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GROWERTALKS

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Plant Growth Regulators for Annuals

A Guide to Growing High-Quality Annuals

2019-20

By Brian Whipker, North Carolina State University

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GreenProfit Supplement Enclosed



Fresco Use Tips

By Brian Whipker, North Carolina State University

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

Fresco is a combination of 1.8% gibberellins A4+A7 [GA₄₊₇] and 1.8% benzyladenine [6-BA]. This combination provides stimulation of internodal elongation with the GA₄₊₇ and enhancement of axillary shoot growth with the BA. When mixed together, the combination provides a controlled stimulation of plant growth.

The other labeled option for enhancing plant growth is Florgib 4L. It contains gibberellin A3 and only the lowest label rates should be trialed and used to avoid excessive stretch. By far, the majority of growers prefer to use Fresco because it enhances elongation and fullness of the plant, while providing a wider window of safety for avoiding overdose applications.

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

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

Application tips

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

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

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

Fresco is the only GA₄₊₇ and 6-BA product registered for drench applications. Drench applications have become increasingly popular because there's more even distribution of Fresco within the plant and less negative effect on leaf and flower growth. ▶

Fresco for Overcoming PGR Overdose



Plants pictured above and below were initially treated with a Paclo drench of 8 ppm, which stopped growth.



Growth enhanced with a Fresco foliar spray from 2.5 to 10 ppm.

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



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

Growth enhancement use tips—Foliar sprays

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

Growth enhancement use tips—Drenches

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

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

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

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

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

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

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

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



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Optimizing Coleus Growth Control

By Brian Whipker, North Carolina State University

There's been an explosion in the offerings of new vegetative coleus cultivars. Coleus are popular because they offer a wide array of leaf colors, leaf shapes and growth forms, but the vigorous nature of coleus can make growth control a challenge.

There are a wide assortment of plant growth regulator (PGR) options available to manage growth (see the Growth Regulators for Floricultural Crops in Greenhouses table starting on page 14). Multiple applications of daminozide (Dazide) or chloromequat (Citadel) may be required to control growth.

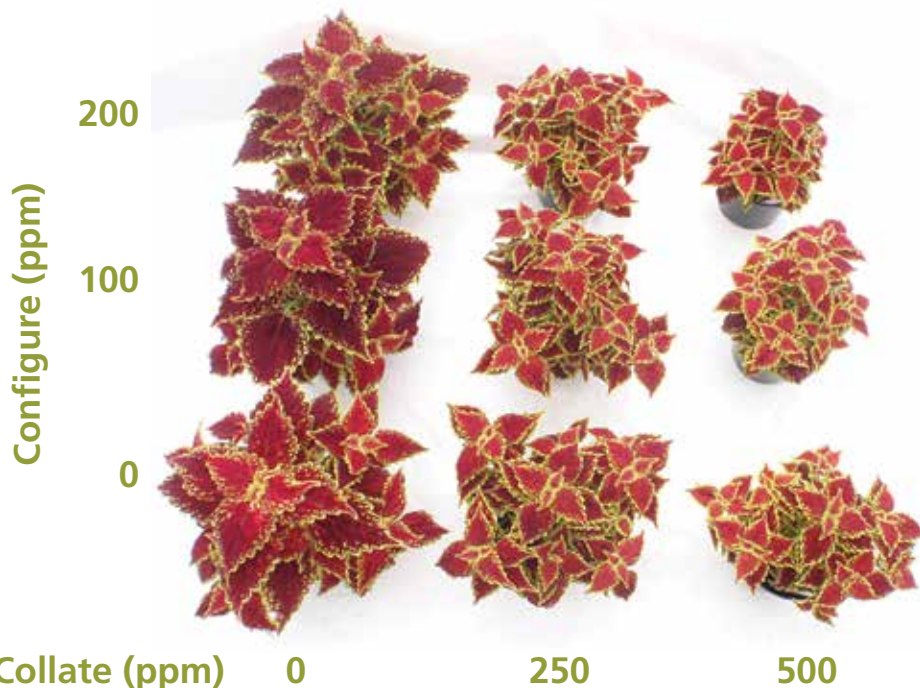
The spring is so busy with production it can be a challenge to be required to make weekly applications. Foliar sprays of paclobutrazol (Piccolo 10XC) and uniconazole (Concise) must be timed early to be able to check excessive growth and drench rates must be customized to the cultivar response. Fortunately, there's one PGR that provides outstanding results for managing coleus growth and that's ethephon (Collate).

NC State University Trial

Experiment Set-up. We conducted a research project to explore the options of controlling vegetative coleus growth. We wanted to trial Collate alone and in combination with benzyladenine (Configure) or paclobutrazol (Piccolo 10XC). We applied Collate at 0, 250 and 500 ppm by itself. In addition, we included treatments of Configure at 0, 100 or 200 ppm to create a 3 x 3 treatment combination regime (nine treatments total).

Effect of adding Configure with Collate foliar sprays

Oxford Street Coleus, June 30



The nine-way combination of Collate at 0, 250 or 500 ppm with Configure at 0, 100 or 200 ppm on Oxford Street Coleus growth.

Effect of adding Piccolo 10XC with Collate foliar sprays

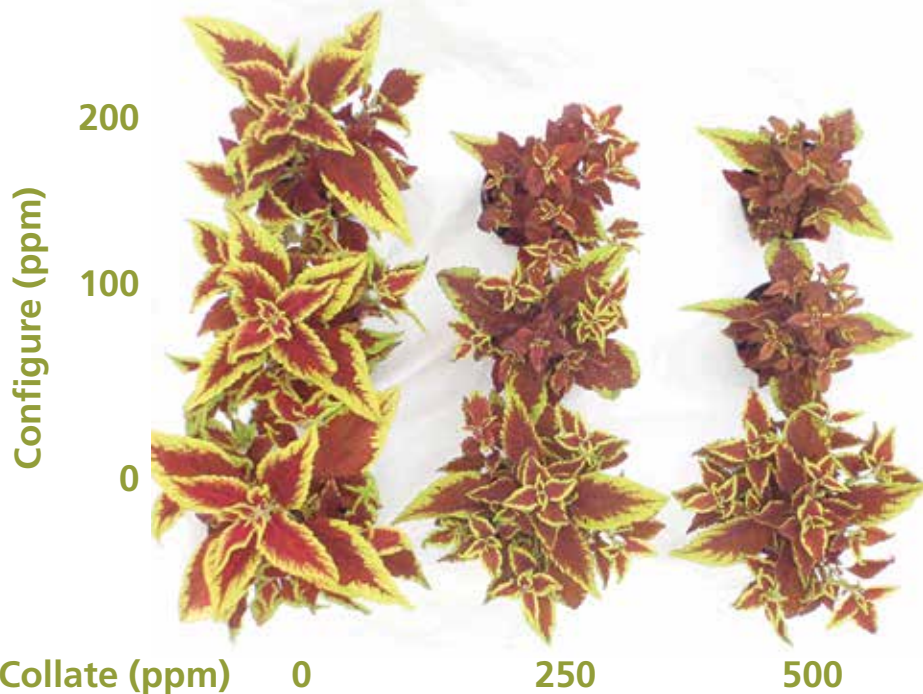
Oxford Street Coleus, June 30



The nine-way combination of Collate at 0, 250 or 500 ppm with Piccolo 10XC at 0, 10 or 20 ppm on Oxford Street Coleus growth.

Effect of adding Configure with Collate foliar sprays

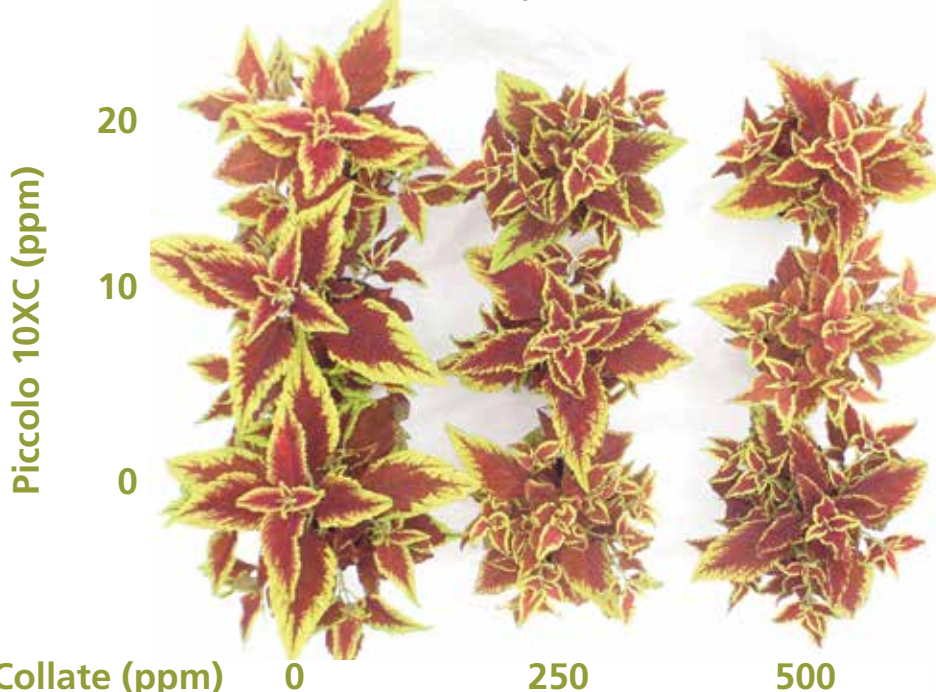
Defiance Coleus, June 19



The nine-way combination of Collate at 0, 250 or 500 ppm with Configure at 0, 100 or 200 ppm on Defiance Coleus growth.

Effect of adding Piccolo 10XC with Collate foliar sprays

Defiance Coleus, June 19



The nine-way combination of Collate at 0, 250 or 500 ppm with Piccolo 10XC at 0, 10 or 20 ppm on Defiance Coleus growth.

We used the same procedure for Collate at 0, 250 and 500 ppm by itself, along with Piccolo 10XC at 0, 10 or 20 ppm for a nine treatment combination. The coleus Oxford Street and Defiance cultivars used in the study were donated by Dümme Orange. Plants were grown under normal greenhouse conditions and evaluated after five weeks of growth.

