply 5 to 6 days after pinching to improve branching of cuttings.
		<b>Collate/Florel</b>	300 to 500 ppm spray	Recommendations based on Michigan conditions. Defoliation can occur with rates greater than 300 ppm.
POTHOS	To control plant growth	<b>Abide/A-Rest</b>	25 to 132 ppm spray	
			0.25 to 0.5 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Drench volumes and mg a.i. vary with pot size.
		<b>Dazide/B-Nine</b>	2,500 to 7,500 ppm spray	
		<b>Piccolo/Piccolo 10 XC/ Bonzi/Paczol</b>	4 to 6 mg a.i. drench for a 8-in. pot; apply 10 fl. oz./8-in. pot	
PRIMULAACAULIS	To control plant growth	<b>Dazide/B-Nine</b>	1,000 to 2,500 ppm spray	PGRs usually not required.
PRIMULA OBCONICA	To control plant growth	<b>Dazide/B-Nine</b>	5,000 ppm spray	PGRs usually not required.
PURPLE CONEFLOWER	To control plant growth	<b>Concise/Sumagic</b>	30 to 40 ppm spray	
PURPLEPASSION	To control plant growth	<b>Abide/A-Rest</b>	26 to 132 ppm spray	
			0.25 to 0.5 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Drench volumes and mg a.i. vary with pot size.
RANUNCULUS	To control peduncle length	<b>Dazide/B-Nine</b>	2,500 to 5,000 ppm spray	Make first application after 4 weeks. Repeat at lower rate every 2 weeks if needed. 3 to 4 applications may be needed. Conduct trials to determine optimal concentrations and timing.
ROSE, Pot	To control plant growth	<b>Concise/Sumagic</b>	0.1 to 0.2 mg a.i./pot drenches	Usually only a single application is made.
		<b>Piccolo/Piccolo 10 XC/ Bonzi/Paczol</b>	16 to 25 ppm sprays	Begin applications after the final pinch. Make the first one in 14 to 21 days. Repeat weekly if needed. Discontinue applications after visible bud.
SALVIA, Annual	To control plant growth	<b>Abide/A-Rest</b>	10 to 26 ppm spray	
		<b>Dazide/B-Nine</b>	2,500 to 5,000 ppm spray	
		<b>Piccolo/Piccolo 10 XC/ Bonzi/Paczol</b>	20 to 60 ppm spray	
		<b>Citadel/Chlormequat E-Pro/ Cyclocel</b>	800 to 1,500 ppm spray	
		<b>Concise/Sumagic</b>	5 to 10 ppm spray	
		<b>Topflor</b>	20 to 80 ppm spray	Based on NC State University trials. Adjust rates for other locations.

## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
SALVIA PLUGS, Annual	To control plant growth	Piccolo/Piccolo 10 XC/ Bonzi/Paczol	5 to 10 ppm spray	Timing of application should normally begin at the 1 to 2 true leaf stage.
SALVIFARINACEA	To control plant growth	Citadel+Dazide/Cycocel+B-Nine	1,000 ppm + 2,500 ppm spray	Apply if growth control is needed.
		Florel/Collate	Spray	Not recommended because of flower delay.
SALVIA GUARANITICA	To control plant growth	Citadel+Dazide/Cycocel+B-Nine	1,000 to 1,500 ppm + 2,000 to 3,500 ppm spray	
SALVIA HYBRID	To control plant growth	Dazide/B-Nine	1,500 to 2,500 ppm spray	
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol/Downsize	0.5 to 1 ppm drench	
SALVIA LONGISPICATA x FARINACEA	To control plant growth	Dazide/B-Nine	2,500 to 3,000 ppm spray	
SALVIA PATENS	To control plant growth	Citadel+Dazide/Cycocel+B-Nine	1,000 ppm + 2,500 ppm spray	
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol/Downsize	1 ppm drench	Trial rate before use.
SALVIA, Perennial	To control plant growth	Piccolo/Piccolo 10 XC/ Bonzi/Paczol	40 to 60 ppm spray	
SALVIA, Vegetative	To control plant growth	Dazide/B-Nine	1,000 to 2,000 ppm spray	Multiple applications may be needed to tone crop.
		Dazide + Citadel/B-Nine + Cycocel	2,000 to 3,500 ppm + 1,000 to 1,500 ppm Citadel/Cycocel applied as a tank-mix spray	
SANVITALIA	To control plant growth	Dazide/B-Nine	1,200 to 5,000 ppm spray	Use to tone plants. Cultivars' response to PGRs varies. Test a few plants to determine rate for optimal control.
SCAEVOLAEMULA	To control plant growth		30 ppm spray	Based on NC State University trials, 30 ppm worked well. Adjust rates to other locations; test on a few plants to determine rate for optimal control.
		Concise/Sumagic	0.125 ppm drench (0.011 mg a.i.) for a 5-in. pot; apply 3 fl. oz./5-in. pot	Drench volumes vary with pot size. See label for recommended volumes. Scaevola is very responsive to Concise/Sumagic drenches. Test on a few plants to determine rate for optimal control. Recommendations based on NC State University trials.
		Dazide/B-Nine	2,500 ppm spray	
			20 to 40 ppm spray	
		Piccolo/Bonzi/Paczol	1 to 3 ppm drench (0.12 to 0.35 mg a.i.)	Drench volumes vary with pot size. See label for recommended volumes. Cultivars' response to PGRs varies. Start with lowest rate in your trials.
			45 to 60 ppm spray	Recommendations based on NC State University trials.
		Topflor	0.79 to 2.25 ppm drench (0.075 to 0.2 mg a.i.)	Drench volumes will vary with pot size. See label for recommended volumes. Scaevola is very responsive to Topflor. Test the lower rates on a few plants. Recommendations based on NC State University trials.
		2 to 4 ppm liner dip	Scaevola is very responsive to Topflor. Test the lower rates on a few plants. Recommendations based on NC State University trials.	
	To increase lateral branching	Florel/Collate	300 to 500 ppm spray	Apply early, typically 2 to 3 weeks after pinching.

## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
SCHEFFLERA	To control plant growth	<b>Abide/A-Rest</b>	25 to 132 ppm spray 0.25 to 0.5 mg a.i. (2 to 4 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Drench volumes and mg a.i. may vary with pot size.
		<b>Dazide/B-Nine</b>	2,500 to 7,500 ppm spray	
	To increase lateral branching	Augeo	3,125 ppm spray	Labeled for Schefflera arboricola only.
SCHIZANTHUS	To control plant growth	<b>Abide/A-Rest</b>	1 to 2 ppm spray	
		<b>Dazide/B-Nine</b>	1,500 to 3,000 ppm spray	
SCOPARIA	To control plant growth	<b>Dazide/B-Nine</b>	1,000 to 2,500 ppm spray	Use to tone plants if needed.
SCUTELLARIA JAVANICA (Skullcap)	To control plant growth	<b>Dazide + Citadel/B-Nine + Cycocel</b>	2,500 ppm Dazide + 1,000 ppm Citadel tank mix spray	Begin applications 2 to 3 weeks after transplanting. Repeat as needed every 2 weeks.
SEMPERVIVUM spp.	To induce offsets	<b>Configure</b>	100 to 400 ppm spray	Based on NC State University trials when applied 2 weeks after potting. For retail sales, 400 ppm produced the most offsets. For stock plant production, 100 to 200 ppm provided a balance between an increase in offset number and a larger offset size.
SHASTA DAISY	To control plant growth	<b>Concise/Sumagic</b>	15 to 30 ppm spray	
SHRIMP PLANT	To control plant growth	<b>Abide/A-Rest</b>	25 to 50 ppm spray	Apply after plants established.
		<b>Dazide/B-Nine</b>	1,000 ppm	Apply after plants established.
	To increase lateral branching	Augeo	781 to 1,562 ppm spray	
SNAPDRAGON, Seed (ANTIRRHINUM)	To control plant growth	<b>Abide/A-Rest</b>	10 to 26 ppm spray	
		<b>Concise/Sumagic</b>	25 to 50 ppm spray	
		<b>Dazide + Citadel/B-Nine + Cycocel</b>	800 to 1,000 ppm Dazide/B-Nine + 800 to 1,000 ppm Citadel/Cycocel applied as a tank-mix spray	
		<b>Piccolo/Piccolo 10 XC/Bonzi/Paczol</b>	30 to 90 ppm spray	Apply at an early stage of plant growth with good stem coverage, especially for vigorous varieties.
SNAPDRAGON PLUGS, Seed (ANTIRRHINUM)	To control plant growth	<b>Piccolo/Piccolo 10 XC/Bonzi/Paczol</b>	10 to 20 ppm spray	Timing of application should normally begin at the 1 to 2 true leaf stage.
SNAPDRAGON, Vegetative (ANTIRRHINUM)	To control plant growth	<b>Piccolo/Bonzi/Paczol</b>	30 to 60 ppm spray	
		<b>Concise/Sumagic</b>	20 to 45 ppm spray	
	To control plant growth and peduncle stretch	<b>Dazide/B-Nine</b>	1,500 ppm spray	Use during periods of high temperatures.
SPATHIPHYLLUM	To induce flowering	GibGro	265 ppm spray	Apply one full-coverage spray during non-seasonal bloom period (June through January). Some cultivars exhibit distorted blooms, increased petiole length and narrow leaves.
	To accelerate bloom and increase flower number	<b>Florgib/ProGibb T&amp;O</b>	150 to 250 ppm spray	Use a single application approximately 9 to 12 weeks prior to expected sale date. Spray to the point of runoff and thoroughly wet all growing points.

## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
STATICE, Cut (Limonium)	To promote plant growth and stem elongation	Florgib/ProGibb T&O	50 to 100 ppm spray	Apply when plants are 4 to 8 in. tall. Other applications can be made at 2- to 3-week intervals. See label.
	For earlier flowering and increased flowering	Florgib/ProGibb T&O	400 to 500 ppm spray	Give each plant 0.33 fl. oz. (10 ml) of solution. Use when plants are 10 in. or more in diameter (approximately 90 to 100 days after sowing). See label.
STEPHANOTIS, Pot	To tone plant growth	Dazide + Citadel/B-Nine + Cycocel	100 ppm + 100 ppm spray	Controls vine elongation and shortens days until flowering.
STOKESIA	To control plant growth	Piccolo/Piccolo 10 XC/ Bonzi/Paczol	40 to 80 ppm spray	
STREPTOCARPUS	To control plant growth	Abide/A-Rest	10 to 50 ppm spray	Rate based on Louisiana State University trial.
		Dazide/B-Nine	1,500 to 2,500 ppm spray	Supplier rate recommendation.
		Topflor	5 to 20 ppm spray	
	To delay premature bloom and promote additional plant growth	Collate	250 to 1000 ppm spray	Optimal rates varied significantly by cultivar. Conduct your own trials to determine optimal rates for each Streptocarpus series and specific cultivar. Results based on Iowa State University trial.
STROBILANTHES DYERIANUS (Persian Shield)	To control plant growth	Dazide/B-Nine	2,500 to 5,000 ppm spray	
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	30 ppm spray	
SUNFLOWER	To control plant growth	Citadel/Chlormequat E-Pro/ Cycocel	800 to 1,500 ppm spray	
		Piccolo/Bonzi/Paczol	2 to 4 mg a.i. drench; apply 4 fl. oz./6-in. pot	Optimal rate based on NC State University trials. Adjust rate for plant vigor. Drench volumes and mg a.i. vary with pot size.
		Concise/Sumagic	16 to 32 ppm sprays	Optimal rate based on NC State University trials. Adjust rate for plant vigor.
		Topflor	30 to 50 ppm spray 1 to 2 mg a.i. (8.45 to 16.9 ppm) drench for a 6-in. pot	
TALINUM PANICULATUM	To control plant growth	Dazide/B-Nine	2,500 to 3,500 ppm spray	For toning the crop. Apply once after transplanting.
TECOMA STANS	To control plant growth	Dazide + Citadel/B-Nine + Cycocel	2,500 ppm Dazide + 1,000 ppm Citadel tank mix spray	Begin applications 2 to 3 weeks after transplanting. Repeat as needed every 2 weeks.
THUNBERGIAALATA	To control stem elongation/plant growth	Dazide + Citadel/B-Nine + Cycocel	2,500 ppm Dazide + 1,000 ppm Citadel tank mix spray	Apply to cuttings in propagation.
TIBOUCHINA	To control plant growth	Dazide/B-Nine	2,500 ppm spray	
TOMATILLO	To control plant growth	Concise/Sumagic	2 to 10 ppm spray	See precautions listed with EGGPLANT.
TOMATO	To control plant growth	Concise/Sumagic	2 to 10 ppm spray	See precautions listed with EGGPLANT.
TORENIA FOURNIERI	To control plant growth	Concise/Sumagic	5 to 15 ppm spray	Apply if growth control is needed.
		Dazide/B-Nine	1,500 to 2,500 ppm spray	Apply if growth control is needed.
TORENIA spp.	To control plant growth	Dazide/B-Nine	1,500 ppm spray	Apply if growth control is needed
		Florel/Collate	Avoid use	Florel and Collate significantly delay flowering.

## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
<b>TROPICAL PLANTS</b> (Not specifically listed in this table)	To induce lateral or basal branching	<b>Configure</b>	50 to 500 ppm spray	The supplemental label allows legal use on greenhouse-grown plants not specifically listed on the original label. See label for trialing suggestions and precautions.
TULIP	To control plant growth	<b>Abide/A-Rest</b>	0.125 to 0.5 mg a.i. (1 to 4 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Drench volumes and mg a.i. vary with pot size.
		<b>Piccolo/Piccolo 10 XC/Bonzi/Paczol/Downsize</b>	0.591 to 4.732 mg a.i. (5 to 40 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Drench volumes and mg a.i. vary with pot size. Apply drenches 1 to 5 days after forcing begins.
		<b>Piccolo/Bonzi/Paczol</b>	2 to 5 ppm bulb soak	Soak bulbs for 1 hr. prior to planting. Ten-minute soaks of 50 ppm (1.6 oz./gal.) provided excellent results in NC State University trials. Cultivar response varied.
		<b>Concise/Sumagic</b>	10 ppm bulb soak	Ten minute preplant soaks provided excellent results in NC State University trials. Cultivar response varied.
		Topflor	0.5 to 1 mg a.i. (4.2 to 8.45 ppm) drench for a 6-in. pot	Based on NC State University trials. Adjust rates for other locations.
80 to 100 ppm spray				
		10 to 40 ppm bulb soak	Ten minute preplant soaks provided excellent results in NC State University trials. Cultivar response varied.	
VERBENA, Annual	To control plant growth	<b>Dazide/B-Nine</b>	2,500 to 5,000 ppm spray	
		<b>Piccolo/Piccolo 10 XC/Bonzi/Paczol</b>	15 to 30 ppm spray	
		<b>Citadel/Chlormequat E-Pro/Cyclocel</b>	800 to 1,500 ppm spray	Begin applications 7 days after pinching. Repeat as needed every 2 weeks.
		<b>Concise/Sumagic</b>	15 to 30 ppm spray	
	To increase lateral branching	<b>Augeo</b>	521 to 1,042 ppm spray	
		<b>Florel/Collate</b>	500 ppm spray	Florel and Collate applications will provide some growth retardant effects and delay flowering. Read the label for restrictions on timing of applications.
VERBENA PLUGS, Annual	To control plant growth	<b>Piccolo/Piccolo 10 XC/Bonzi/Paczol</b>	5 to 10 ppm spray	Timing of application should normally begin at the 1 to 2 true leaf stage.
VERBENA, Perennial	To control plant growth	<b>Piccolo/Piccolo 10 XC/Bonzi/Paczol</b>	120 to 160 ppm spray	
		<b>Piccolo/Piccolo 10 XC/Bonzi/Paczol/Downsize</b>	>0.36 mg a.i. (>3 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	
VERBENA, Vegetative	To control plant growth	<b>Dazide + Citadel/B-Nine + Cyclocel</b>	2,000 to 3,500 ppm Dazide/B-Nine + 750 to 1,000 ppm Citadel/Cyclocel applied as a tank-mix spray	See General Recommendations.
		<b>Piccolo</b>	8 to 12 ppm liner root soak	See BACOPA. Rate based on Michigan State University trials.
		<b>Citadel/Chlormequat E-Pro/Cyclocel</b>	1,500 to 2,000 ppm spray	
		<b>Concise/Sumagic</b>	5 to 10 ppm spray	Apply as needed.
		<b>Dazide/B-Nine</b>	1,500 to 2,500 ppm spray	Do not apply within 2 weeks of a Florel or Collate application.
		<b>Florel/Collate</b>	250 to 300 ppm spray	Make last application 8 weeks before sale.
VERONICA	To control plant growth	<b>Piccolo/Piccolo 10 XC/Bonzi/Paczol</b>	20 to 40 ppm spray	
		<b>Concise/Sumagic</b>	20 to 40 ppm spray	