Results. The combination sprays of Collate + Configure or Collate + Piccolo 10XC didn't provide any substantial improvement in plant growth control. In some cases, the plants were too stunted with the higher combination treatment rates.

For marketable plants, individually, Collate at 250 ppm, Configure at 200 ppm or Piccolo at 20 ppm provided growth control of Oxford Street. For the more vigorous cultivar Defiance, Collate at 250 to 500 ppm provided the greatest growth control for marketable plants. Higher combination rates with Configure provided excessive control, while Piccolo 10XC in combination with Collate didn't provide any additional control. Collate also helped avoid any flower bud formation.

Conclusions. There are a number of different PGRs registered for use with vegetative coleus. Collate at 250, and up to 500 ppm for more vigorous cultivars, offers excellent growth control of excessive plant growth during greenhouse production. Many of the combination rates provided excessive control. Another advantage is the effects of the Collate treatment wears off once the plant goes into the landscape, thus increasing the plant's performance for the garden consumer. 🌱

Enhancing Stem Elongation and Flowering in Ornamental Plants with Florgib 4L

By Brian Whipker, North Carolina State University

Florgib is a plant growth regulator (PGR) that's often overlooked by greenhouse growers. Its primary niche use is to enhance stem elongation, especially when growing larger tree style of plants (Figures 1 and 2). It's also used extensively with foliage plants to enhance flowering in species such as spathiphyllum (Figure 3). To find out where Florgib may be beneficial to your operation, let's review some of its uses.

Gibberellins

Gibberellic acid (GA₃) is a compound that's naturally produced in plants to stimulate growth (stem elongation). Gibberellins were initially identified in Japan during the 1920s as a metabolic by-product of the plant fungus *Gibberella fujikuroi*. Gibberellins in *Gibberella fujikuroi* lead to the extensive stem growth of infected rice plants. This is a similar stem elongation response we observe with a scab infection (*Sphaceloma poinsettiae*) of poinsettias (Figure 4). Since that time, over 130 GA types have been discovered by scientists. The number after the GA designates the type; currently, in commercial greenhouse production, we mainly rely upon GA₃, GA₄ and GA₇.

Gibberellin-containing formulations available from Fine

Florgib 4L contains 4.0% gibberellic acid (GA₃) as the active ingredient. It's used to enhance stem elongation and flowering in some foliage plants. Fresco is another Fine Americas product that contains 1.8% gibberellin, but the gibberellins are in a different form (GA₄₊₇) and the formulation also contains 1.8% benzyladenine (BA). The (GA₄₊₇)+BA mixture contained in Fresco is more effective at stimulating plant growth after a PGR overdose and at inhibiting lower leaf yellowing of Easter lilies.



Figure 1. Stem elongation of tree forms of poinsettia is enhanced with the use of Florgib applications.

Example uses of Florgib

■ **Tree forms of geraniums and poinsettias:** With both types of plants, it's important to establish the plants within the pots. Normally, it takes two to four weeks for extensive root systems to develop. With geraniums, apply 250 ppm Florgib weekly for four to five weeks. With poinsettias, apply 50 to 100 ppm of Florgib weekly for four to five weeks. Excessively high rates will result in undesirable, excessive stem stretching. Many growers will apply a 0.5 ppm paclobutrazol (Piccolo) drench once the desired amount of stem length has been achieved to slow top growth.

■ **Calla lilies (*Zantedesia sp.*):** Application of Florgib by soak or spray increases flowering, controls height and shortens days to flowering. As a soak, use a 100 ppm to 500 ppm solution. Spray applications are generally made at concentrations between 50 and 100 ppm to plants to stimulate flowering. For best results, trials should be conducted to determine desired rates and timings for optimum responses under local growing conditions.

■ **Spathiphyllum sp.:** Application to foliage will stimulate flowering for breeding and other purposes. Applications between 250 and 1,000 ppm stimulate the production of flowers, increasing the flexibility of production and the ability to sell plants in flower. For best results, trials should be conducted to determine desired rates and timings for optimum responses under local growing conditions.

■ **Caladium sp.:** Application will influence flowering. Soaking bulbs in solutions of between 250 ppm and 1,000 ppm will produce a favorable result. For best results, trials should be conducted to determine desired rates and timings for optimum responses under local growing conditions and specific varieties.

■ **Foliage plants:** For additional information about the use of gibberellins in foliage plants, use the link to the article by R.J. Henny and J. Chen, "Using Gibberellic Acid and Ethephon to Induce Flowers on Tropical Foliage Plants": <http://edis.ifas.ufl.edu/ep447>.

Avoiding carryover effect

When used as a normal foliar spray application of Florgib or Fresco at the volume of 2 qt. per 100 sq. ft., the potential for carryover of any gibberellin is practically nonexistent. Drench applications of Fresco in particular are



Figure 2. Tree forms of other plant species, such as geraniums, can be grown with the use of Florigib to stimulate stem elongation.



Figure 3. Flowering in spathiphyllum is enhanced with foliar sprays of Florigib.

Table 1. Mixing table for desired Florigib 4L concentrations.

| Desired Concentration [ppm (parts per million) (GA ₃)] | Milliliters (ml) of Florigib per Liter of spray solution | Milliliters (ml) of Florigib per Gallon of spray solution | Fluid Ounces of Florigib per Gallon of spray solution |
|--|--|---|---|
| 50 | 1.5 | 5.6 | 0.19 |
| 100 | 3.0 | 11.2 | 0.4 |
| 250 | 7.4 | 28.0 | 0.95 |
| 500 | 14.8 | 56.0 | 1.9 |
| 1,000 | 29.6 | 112.0 | 3.8 |

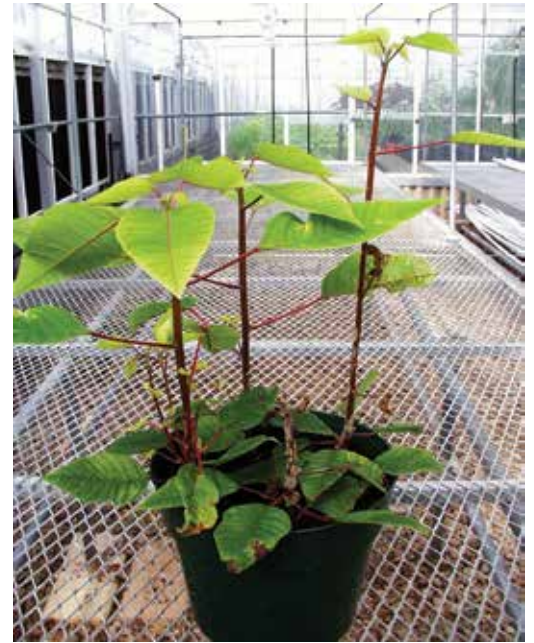



Figure 4. The discovery of gibberellins occurred after the study of rice elongation caused by a fungal infection. This same stem elongation response occurs with a poinsettia scab infection.

becoming more popular, especially with preventing lower leaf yellowing of Easter lilies.

If some of the drench solution comes in contact with concrete floors it can accumulate and cause unwanted stem elongation of any subsequent crop. To avoid this, research by Erik Runkle at Michigan State University recommends applying a 500 ppm solution of baking soda (sodium bicarbonate) to bind up the GA, thus making it non-reactive to plants.

Additional usage tips

Florigib isn't readily translocated within plants, thus all parts of the plant or crop should be covered thoroughly by the spray to obtain the desired result. Typical application rates are between 50 and 500 ppm. Foliar sprays should be applied at the volume of 2 qt. of water per 100 sq. ft. of growing area. The pH of the water used for mixing should be less than 8.5. A target pH of 6.5 to 7.0 is preferred.

Absorption of Florigib into the plant is greatest under slow drying conditions. Early morning or late applications will be more effective because of the slower drying conditions. Avoid applying Florigib when daytime conditions cause rapid drying (hot, sunny, windy weather). Florigib should be reapplied if significant rainfall occurs within two hours of application. 

Wide Assortment of Available PGRs

By Brian E. Whipker, North Carolina State 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). Here is an overview of the PGRs now available for use on ornamental crops.

Ancymidol

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

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

Chlormequat chloride

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

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

Daminozide

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

This material is applied only as a foliar spray because it's rapidly broken down when applied to the substrate. It's highly mobile in the plant and will rapidly move from the point of application to all parts of the plant. Daminozide is effective on most crops except lilies. It's highly effective in controlling growth of seedlings in plug flats and it's most effective in cooler climates.

Dikegulac sodium

(Commercial name: **Atrimmec**)

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

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

| CHEMICAL | PRODUCTS |
|--------------------------------|---|
| Ancymidol | Abide , A-Rest |
| Chlormequat chloride | Citadel , Cycocel |
| Daminozide | Dazide , B-Nine |
| Dikegulac sodium | Atrimmec |
| Ethephon | Collate , Florel |
| Flurprimidol | Topflor |
| Paclobutrazol | Piccolo , Piccolo 10 XC , Bonzi, Paczol, Downsize (drenches only) |
| Uniconazole | Concise , Sumagic |
| Benzyladenine (BA) | Configure |
| Gibberellin (GA ₃) | Florgib , ProGibb T&O |
| BA+GA ₄₊₇ | Fresco , Fascination |

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 (%) | 0.03% | 11.80% | 85% | — | 21.7%/3.9% | 0.38% | 0.4% 4% (Piccolo 10 XC) | 0.06% |
| Activity level | ++ | + | + | ++ | + | +++ | +++ | +++ |
| Multiple applications needed | ++ | +++ | +++ | ++ | ++ | + | + | + |
| Application type¹ | | | | | | | | |
| Foliar spray | yes | yes | yes | yes | yes | yes | yes ¹ | yes |
| Substrate drench | yes | yes | no | no | no | yes | yes | yes |
| Dips/Soaks | plugs/liners | plugs/liners | cuttings | — | — | 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) | — | — | — | 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

¹ Check label for legal uses

Resources

Ethephon phosphonic acid

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

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

Flurprimidol

(Commercial name: **Topflor**)

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

Paclobutrazol

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

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 **Sumag**)

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

Cautions

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

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

Other Growth Regulators

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

Benzyladenine

(Commercial name: **Configure**)

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

Gibberellins

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

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

Benzyladenine + Gibberellin Combinations

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

These combination products are used on potted lilies as foliar sprays to avoid lower leaf yellowing and leaf drop, plus prolonging flower life. They're also used to overcome the effects of an over-application of gibberellin-inhibiting plant growth retardants. ⑤



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Excellence in PGR Technology

Growth Regulators for Floricultural Crops in Greenhouses

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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.

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 | Florei/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. |
| AGASTACHE Purple Haze (Hyssop) | Induce branching of plugs | Configure | 300 ppm | Foliar spray applied ~27 days after sticking (plants moderately rooted) increased lateral branching but not basal branching. Multiple applications or higher rates decreased root surface area. |
| 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. |

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 |
|--------------------------------------|-----------------------------------|---|---|---|
| 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. |
| 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 | | 25 to 132 ppm spray | |
| | | Abide/A-Rest | 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/ Cyclocel | 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 | 30 to 45 ppm spray | Rate for <i>Alternanthera dentata</i> . |
| | | Piccolo/Piccolo 10 XC/ Bonzi/Paczol/Downsize | 4 ppm drench | 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 | 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. |
| ANTHURIUM | Induce lateral or basal branching | Configure | 250 ppm | 10 ml drench applied at the plant base. 250 ppm recommended. |
| | | | 1000 ppm | Single foliar spray. 1000 ppm recommended. |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|--|---|--|--|---|
| AQUILEGIA | To control plant growth | Dazide /B-Nine | 3,000 to 5,000 ppm spray | |
| 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 trails 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 | | |
| To induce basal branching | Collate /Florel | 500 ppm spray | Apply one week after establishment. | |
| ASCLEPIAS TUBEROSA (Butterfly Weed) | To control plant growth | Piccolo/Piccolo 10 XC / Bonzi/Paczol | 30 to 60 ppm spray | |
| | Induce lateral or basal branching | Configure | 600 ppm | Not responsive to a single foliar spray. |
| ASTER NOVI-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 (<i>Callistephus chinensis</i>) | To control plant growth | Abide /A-Rest | 7 to 26 ppm spray | |
| | | Dazide /B-Nine | 2,500 to 5,000 ppm spray | |
| ASTER, Cut (<i>Callistephus chinensis</i>) | 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. |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|--|---|---|--|--|
| AZALEA <i>continued</i> | 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/ Cyclocel | 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. |
| | 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. |
| | | Florgib /ProGibb T&O | 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. |
| | | Florgib /ProGibb T&O | 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 | |
| | | Florel/ Collate | 2,500 to 5,000 ppm spray | |
| | To control plant growth, reduce bypass shoot elongation and promote flower bud initiation | Piccolo/Piccolo 10 XC / Bonzi/Paczol | 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. |
| 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) | Drench volumes mg a.i. vary with pot size. | |
| To control plant growth | Concise /Sumagic | 10 to 15 ppm spray | Apply at 1.5 qt per 100 sq. ft. of bench area. | |
| BACOPA (SUTERA) | To control plant growth | Dazide /B-Nine | 750 to 1,500 ppm spray | At planting, soft pinch to promote lateral shoot development. Initially try with lower rate. |
| | | Piccolo | 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. |
| | | Piccolo/Piccolo 10 XC / Bonzi/Paczol | 1 to 2 ppm drench | |
| | | Florel/ Collate | 150 to 200 ppm spray | Early spray will increase branching and reduce early flowering. |
| To increase lateral branching | Florel/ Collate | 150 to 200 ppm spray | | |
| BANKSIA ASHBYI | Flower enhancer/ Dormancy interruption/ Branching inducer | Configure | 100 to 500 ppm | BA overcame winter quiescence of buds and breaks apical dominance. The effects are long lasting. Plants have many more branches. 400 ppm BA sprayed on the overwintering inflorescences hastened spring flowering by 1 to 2 months. |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|--|--|---|--|--|
| BEDDING PLANTS (Not specifically listed in this table) | To control plant growth | Abide/A-Rest | 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. |
| | | Citadel + Dazide/Cycocel + B-Nine | 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. |
| | | Piccolo/Bonzi/Paczol | 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. |
| | | 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. |
| | | | Fresco/Fascination | 1 to 25 ppm spray |
| | 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. |
| BEDDING PLANT 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. | |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|---|---|---|--|--|
| BEDDING PLANT PLUGS (Not specifically listed in this table) <i>continued</i> | To control plant growth <i>continued</i> | 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. |
| | | Citadel/Cycocel | 400 to 1,500 ppm spray | Conduct trials on a small number of plants. Start with lower rates and adjust 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. |
| 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 | |
| | | Florel/ 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. |
| | Induce lateral or basal branching | Configure | 20 to 160 ppm | Foliar spray. Slight increase in branching but no decrease in height. Flowers emerged slightly earlier. |
| 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 | Florel/ Collate | 300 to 500 ppm spray | |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|---|--|--|---|---|
| BLETILLA STRIATA (Hardy Orchid) | Increase the sprouting of pseudobulbs | Configure | 50 and 100 ppm | Soak pseudobulbs in solution for 30 min – 1 hr. 50 ppm increased growth rate but only under low temperatures. 100 ppm inhibited sprouting. |
| BORONIA HETEROPHYLLA (Red Boronia) | Induce lateral or basal branching | Configure | 100 ppm foliar spray every 3 days for 18 days on mature plants in mid-fall; or 10 to 150 ppm foliar spray every 2 days for 4 to 8 days on rooted cuttings in mid-fall | 100 ppm on mature plants vastly increased branching over pinching. Transient phytotoxicity noted. 50 ppm, 4 applications increased branching over pinching in rooted cuttings. Higher rates and more applications caused phytotoxicity and reduced flowering. |
| BORONIA METASTIGMA (Brown Boronia) | Induce lateral branching and additional cuttings | Configure | 100 ppm | Foliar spray 3 times, 1 week apart – 2 months prior to taking cuttings. BA increased branching but subsequent cuttings rooted very poorly compared to control. |
| BOSTON FERN (<i>Nephrolepis exaltata</i>) | Induce lateral branching | Configure | 50 to 150 ppm | Single foliar spray 4 weeks after planting. BA controlled frond length but did not stimulate more fronds. |
| 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 | |
| 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 (<i>Fosterella penduliflora</i>) | To promote flower initiation | Flore/Collate | 2,471 ppm spray | Cultivar response rates vary. Conduct your own trials to determine suitability and appropriate timing. |
| | Branching agent/ Enhance cutting numbers | Configure | 200 to 800 ppm | Foliar spray on 9 month old plants 4 times at two week intervals. BA 800 ppm increased lateral shoot production by 50% and is better than pinching. New shoots were shorter and not as thick. |
| BROWALLIA | To control plant growth | Dazide/B-Nine | 2,500 to 5,000 ppm spray | |
| BULB CROPS (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. | | | |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|---|---|---|--|--|
| BULB CROPS (Not specifically listed in this table) <i>continued</i> | To control plant growth <i>continued</i> | 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. | |
| Branching agent and de-eying agent | Configure | 250 to 4000 ppm | Pre-plant bulb soak for 1 hour. Shoot emergence delayed, shorter plants, and fewer shoots than non-de-eyed controls. | |
| 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. |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|---|-----------------------------------|---|--|--|
| 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. |
| | | Florei/Collate | 300 to 500 ppm spray | Early spray will increase branching and reduce early flowering. |
| | | Topflor | 5 to 10 ppm spray | |
| | Induce lateral or basal branching | Configure | 150 to 300 ppm | Rates of 150 to 300 ppm improved branching of the cultivars 'Callie Bright Red' and 'Deep Yellow'. |
| CALLA LILY (<i>Zantedeschia aethiopica</i>) | 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 | Make first application when plants are 1 to 2 in. tall. Drench volumes and mg a.i. vary with pot size. |
| | | 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 | Florigib /ProGibb T&O | 500 ppm rhizome/tuber soak | Soak the rhizomes or tubers for 10 min. prior to planting. See label for details. |
| Flower enhancer | Configure | 250 to 350 ppm | Pre-plant rhizome dip for 20 minutes. BA 350 ppm increased total flowers produced. BA caused some flower abnormalities. Increasing flower production in one year reduces future production from the rhizome. | |
| 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 | |
| CASTOR BEAN (<i>Ricinus communis</i>) | Flower enhancer | Configure | 50 to 75 ppm | Applied to buds 0 to 8 days after formation. BA 75 ppm at 4 to 8 days after bud formation causes the normally monocious flowers to become perfect. |
| 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. |
| 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. |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|---|---|---|---|---|
| CHAMAECEREUS SILVESTRI (Succulent, Peanut Cactus) | Induce lateral branching | Configure | 100 to 200 ppm | Single foliar spray. 200 ppm increased branching. |
| CHAMAECEREUS SILVESTRII F. VARIEGATA (Peanut Cactus) | Increase offset production | Configure | 1000 to 5000 ppm | Application method not listed. 5000 ppm increased offset (tuberclles) of sufficient size. |
| CHRISTMAS CACTUS (<i>Schlumbergera spp.</i>) | 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. |
| | Flower enhancer | Configure | 10 to 100 ppm | High temperatures and foliar sprays applied at beginning of short day or 10 to 20 days later. BA inhibits flower production if applied at beginning of short day. At temperatures above 20C it is best applied 10 to 20 days after start of short day. |
| | 100 to 1000 ppm | | Foliar sprays during long days as well as 5 to 10 days after start of short days. Under long days, 100 to 200 ppm was ideal for increasing phylloclade branching. From 5 to 10 days after start of short days, BA caused more flowers per phylloclade and flowering occurred 10 days sooner. BA also induced flowering on immature plants under short days when short days alone did not. | |
| 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 | Florigib /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. |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|--|---|--|--|---|
| CHRYSANTHEMUM, Potted <i>continued</i> | To control plant growth <i>continued</i> | 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 to 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. |
| | | Concise/Sumagic | 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. |
| | Induce lateral branching | Configure | 200 to 400 ppm | Single foliar spray 2 weeks before pinch, at pinch, or 2 weeks after pinch. 400 ppm applied at pinch increased branching and was better than spraying 2 weeks before or after pinch. No delay in flowering. Plants shorter. |
| CHRYSANTHEMUM, Garden | To control plant growth | 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. For medium to tall cultivars, increase the spray volume to 3 qts/100 sq. ft. |
| | | Concise/Sumagic | 2.5 to 10 ppm spray | |
| | | Dazide/B-Nine | 1,000 to 5,000 ppm foliar spray | Normal starting point is 2,500 ppm. Multiple applications may be needed. Trial rates for cultivar response. Do not apply after bud set to avoid flower delay and/or discoloration. |
| | | Piccolo/Piccolo 10 XC/ Bonzi/Paczol | 30 to 50 ppm spray | Trial rates for cultivar response. Do not apply after bud set to avoid flower delay and/or discoloration. |
| | | Piccolo/Piccolo 10 XC / Bonzi/Paczol/Downsize | 0.5 to 2 ppm drench | Trial rates for cultivar response. Start trials at the lower rate range. Multiple applications may be needed if using low concentration drenches for the entire season growth control program. In grower trials late season drenches have been reported to help maintain plant finish size and avoid stretching. In addition, flowering delay has not been reported with late season applications at lower rates. |
| | 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. |
| | Flower enhancer | Configure | 0.1 to 10 ppm | Three foliar sprays (planting day, at 5 open leaves or 10 open leaves) in the early summer on field grown plants. 0.1 to 1.0 ppm resulted in slightly earlier flowering (up to 3.9 days) and stem lengths were unchanged. 10 ppm delayed flowering, stem lengths were shorter, leaves were larger and there was slight phytotoxicity. |
| CHRYSOCEPHALUM APICULATUM | To control plant growth | Dazide/B-Nine | 2,500 ppm spray | Plants pinched and grown with good light and optimal growing conditions generally do not need PGRs. |