## Growth Regulators for Floricultural Crops in Greenhouses

CROP	PURPOSE	CHEMICAL	RATE*	PRECAUTIONS AND REMARKS
VINCA (Catharanthus)	To control plant growth	Abide/A-Rest	5 to 18 ppm spray	
		Dazide/B-Nine	2,500 to 5,000 ppm spray	
		Citadel/Chlormequat E-Pro/ Cyclocel	800 to 1,500 ppm spray	
		Concise/Sumagic	1 to 3 ppm spray	Apply after plants reach a height of 4 in.
		Topflor	2.5 to 7.5 ppm spray	Based on NC State University trials. Adjust rates for other locations. Vinca is very responsive to Topflor, so start trials with lower rates.
VINCA VINE (Vinca spp.)	To increase lateral branching	Florel/Collate	500 ppm spray	Florel and Collate applications will provide some growth retardant effects and delay flowering. Read the label for restrictions on timing of applications.
VIOLA	To control plant growth	Concise/Sumagic	1 to 5 ppm spray	
WANDERINGJEW	To control plant growth	Abide/A-Rest	26 to 132 ppm spray	
WOODY LANDSCAPEPLANT (Not specifically listed in this table)	To control plant growth	Abide/A-Rest	50 ppm spray	
			0.25 mg a.i. (2 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	Drench volumes and mg a.i. vary with pot size.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	100 ppm spray	See BEDDING PLANTS.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol/Downsize	0.47 mg a.i. (4 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot	
		Concise/Sumagic	10 to 50 ppm spray 1 to 2 ppm drench	
ZINNIA	To control plant growth	Abide/A-Rest	7 to 26 ppm spray	
		Citadel/Chlormequat E-Pro/ Cyclocel	800 to 1,500 ppm spray	
		Concise/Sumagic	5 to 25 ppm spray	
		Dazide/B-Nine	2,500 to 5,000 ppm spray	Multiple applications may be required. Use higher rates for summer crops.
		Piccolo/Piccolo 10 XC/ Bonzi/Paczol	15 to 45 ppm spray	
ZINNIA PLUGS	To control plant growth	Piccolo/Piccolo 10 XC/ Bonzi/Paczol	4 to 10 ppm spray	Timing of application should normally begin at the 1 to 2 true leaf stage.

# 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/ Paczol (milliliters)	Piccolo10 XC (milliliters)	Topflor (milliliters)	Configure (milliliters)	Augeo (milliliters)
0.5	7				4	0.5	0.05	0.48		
1.0	14				8	1.0	0.1	0.96		
5.0	72				38	5.0	0.5	4.8		
10	143				76	10	1.0	9.6		
25	359				189	25	2.5	23.9		
30	430				227	30	3.0	28.7		
40	573				303	40	4.0	38.2		
50	717			0.8	379	50	5.0	47.8	9.0	
100	1433			1.6	758	100	10.0	95.5	18	
200			6.5	3.1		200	20.0	191.0	36	
400			13	6.2					72	7.3
500			16	7.8					90	9.1
800			26	12.5					144	14.7
1,000		4.5	32	15.6					180	18.2
1,250		5.6	40	19.5						22.8
1,500		6.8	48	23.5						27.3
2,000		9.0	64	31.2						36.4
2,500		11.1	80	39.3						45.5
5,000		22.3		79.4						91.0

When mixing PGRs, great care needs to be given to accurately measure and apply the chemical. Drench applications vary by pot size and desired dose, so refer to the product label for exact mixing instructions. As always, the label contains the legal mixing information. North Carolina State University and the University of New Hampshire have a free web-based PGR calculator to assist with calculating PGR rates: <http://extension.unh.edu/agric/AGGHFL/Plantgrowthregulatorcalculator.cfm>

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.

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 to each pot. The volume of drench applied increases with the pot size (specifics are listed on each product label). **GT**

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