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| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|---------------------------|-----------------------------------|--|---|--|
| CLARKIA (Godetia) | To control plant growth | Concise /Sumagic | 15 to 25 ppm drench | Trial rates for cultivar response. Rates based on older cultivars. |
| | | Dazide /B-Nine | 3,000 ppm foliar spray | Trial rates for cultivar response. Rates based on older cultivars. |
| | | Piccolo/Piccolo 10 XC / Bonzi/Paczol | 20 to 30 ppm drench | Trial rates for cultivar response. Rates based on older cultivars. |
| CLEMATIS | 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 | |
| CLEOME | To control plant growth | Abide /A-Rest | 7 to 26 ppm spray | |
| | | Citadel /Chlormequat E-Pro/ Cyclocel | 800 to 1,500 ppm spray | |
| | | Dazide /B-Nine | 4,000 to 5,000 ppm spray | Multiple applications may be required. Make them at 7- to 10-day intervals. |
| | | Piccolo/Piccolo 10 XC / Bonzi/Paczol | 20 to 30 ppm spray | Multiple applications may be required. Make them at 7- to 10-day intervals. |
| CLERODENDRUM | To control plant growth | Abide /A-Rest | 50 ppm spray | |
| | | | 0.9 mg a.i. drench | |
| | | Piccolo/Piccolo 10 XC / Bonzi/Paczol | 100 ppm drench | |
| | | | 0.5 mg a.i. drench | |
| | To increase lateral branching | Augeo | 1,042 to 2,083 ppm spray | |
| COLEUS PLUGS, Seed | 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. |
| COLEUS, Seed | To control plant growth | Dazide /B-Nine | 2,500 to 5,000 ppm spray | |
| | | Piccolo/Piccolo 10 XC / Bonzi/Paczol | 15 to 30 ppm spray | |
| | | Citadel /Chlormequat E-Pro/ Cyclocel | 400 to 3,000 ppm spray | |
| | | Concise /Sumagic | 10 to 20 ppm spray | |
| | | Topflor | 20 to 40 ppm spray | Based on NC State University trials. Adjust rates for other locations. |
| COLEUS, Vegetative | To control plant growth | Citadel + Dazide /Cyclocel + B-Nine | 2,500 to 4,000 ppm + 1,000 to 1,500 ppm Cyclocel 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 | | |
| | Induce lateral or basal branching | Configure | 400 to 1200 ppm | Foliar spray. 800 ppm BA increased branching and height of pinched and unpinched coleus. |
| 100 to 3200 ppm | | | Single foliar spray applied 2 weeks after potting. BA controlled plant growth in one of 2 cultivars tested. | |
| COLUMBINE | To control plant growth | Abide /A-Rest | 65 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 | |

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| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|--|--|---|---|---|
| CONFLOWER (<i>Echinacea</i> 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 | Drench volumes and mg a.i. vary with pot size. |
| | | | 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) | |
| | | 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. |
| CORDYLINE | Induce lateral or basal branching | Configure | 250 ppm | 8 foliar sprays applied weekly. 250 ppm recommended. |
| 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. |
| | Induce lateral or basal branching on plugs | Configure | 300 to 500 ppm | Rates of 300 to 500 ppm improved branching of the cultivars 'American Dreams', 'Moonbeam', 'Zagreb', and 'Rum Punch'. |
| COREOPSIS GRANDIFLORA (Tickseed) | Induce lateral branching | Configure | 50 to 1600 ppm | No effect |
| COREOPSIS VERTICILLATA | Induce lateral branching | Configure | 250 to 2000 ppm | Single foliar spray or crown drench. 500 ppm increased branching and also delayed flowering. Higher rates caused phytotoxicity. |
| CORNFLOWER (<i>Centaurea</i>) | 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 |
|------------------------------------|---|---|---|--|
| CYCLAMEN PERSICUM | Flower enhancer and promote early flowering | Configure | 50 to 100 ppm | Foliar spray applications. Flowering was advanced, especially at low temperatures. Flower malformations at high temperatures and when BA was applied with high levels of nitrogen. A foliar spray of 50 to 100 ppm applied after early October (cooler temperatures) is recommended. |
| DAFFODIL | To control plant growth | Piccolo/Piccolo 10 XC/ Bonzi/Paczol/Downsize | 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. |
| | | Piccolo/Piccolo 10 XC/ Bonzi/Paczol | 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. |
| | | Florel/Collate | 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 | Abide/A-Rest | 7 to 26 ppm spray | |
| | | Dazide/B-Nine | 2,500 to 5,000 ppm spray | |
| | | Citadel + Dazide/Cycocel + B-Nine | 2,500 to 4,000 ppm + 1,000 to 1,500 ppm Cycocel applied as a tank-mix 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 | |
| DAHLIA PLUGS, Bedding Plant | 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. |
| DAHLIA, Tuberous | To control plant growth | Abide/A-Rest | 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. |
| | | Piccolo/Piccolo 10 XC/ Bonzi/Paczol/Downsize | 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 | |
| | | Piccolo/Piccolo 10 XC/ Bonzi/Paczol | Greater than 40 ppm tuber soak | Soak tubers for 20 min. prior to planting. |
| | | Concise/Sumagic | 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. |
| | | Topflor | 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. |
| | Induce lateral or basal branching | Configure | 20 to 40 ppm | 3 foliar sprays made one week apart in summer. Lateral branching increased. |
| DELPHINIUM | 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 | |
| DELPHINIUM, 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. |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|--|---|--|--|--|
| DIANTHUS, Bedding Plant | 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 | 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. |
| | | Citadel/Chlormequat E-Pro/ Cyclocel | 800 to 1,500 ppm spray | |
| | | Concise/Sumagic | 3 to 5 ppm spray | |
| DIANTHUS CARYOPHYLLUS (Carnation) | Induce basal branching and cutting number | Configure | 25 to 800 ppm | Single foliar spray onto stock plants. 400 ppm increased the cutting number by 35% without inhibiting subsequent rooting. |
| DIANTHUS PLUGS, 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. |
| | Induce lateral or basal branching | Configure | 100 ppm | Single foliar spray at various times. BA increased branching but the timing of the spray was very important. Plants sprayed at the 5 open leaf stage of development branched the most. |
| 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. |
| | | Florell/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. |
| DIEFFENBACHIA | Induce lateral or basal branching | Configure | 500 to 2000 ppm | Single foliar spray 500 to 1000 ppm was the optimal. 2000 ppm caused phytotoxicity. |
| | | | 750 ppm | Apply foliar sprays on 3 consecutive days. |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|---|---|---|---|---|
| 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 | |
| DORITAENOPSIS (Orchid) | Flower enhancer | Configure | 100 to 400 ppm | 3 Foliar sprays on days 0, 7, 14 from the time they were moved into a floral inductive environment, or a single spray from -1 to +6 weeks after moving to an inductive environment. 200 to 400 ppm sprayed 3 times resulted in 3 to 9 days earlier flowering and produced 3 to 8 additional flowers per plant than the untreated plants. Spraying 1 week after the transfer to inductive conditions increased flowering the most. |
| 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 | 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 | |
| DUSTY MILLER (Senecio cineraria) | To control plant growth | Dazide/B-Nine | 2,500 to 5,000 ppm spray | |
| | | Concise/Sumagic | 30 ppm spray | |
| | Induce lateral or basal branching | Configure | 50 to 400 ppm | Foliar spray or drench applied at 2 weeks after potting (WAP), 2+3 WAP or 2+3+4 WAP. BA decreased the size of the plants. |
| EASTER LILY (See Lily, Easter) | | | | |
| ECHEVERIA spp | To induce offsets and induce flower development | Configure | 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. |
| ECHINACEA HYBRIDS Fragrant Angel, Merlot, Tiki Torch (Hybrid Coneflower) | Induce lateral or basal branching | Configure | 600 ppm | Single foliar application increased basal branching. This rate was our screening rate. Lower rates may be effective. |
| ECHINACEA PURPUREA | Induce lateral or basal branching on plugs | Configure | 300 ppm | Single foliar application increased basal branching on plugs. |
| ECHINACEA PURPUREA Doubledecker, Magnus, Ruby Star, White Swan (Purple Coneflower) | Induce lateral or basal branching | Configure | 300 ppm | Single foliar spray increased basal branching. No significant effect on plant height. |
| 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. |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|--|--|---|--|---|
| EPIPREMNUM AUREUM (<i>syn Rhipidophora aurea</i>) (Golden Pothos) | Induce lateral or basal branching | Configure | 50 to 200 ppm | Foliar spray 3 times every two weeks starting 2 weeks after potting. 200 ppm increased branching. |
| 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 | Piccolo/Piccolo 10 XC/ Bonzi/Paczol | >240 ppm spray | |
| | | Piccolo/Piccolo 10 XC/ Bonzi/Paczol/Downsize | 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 DULCIS Chameleon (Purple spurge) | Induce lateral or basal branching | Configure | 600 ppm | Single foliar spray increased lateral branching but not basal branching. Lower rates may be effective. |
| EUPHORBIA HYPERICIFOLIA HYBRID | To control plant growth | Dazide/B-Nine | 2,500 ppm spray | Plant growth slow early on. Apply PGRs if control is needed. |
| | | Citadel+Dazide/Cycocel+B-Nine | 750 ppm + 2,500 ppm spray | |
| | | Florel/Collate | Spray | Not recommended. |
| | | Piccolo/Piccolo 10 XC/ Bonzi/Paczol | 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 (Persian Violet) | To control plant growth | Dazide/B-Nine | 2,500 to 5,000 ppm spray | |
| | | Piccolo/Piccolo 10 XC/ Bonzi/Paczol | 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. | |
| Induce lateral or basal branching | Configure | 50 to 400 ppm | Foliar spray applied twice at weekly interval. No effect on growth. Phytotoxicity at all rates. Severely delayed flowering. Applications to exacum is NOT recommended. | |
| FATSHEDERA | 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. |
| FELICIA | To control plant growth | Citadel+Dazide/Cycocel+B-Nine | 1,000 to 1,500 ppm + 2,500 to 4,000 ppm spray | Pinch plant as needed to improve shape. |
| | | Citadel/Cycocel | 1,500 ppm spray | Applied to pinched plants. |
| FLOWERING/ FOLIAGE PLANTS, 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. |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS | |
|--|---|-----------------------------|---|--|---|
| FLOWERING/ FOLIAGE PLANTS, Herbaceous Species (Not specifically listed in this table) <i>continued</i> | To control plant growth <i>continued</i> | 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, <i>Gynura aurantiaca</i> , Ivy, Kalanchoe, <i>Lilium spp.</i> , Morning glory, Pachystachys, <i>Pilea spp.</i> , Pentas, <i>Salvia spp.</i> , Schefflera, <i>Sedum spp.</i> 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. | |
| | | Fresco /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/ FOLIAGE PLANTS, 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. | |
| 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: woody species known to respond to Cycocel 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 Cycocel 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. | |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|--|--|---|---|--|
| 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. | |
| GAILLARDIA ARISTA Dazzler (Common gaillardia) | Induce lateral or basal branching | Configure | 600 ppm | A single foliar spray caused excessive branching. Use much lower rates for this crop. |
| GAILLARDIA X GRANDIFLORA Gallo Yellow, Orange Lemon | Induce lateral or basal branching on plugs | Configure | 300 ppm | Single foliar spray increased lateral branching. |
| 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 GAURA Siskiyou Pink | 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 | |
| | Induce branching on plugs | Configure | 300 ppm | Single or multiple foliar sprays applied ~27 days after sticking (plants moderately rooted) increased lateral and basal branching with no adverse effects on rooting. |
| | Induce lateral or basal branching/enhance flower numbers | Configure | 600 ppm | A single foliar spray resulted in increased lateral and basal branching. Increased number of flower stalks. This was our screening rate. Lower rates may be effective. |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|--|--|--|--|---|
| 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 (<i>Pelargonum x hortorum</i>) | 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. |
| Induce lateral or basal 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. | |
| | | 1000 ppm | Single foliar sprays applied 2 weeks before, during, or 2 weeks after a soft pinch. BA applied at pinch increased branching of geranium. BA applied at pinch delayed flowering 2 to 5 days. | |
| | Configure | 50 to 200 ppm | Rates of 50 to 200 ppm improved branching of the cultivars 'Melody', 'Candy Lavender', and 'Patriot Bright Red'. Some cultivars may be sensitive to Configure , and small trials should be conducted to evaluate the potential for phytotoxicity. | |
| GERANIUM, IVY (<i>Pelargonum x peltatum</i>) | 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 | |
| | Induce lateral or basal branching | Configure | 50 to 200 ppm | Rates of 50 to 200 ppm improved branching of the cultivars 'Caliente Rose', 'Caliente Lavender, and 'Caliente Dark Red. Some cultivars may be sensitive to Configure , and small trials should be conducted to evaluate the potential for phytotoxicity. |

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| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|--|---|--|---|--|
| GERANIUM, REGAL <i>(Pelargonum grandiflorum)</i> | To control plant growth | Citadel /Chlormequat E-Pro/ Cyclocel | 1,500 to 3,000 ppm spray | Multiple applications may be needed. Trial rates for cultivar response. Do not apply after bud set to avoid flower delay and/or discoloration. |
| | | Piccolo/Piccolo 10 XC / Bonzi/Paczol | 5 to 10 ppm spray | Multiple applications may be needed. Trial rates for cultivar response. Do not apply after bud set/flower coloration to avoid flower delay and/or discoloration. |
| | Induce lateral or basal branching | Configure | 150 ppm | Single foliar increased lateral branching and reduced plant height |
| 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. |
| GERBERA DAISY <i>(Gerbera jamesonii)</i> | 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. |
| | Branching agent/ Enhance cutting numbers | Configure | 100 to 400 ppm | Plants defoliated and sprayed twice 6 weeks apart to induce new shoots. 2 sprays of 200 ppm BA promoted more sprouting shoots harvested for cuttings. Large cultivar differences. |
| | Flower enhancer | Configure | 25 or 50 ppm | Single foliar spray. No effect on height, branching, flower number or timing, or fasciation. |
| GLADIOLUS | To control plant growth | Abide /A-Rest | 1.5 mg drench per 0.5 gal. pot | For container-grown plants. |
| | | Piccolo/Piccolo 10 XC / Bonzi/Paczol | 2.5 to 5.0 mg drench per 0.5 gal. pot | For container-grown plants. |
| | Increase corm and cormel yield | Configure | 25 ppm | Corm or cormel preplant soak for 24 to 30 hours just after harvesting in April. BA decreased time to sprouting from 90 days to 10 days and increased the number of corms and slightly increased the number of cormels produced one year later. |
| | | | 25 to 100 ppm | Pre-plant bulb soak for 24 hours. 25 ppm BA decreased the number days to sprouting by 10 days as well as increasing sprouting percentage. BA increased corm diameter and weight and cormel number and weight. |
| GLOXINIA <i>(Sinningia speciosa)</i> | To control peduncle length | Dazide /B-Nine | 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. |
| | | Piccolo/Piccolo 10 XC / Bonzi/Paczol | 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 | Dazide /B-Nine | 2,500 to 5,000 ppm spray | |
| | | Citadel /Chlormequat E-Pro/ Cyclocel | 800 to 1,5,00 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 | Concise /Sumagic | 2 to 10 ppm spray | See precautions listed with EGGPLANT. |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|--|--|---|---|---|
| GYPSOPHILA | To accelerate plant growth, increase stem and flower number and increase flower uniformity | Florigib /ProGibb T&O | 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. |
| HEDERA CANARIENSIS (Algerian Ivy) | Induce lateral or basal branching | Configure | 50 to 200 ppm | Foliar spray 3 times every two weeks starting 2 weeks after potting. 200 ppm increased branching |
| HELENIUM AMARUM | To control plant growth | Dazide /B-Nine | 5,000 ppm spray | Apply after plant established (2 weeks after transplant). |
| HELENIUM (Sneezeweed) | Induce lateral/ Flowering enhancer | Configure | 20 to 40 ppm | Foliar sprays 3 times, one week apart in summer. Increased lateral branching but did not affect height. Delayed flowering but increased flower number. |
| HELENIUM AUTUMNALE Coppelias (Sneezeweed) | Induce lateral or basal branching | Configure | 600 ppm | Not responsive to a single foliar spray at this screening rate. Multiple sprays may be effective. |
| HELICHRYSUM PETIOLARE/ H. ITALICUM (Licorice plant) | To control plant growth | Piccolo/Piccolo 10 XC / Bonzi/Paczol | 1 ppm drench | Plants grown with good light and optimal growing conditions generally do not need PGRs. |
| | To increase lateral branching | Flore / Collate | 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 | Piccolo/Piccolo 10 XC / Bonzi/Paczol | 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. |
| HELIOTROPIMUM ARBORESCENS | To control plant growth | Citadel /Chlormequat E-Pro/ Cycocel | 500 ppm spray | Rate for compact genetics needing slight growth control. |
| | | Citadel+Dazide /Cycocel+B-Nine | 750 to 1,000 ppm + 1,500 to 3,000 ppm spray | Rate for compact genetics needing slight growth control. |
| HELLEBORUS X HYBRIDUS (Lenten Rose) | Induce lateral or basal branching | Configure | 50 to 800 ppm | Foliar spray or drench applied every 2 weeks for 12 weeks during the summer. Some increase in branching. No phytotoxicity but leaves were feathered. |
| HEMEROCALLIS (Daylily) | Induce lateral or basal branching | Configure | 2500 or 5000 ppm | Foliar spray for 1, 2, 3, 4, or 5 consecutive weeks. BA increased offset formation. Higher rates and more applications were generally optimal. |
| | | | 1250, 2500, 3750 ppm | Foliar sprays applied twice in the summer. BA at 2500 ppm increased divisions by 20%. |
| HEMEROCALLIS Strutters Ball (Daylily) | Induce lateral or basal branching | Configure | 600 ppm | Not responsive to a single foliar spray. Multiple applications may improve response. |
| HEUCHERA Raspberry Ice, Silver Lode (Coral bells) | Induce lateral or basal branching | Configure | 600 ppm | A single foliar spray increased basal branching. Lower rates may be effective. |
| HIBISCUS MOSCHEUTOS | To control plant growth | Citadel /Cycocel | 1000 ppm foliar spray | Multiple applications may be required. |
| | | Concise /Sumagic | 15 ppm foliar spray | |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|---|---|--|--|--|
| 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. |
| | Induce lateral or basal branching | Configure | 1250 to 3750 ppm | Single foliar sprays in summer onto plants with 0, 1, 2, or 3 pre-existing offsets. The optimal rate was 3750 ppm onto plants with 0 initial offsets. |
| | | | 3000 ppm | 1 to 4 foliar sprays at 30 day intervals. 4 applications yielded the highest number of offsets. |
| | | | 1250 to 3750 ppm | Single foliar spray. Optimal rate varied by cultivar. 10 cultivars trialed. BA improves offset number on all cultivars. No phytotoxicity was observed. |
| | | | 3000 ppm | Foliar spray, crown spray, crown + foliar spray, crown drench, root immersion, or crown + root immersion. Foliar sprays were the least effective. Crown and crown + root immersions were the most effective. |
| 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. |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|---|---|---|--|--|
| HYACINTH, GRAPE (<i>Muscari armeniacum M. comosum</i>) | Propagation/ Increase bulblet production | Configure | 1000 to 5000 ppm | BA mixed with lanolin paste and applied to basal plate of 6 to 7 cm bulbs. All rates increased bulblet formation 30x over controls in <i>M. armeniacum</i> and 3x over controls in <i>M. comosum</i> . |
| HYBRID LILY (See Lily, Hybrid) | | | | |
| HYDRANGEA | To control plant growth | Abide/A-Rest | 50 ppm spray | Drench volumes and mg a.i. vary with pot size. 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. |
| | | | 0.25 mg a.i. (2 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot | |
| | | Dazide/B-Nine | 1,250 to 7,500 ppm spray | |
| | | Topflor | 100 to 200 ppm spray | |
| HYLOCEREUS | Induce lateral or basal branching | Configure | 25 to 100 ppm | 24-hour soak of cuttings (apical tip only). 100 ppm caused more lateral shoots to break, providing more shoots for propagation. |
| HYPOCALYMMMA ANGUSTIFOLIA (White myrtle) | Induce lateral or basal branching | Configure | 100 ppm | Foliar spray 3 times, 1 week apart – 2 months prior to taking cuttings. BA increased branching but subsequent cuttings rooted very poorly compared to control. |
| 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. |
| | | Citadel/Cycocel | 400 to 1,500 ppm spray | Initially apply after second set of leaves have developed. If needed, reapply 2 weeks later. |
| | | Dazide/B-Nine | 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 | Abide/A-Rest | 10 to 44 ppm spray | |
| | | Piccolo/Piccolo 10 XC/Bonzi/Paczol | 10 to 45 ppm spray | |
| | | Concise/Sumagic | 5 to 10 ppm spray | |
| | | Topflor | 20 to 60 ppm spray | Based on NC State University trials. Adjust rates for other locations. |
| | To increase branching | Florel/Collate | 100 to 300 ppm spray | Use if better branching needed. |
| IMPATIENS PLUGS, Seed | To control plant growth | Piccolo/Piccolo 10 XC/Bonzi/Paczol | 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 | Piccolo/Bonzi/Paczol | 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. |
| | | Florel/Collate | 100 to 300 ppm spray | Will improve branching. |
| IMPATIENS, Seashell-type | To control plant growth | Piccolo/Bonzi/Paczol | 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 | Dazide/B-Nine | 5,000 ppm spray | |
| | | Piccolo/Piccolo 10 XC/Bonzi/Paczol | 2 ppm spray | |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|---|---|---|---|---|
| IPOMOEA (<i>Ipomoea batatas</i> ; Ornamental Sweet Potato) | To control plant growth | Concise /Sumagic | 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. |
| | | Dazide /B-Nine | 2,500 ppm spray | Apply as needed. |
| | | Florel / Collate | 500 to 1,000 ppm spray | Will improve branching and control growth. |
| | | Piccolo/Piccolo 10 XC / Bonzi/Paczol | 8 ppm drench | Applied to plugs prior to transplanting. |
| | Induce lateral or basal branching | Configure | 12.5 to 1600 ppm | Two foliar sprays applied 30 days apart during winter production. No effect with rates used. |
| IRESINE HYBRID (Blood Leaf) | To control plant growth | Citadel+Dazide /Cycocel+B-Nine | 1,000 to 1,500 ppm + 2,500 to 4,000 ppm spray | |
| | | Piccolo/Piccolo 10 XC / Bonzi/Paczol | 5 to 10 ppm spray | |
| | | Piccolo/Piccolo 10XC /Bonzi/ Paczol/Downsize | 1 to 3 ppm drench | |
| | Induce lateral or basal branching | Configure | 50 to 800 ppm | Single foliar spray applied 2 weeks after potting. No effect on growth. Some phytotoxicity at the highest rates. |
| IRIS GERMANICA (Tall bearded Iris) | Induce lateral/ Flowering enhancer | Configure | 100 to 200 ppm | Single foliar spray. 100 ppm slightly increased lateral branching on one cultivar. This resulted in more bloom stalks the following year. |
| JACOBINIA (Pink) | To control plant growth | Piccolo/Piccolo 10 XC / Bonzi/Paczol | 5 to 10 ppm spray | |
| | | Piccolo/Piccolo 10 XC / Bonzi/Paczol/Downsize | 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 (<i>Solanum pseudocapsicum</i>) | To control plant growth | Citadel /Chlormequat E-Pro | 800 to 1,500 ppm spray | |
| | | Citadel /Cycocel | 400 to 1,500 ppm spray | |
| | To promote stem elongation for topiary | Florgib /ProGibb T&O | 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. |
| JOVIBARBA HIRTA (Hens and Chicks) | Induce lateral or basal branching | Configure | 50 to 1600 ppm | Single foliar spray. 1600 ppm increased offsetting the most. |
| 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. |
| | Induce lateral branching/ Pinching replacement | Configure | 10 to 50 ppm | Single foliar spray. 50 ppm increased branching above that of hand pinching. |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|--|--|--|---|--|
| 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. |
| | Induce lateral or basal branching | Configure | 800 to 1200 ppm | Weekly foliar sprays for 3 weeks. BA increased branching. |
| LAVANDULA X INTERMEDIA Provence (Lavandin) | Induce branching on plugs | Configure | 300 ppm | Two foliar sprays applied, first at ~34 days after sticking (plants moderately rooted) and again 2 weeks later; increased lateral and basal branching but reduced root surface area and root volume of plugs.; no reduction in establishment of plants. Apply after plugs are well rooted. |
| 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 | |
| LEUCANTHEMUM X SUPERBUM Alaska, Becky (Shasta Daisy) | Induce basal branching/ enhance flower number | Configure | 600 ppm | A single foliar spray increased basal branching on both cultivars but effect was short term on 'Alaska'. Multiple applications may improve branching. This treatment doubled the number of flowers on 'Alaska'. |
| LEUCANTHEMUM X SUPERBUM Snowcap (Shasta daisy) | Induce branching on plugs | Configure | 300 ppm | Single or multiple foliar sprays applied ~27 days after sticking (plants moderately rooted) increased basal branching but reduced root surface area and root volume. Apply after plugs are well rooted. |
| LEUCOSPERMUM (Pincushion) | Flower enhancer | Configure | 50 to 300 ppm | Foliar spray (50 to 300 ppm) applied once or 200 ppm applied 1 to 4 times in late summer to fall. 200 ppm applied once in late summer increased the number of florets and increased flower stem diameter. |
| 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 | |
| LILIUM X FORMOLONGI (Lily) | Propagation/ Seed Germination | Configure | 100 ppm | 24 pre-plant seed soak. 100 ppm increased germination by 20%, and reduced germination time by 3 days. |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|---------------------------|--|--|--|--|
| 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. |
| | | 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). |
| | To prevent leaf yellowing | 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 and prolong flowering | 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. |
| 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. |
| | | | 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 |
| | | Concise | 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 |
| | 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 | 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. |
| | | | Fresco/Fascination | 5 to 10 ppm spray |
| Fresco/Fascination | | | | 100 ppm spray |
| | To prevent leaf yellowing and prolong flowering | | | |

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. |
| LINARIA HYBRIDA (Baby snapdragon) | 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. Stengthened 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. | | | |
| LOBELIA CARDINALIS (Cardinal flower) | Induce basal branching | Configure | 600 ppm | A single foliar spray increased basal branching. Lower rates may be effective. |
| LOBELIA X SPECIOSA Fan Deep Rose (Hybrid Lobelia) | Induce basal or lateral branching | Configure | 600 ppm | A single foliar spray increased number of shoots not branches. Moderate response. This rate was our screening rate. Multiple applications may be more effective. |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|--|---|---|--|---|
| LOBULARIA | To control plant growth | Piccolo | 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. |
| | | Concise | 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 | | | |
| LOPHSOPERMUM (LOFUS) | To control plant growth and improve branching | Collate /Florol | 250 to 500 ppm spray | Cultural requirements vary with the cultivar grown. Many cultivars only require high light, optimal growing conditions and regular pinching to control growth. Use a PGR if needed. Multiple applications may be needed in warmer climates. Avoid applications within 8 weeks of sale to ensure flowering is not delayed. |
| LUPINE (<i>Lupinus angustifolius</i>) | Enhance seed set | Configure | 450 ppm | Painted onto flowers daily until senescence with a paint brush. BA increased the number of seed pods set, but reduced the number of seeds per pod. Overall seed production increased 11%. |
| LYCHNIS X ARKWRIGHTII Vesuvius (Arkwright's Champion) | Induce basal or lateral branching | Configure | 600 ppm | A single foliar spray increased lateral branching. Lower rates may be effective. |
| MAMMILLARIA ELONGATA (Succulent) | Induce lateral branching | Configure | 100 to 200 ppm | Single foliar spray. 200 ppm increased branching (linearly with rate). |
| MANDEVILLA SANDERI (Dipladenia) | To control plant growth | None | None | Cultural requirements vary with the cultivar grown. Many cultivars only require high light, optimal growing conditions, and regular pinching to control growth. |
| | | Dazide /B-Nine | 2,500 to 3,500 ppm spray | Use a PGR if needed. Multiple applications may be needed in warmer climates. |
| | | Dazide /B-Nine + Citadel /Cyclocel | 1,000 to 1,500 ppm Dazide/B-Nine + 750 ppm Citadel/Cycocel spray | Use a PGR if needed. Multiple applications may be needed in warmer climates. |
| MARIGOLD | To control plant growth | Abide /A-Rest | 13 to 33 ppm spray | |
| | | Dazide /B-Nine | 2,500 to 5,000 ppm spray | |
| | | Piccolo / Piccolo 10 XC /Bonzi/Paczol | 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). |
| | | Citadel /Chlormequat E-Pro/Cyclocel | 800 to 1,500 ppm spray | |
| | | Concise /Sumagic | 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 | Piccolo / Piccolo 10 XC /Bonzi/Paczol | 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. |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|---|---------------------------------------|---|--|---|
| MATTHIOLA, Bedding Plant (Stock) | To control plant growth | Dazide + Citadel /B-Nine + Cycocel | 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 | 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. |
| MELAMPODIUM | To control plant growth | Dazide /B-Nine | 2,500 ppm spray | Use when plants reach 75% of marketable size to tone. |
| MIMULUS | To control plant growth | Dazide /B-Nine | 2,500 ppm spray | Use if needed. Delay in flowering possible with multiple applications. |
| MONARDA | To control plant growth | Piccolo/Piccolo 10 XC /Bonzi/Paczol | 60 to 160 ppm spray | |
| | | Piccolo/Piccolo 10 XC /Bonzi/Paczol/Downsize | >0.48 mg a.i. (>4 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot | |
| | | Concise /Sumagic | 15 to 30 ppm spray | |
| MONSTERA | 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. |
| 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 | Florel/Collate | 500 to 2,000 ppm spray | For types requiring a vernalization period (<i>Narcissus hybrids</i>), apply when new leaves reach 3 to 4 in. of height. For paperwhite narcissus (<i>Narcissus tazetta</i>), 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. |
| NASTURTIUM | To control plant growth | Citadel /Chlormequat E-Pro/Cycocel | 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. |
| | | Collate /Florel | 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 | |
| | | | 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. |
| 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. |
| | | Florel/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. |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|--|-------------------------|--|---|--|
| 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. |
| NOLANA PARADOXA | To control plant growth | Florei/ 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 | |
| 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 | | | |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|--|---|---|---|--|
| OSTEOSPERMUM <i>continued</i> | To control plant growth <i>continued</i> | Topflor | 20 to 60 ppm spray | 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. |
| | | | 1 to 2 ppm drench; apply 3 fl. oz./5-in pot | |
| OSTEOSPERMUM Astra Yellow, Voltage Yellow | Induce lateral or basal branching | Configure | 150 to 200 ppm | Single foliar spray increased lateral branching and reduced plant height |
| 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> . |
| PANSY (<i>Viola x wittrockiana</i>) | 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. |
| | Induce lateral or basal branching | Configure | 50 to 800 ppm | Single foliar spray. Limited plant height control and small increase in branching. There were cultivar differences with violas being more tolerant than pansies. Flowering was delayed. Phytotoxicity occurred above 100 ppm. |
| 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 DIGITALIS Husker Red (Smooth White Penstemon) | Induce basal branching | Configure | 600 ppm | A single foliar spray induced a small increase in number of laterals but increased pot fill. Slight delay in plant development resulted in reduced plant height. |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|---|--------------------------------------|--|---|--|
| 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 | |
| PEONY (Paeonia) | Induce lateral branching | Configure | 100 to 1600 ppm | 5 minute pre-plant bulb soaks in the fall. BA caused buds to sprout earlier and closer together. Without BA, bud emergence occurred over a longer period of time. With BA, bud emergence was more synchronized and overall, the bud emergence dates per plant were about 20 days earlier. |
| PEPEROMIA | Induce lateral or basal branching | Configure | 250 to 1000 ppm | Single foliar spray applied at planting. 500 ppm recommended. 1000 ppm BA resulted in more than double the number of lateral branches and a reduction in plant height and internode length. No phytotoxicity noted. Custom solution of BA used, not commercial mix. Effects lasted about 12 weeks. |
| PEPINO | To control plant growth | Sumagic | 2 to 10 ppm spray | See precautions listed with EGGPLANT. |
| PEPPER | To control plant growth | 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 | |
| PETUNIA, Seed | To control plant growth | Abide /A-Rest | 10 to 26 ppm spray | See AGERATUM. |
| | | Dazide /B-Nine | 2,500 to 5,000 ppm spray | |
| | | Piccolo/Piccolo 10 XC / Bonzi/Paczol | 15 to 45 ppm spray | |
| | | Concise /Sumagic | 25 to 50 ppm spray | |
| | | Topflor | 20 to 60 ppm spray | Based on NC State University trials. Adjust rates for other locations. |
| PETUNIA PLUGS, Seed | 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 | |
|---|---|---|--|---|---|
| PETUNIA, Vegetative | To control plant growth | Abide /A-Rest | 10 to 26 ppm spray | Multiple applications may be required. | |
| | | Dazide /B-Nine | 2,500 to 5,000 ppm spray | | |
| | | Dazide /B-Nine + Bonzi/ Piccolo /Paczol | 2,500 ppm spray + 40 ppm Bonzi/ Piccolo /Paczol applied as a tank-mix spray | Recommendation based on NC State University trials. | |
| | | Dazide /B-Nine + Topflor | 2,500 ppm spray + 15 to 30 ppm Topflor applied as a tank-mix spray | Recommendation based on NC State University trials. | |
| | | Piccolo /Bonzi/Paczol | 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. | |
| | | Concise /Sumagic | 20 to 50 ppm spray | 20 ppm worked well in NC State University trials. | |
| | | Piccolo | 12 ppm liner root soak | See BACOPA. Rate based on Michigan State University trials with petunia multiflora prostrate Wave Purple. | |
| | | Topflor | 15 to 60 ppm spray | Recommendation based on NC State University trials. | |
| | | To increase lateral branching | Florel / Collate | 300 to 500 ppm spray | |
| | | Induce lateral or basal branching | Configure | 20 to 160 ppm | Foliar spray 1 to 2 times. 80 ppm applied twice was optimal at increasing branching, improving shape, increasing flowering. Transient phytotoxicity noted at 160 ppm. |
| PHALAENOPSIS Orchids | To increase flower number and earlier flowering | Configure | 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 | Concise /Sumagic | 100 to 200 ppm spray | Apply when the flower spike length is 1 in. (3 cm). | |
| | | Piccolo / Piccolo 10 XC /Bonzi/Paczol | 250 ppm spray | Apply when the flower spike length is 1 in. (3 cm). | |
| PHILODENDRON | To control plant growth/vine control | 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 | | |
| | | Citadel /Cycocel | 3,000 ppm spray | | |
| | | Dazide /B-Nine | 2,500 to 7,500 ppm spray | | |
| PHLOX DRUMMONDII | To control plant growth | Dazide /B-Nine | 2,500 to 5,000 ppm spray | | |
| PHLOX MACULATA, (Hybrid) | To control plant growth | Concise /Sumagic | 5 to 10 ppm spray | | |
| | | Dazide /B-Nine | 2,500 to 5,000 ppm spray | | |
| | | Topflor | 10 to 15 ppm spray | | |
| PHLOX PANICULATA David (Garden Phlox) | Induce lateral or basal branching | Configure | 600 ppm | Not responsive to a single foliar spray. Multiple applications may be effective. | |
| PHLOX PANICULATA Franz Schubert (Garden Phlox) | Induce lateral or basal branching | Configure | 600 ppm | A single foliar spray increased the number of shoots. No effect on height. | |

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| 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. |
| | Induce lateral or basal branching | Configure | 300 ppm | Single foliar spray resulted in significant phytotoxicity. |
| 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/Sumagic | 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/Cyclocel | 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. |
| | | 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. | |

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| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|---|--|--|--|--|
| POINSETTIA <i>continued</i> | Growth enhancer/ Rooting enhancer | Configure | 1250 ppm | Single drench when IBA treated cuttings were stuck in the mist bed. Increased the number of roots per cutting and the root fresh weight. |
| | Branching agent/ Enhance cutting numbers | Configure | 62.5 to 500 ppm | Foliar spray 2 times at 20 day intervals. BA 125 ppm worked optimally at maximizing the number of cuttings produced on stock plants. Rooting percentage was not affected by this rate. 500 ppm BA delayed rooting in the cuttings. |
| POINSETTIA, Tree | To control plant growth | Concise | 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 | Piccolo/Piccolo 10 XC/ Bonzi/Paczol | 3 to 5 ppm spray | Height control generally not needed and rates above 5 ppm can cause leaf puckering. |
| PORTULACA GRANDIFLORA (Moss rose) | Induce lateral or basal branching | Configure | 62.5 to 250 ppm | Single foliar spray. 250 ppm BA reduced shoot length by 25%, increased branching by 143%, and caused a more prostrate habit. |
| PORTULACA OLERACEA (Moss rose) | To control plant growth | Abide/A-Rest | 7 to 26 ppm spray | |
| | | Concise/Sumagic | 15 to 30 ppm spray | |
| | | Piccolo/Piccolo 10 XC/ Bonzi/Paczol | 5 ppm drench | Apply 7 days after transplant. May replace the need to pinch. |
| | | Topflor | 30 ppm spray | Apply 7 days after transplant. Repeat 2 weeks later, if needed. |
| | To increase lateral branching | Citadel/Cyclocel | 5,000 ppm spray | Apply 5 to 6 days after pinching to improve branching of cuttings. |
| | | Collate/Florel | 300 to 500 ppm spray | Recommendations based on Michigan conditions. Defoliation can occur with rates greater than 300 ppm. |
| Induce lateral or basal branching | Configure | 50 to 400 ppm | Single foliar spray. BA increases branching of one of two cultivars tested. | |
| POTHOS | 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 7,500 ppm spray | |
| | | Piccolo/Piccolo 10 XC/ Bonzi/Paczol | 4 to 6 mg a.i. drench for an 8-in. pot; apply 10 fl. oz./8-in. pot | |
| PRIMULA ACAULIS | To control plant growth | Dazide/B-Nine | 1,000 to 2,500 ppm spray | PGRs usually not required. |
| PRIMULA OBCONICA | To control plant growth | Dazide/B-Nine | 5,000 ppm spray | PGRs usually not required. |
| PURPLE CONEFLOWER | To control plant growth | Concise/Sumagic | 30 to 40 ppm spray | |
| PURPLE PASSION | To control plant growth | Abide/A-Rest | 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 | Dazide/B-Nine | 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. |
| REBUTIA VIOLACIFLORA (Cactus) | Flower enhancer | Configure | 10 to 100 ppm | Applied 1 to 3 times. 100 ppm sprayed 3 times induces more flower buds but many of these buds aborted. <i>Rhipsalidopsis gaertneri</i> |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|--|--|---|---|--|
| ROSE, Bush | Induce lateral or basal branching | Configure | 100 ppm | Foliar spray 2 to 3 times. Slight increase in branching and increase in the length of the side branches. Subsequent flowering was increased too. Effect was better than pinching. |
| ROSE, Pot | To control plant growth | Concise/Sumagic | 0.1 to 0.2 mg a.i./pot drenches | Usually only a single application is made. |
| | | Piccolo/Piccolo 10 XC/ Bonzi/Paczol | 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. |
| | Senescence inhibitor | Configure | 45 to 180 ppm | Single foliar spray followed by simulated shipping. At 180 ppm inhibit flower senescence and leaf abscission in simulated shipping and was nearly equal to silver thiosulfate (STS). |
| RUDBECKIA HIRTA (syn. R. bicolor) (Blackeyed susan) | Induce lateral or basal branching | Configure | 50 to 1600 ppm | Single foliar spray applied 2 weeks after potting. Height controlled. 1600 ppm caused phytotoxicity. |
| RUDBECKIA Goldstrum | Induce lateral or basal branching on plugs | Configure | 300 ppm | Single foliar spray increased basal branching with significant early phytotoxicity. |
| SALVIA, Annual (Salvia splendens; Scarlet sage) | To control plant growth | Abide/A-Rest | 10 to 26 ppm spray | |
| | | Dazide/B-Nine | 2,500 to 5,000 ppm spray | |
| | | Piccolo/Piccolo 10 XC/ Bonzi/Paczol | 20 to 60 ppm spray | |
| | | Citadel/Chlormequat E-Pro/ Cyclocel | 800 to 1,500 ppm spray | |
| | | Concise/Sumagic | 5 to 10 ppm spray | |
| | | | Topflor | 20 to 80 ppm spray |
| | Induce lateral or basal branching | Configure | 50 to 800 ppm | Single foliar spray applied 2 weeks after potting. Growth index decreased with increasing rates. |
| 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. |
| SALVIA FARINACEA (Mealy sage) | To control plant growth | Citadel+Dazide/Cycocel+B-Nine | 1,000 ppm + 2,500 ppm spray | Apply if growth control is needed. |
| | | Flore/Collate | Spray | Not recommended because of flower delay. |
| | Induce lateral or basal branching | Configure | 250 ppm | Single foliar spray. Controlled height and increased branching on par with Florel sprayed at 500 ppm. |
| 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 NEMOROSA May Night (Meadow sage) | Induce lateral or basal branching | Configure | 50 to 800 ppm | Single foliar spray applied 2 weeks after potting. Branching increased and flowering delayed with increasing rates. 400 ppm was optimal. |
| | Induce branching on plugs | Configure | 300 ppm | Single or multiple foliar sprays applied ~34 days after sticking (plants moderately rooted) increased basal branching but reduced root surface area and root volume moderately. Apply after plugs are well rooted. |
| 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. |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|---|--|---|--|---|
| 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. |
| SCABIOSA CAUCASICA (Pincushion flower) | Induce lateral or basal branching | Configure | 50 to 800 ppm | Single foliar spray applied 2 weeks after potting. No effect. |
| SCAEVOLA AEMULA | To control plant growth | Concise /Sumagic | 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. |
| | | | 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 | |
| | | Piccolo /Bonzi/Paczol | 20 to 40 ppm spray | |
| | | | 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. Scaevolans are very responsive to paclobutrazol. |
| | | | Topflor | 45 to 60 ppm spray |
| | 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. Late applications can delay flowering. | |
| SCHEFFLERA | 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. may vary with pot size. |
| | Dazide /B-Nine | 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 | Abide /A-Rest | 1 to 2 ppm spray | |
| | | Dazide /B-Nine | 1,500 to 3,000 ppm spray | |
| SCOPARIA | To control plant growth | Dazide /B-Nine | 1,000 to 2,500 ppm spray | Use to tone plants if needed. |
| SCUTELLARIA JAVANICA (Skullcap) | To control plant growth | Dazide + Citadel /B-Nine + Cycocel | 2,500 ppm Dazide/B-Nine + 1,000 ppm Citadel/Cycocel tank mix spray | Begin applications 2 to 3 weeks after transplanting. Repeat as needed every 2 weeks. |
| SEMPERVIVUM spp. | To induce offsets | Configure | 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. |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|--|--|--|---|---|
| SEMPERVIVUM CANTABRICUM X MONTANUM VAR STRIACUM (Hens and Chicks) | Offset enhancer | Configure | 50 to 400 ppm | Single foliar spray. Rates between 200 and 400 ppm was optimal for increasing offsets. Rates up to 400 ppm did not affect subsequent rooting of offsets. Cultivars varied in the number of offsets produced. |
| SHASTA DAISY | To control plant growth | Concise/Sumagic | 15 to 30 ppm spray | |
| SHRIMP PLANT | To control plant growth | Abide/A-Rest | 25 to 50 ppm spray | Apply after plants established. |
| | | Dazide/B-Nine | 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 | Abide/A-Rest | 10 to 26 ppm spray | |
| | | Concise/Sumagic | 25 to 50 ppm spray | |
| | | Dazide + Citadel/B-Nine + Cycocel | 800 to 1,000 ppm Dazide/B-Nine + 800 to 1,000 ppm Citadel/Cycocel applied as a tank-mix spray | |
| | | Piccolo/Piccolo 10 XC/ Bonzi/Paczol | 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 | 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. |
| SNAPDRAGON, Vegetative (ANTIRRHINUM) | To control plant growth | Piccolo/Bonzi/Paczol | 30 to 60 ppm spray | |
| | | Concise/Sumagic | 20 to 45 ppm spray | |
| | To control plant growth and peduncle stretch | Dazide/B-Nine | 1,500 ppm spray | Use during periods of high temperatures. |
| SPATHIPHYLLUM (Peace lily) | 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 | Florgib/ProGibb T&O | 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. |
| | Induce lateral or basal branching | Configure | 250 to 1000 ppm | Single foliar spray or 10 ml substrate drench. Drench rates of 500 ppm recommended. Drenches at 1000 ppm resulted in the greatest number of lateral shoots and reduced overall height. All drench rates were better than any foliar rate. |
| 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 (Stokesia laevis; Silver Moon Stoke's Aster) | To control plant growth | Piccolo/Piccolo 10 XC/ Bonzi/Paczol | 40 to 80 ppm spray | |
| | Induce basal branching | Configure | 600 ppm | Not responsive to a single foliar spray. Higher rates or multiple applications may be effective. |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|--|--|--|--|---|
| 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. |
| | To delay premature bloom and promote additional plant growth | Topflor | 5 to 20 ppm spray | |
| | | Collate | 250 to 1000 ppm spray | Optimal rates varied significantly by cultivar. Conduct your own trials to determine optimal rates for each <i>Streptocarpus</i> 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 (<i>Helianthus annuus</i>) | 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 | |
| | Enhance seed set | | 1 to 2 mg a.i. (8.45 to 16.9 ppm) drench for a 6-in. pot | |
| | | Configure | 150 to 250 ppm | Single foliar spray 20 to 60 days after planting to field grown plants. 150 ppm applied on day 40 was optimal and increased seed set and yield by 25%. |
| SYNGONIUM PODOPHYLLUM (Arrowhead vine) | Induce lateral or basal branching | Configure | 250 to 2000 ppm | Single foliar spray onto rooted cuttings at the 3 or 5 leaf stage. BA at the 3 to 5 leaf stage resulted in earlier development of lateral shoots and shorter bushier plants. |
| 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/B-Nine + 1,000 ppm Citadel/Cycocel tank mix spray | Begin applications 2 to 3 weeks after transplanting. Repeat as needed every 2 weeks. |
| TECOMA STANS (Texas star) | Induce lateral or basal branching | Configure | 125 to 500 ppm | 4 foliar sprays at 2 week intervals following a hard pinch. BA increased the number of cuttings but reduced rooting percentage. |
| THANKSGIVING CACTUS (<i>Rhipsalidopsis gaertneri</i>) | Branching agent/Flower enhancer | Configure | 10 to 200 ppm | Single foliar spray 3 or 6 months after planting. 200 ppm on older plants increases branching and improves appearance. |
| THANKSGIVING CACTUS (<i>Schlumbergera truncata</i>) | Flower enhancer | Configure | 100 to 800 ppm | Single foliar spray applied 5 to 10 days after start of short days. BA hastens time to flower and increases number of flowers. BA 100 to 200 ppm was optimal. |
| | Phylloclade enhancer/Flower enhancer | Configure | 100 ppm | Single foliar spray 2 weeks after start of short days or during long days. Applications at 2 weeks after beginning of short day increased number of flower buds by 40%. Applications during long day increased phylloclade numbers by 150%. |
| THUNBERGIA ALATA | To control stem elongation/plant growth | Dazide + Citadel /B-Nine + Cycocel | 2,500 ppm Dazide/B-Nine + 1,000 ppm Citadel/Cycocel tank mix spray | Apply to cuttings in propagation. |
| TIBOUCHINA | To control plant growth | Dazide /B-Nine | 2,500 ppm spray | |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|---|--------------------------------------|---|--|--|
| TILLANDSIA BUTZII <i>T. aeranthos</i> <i>T. cacticola</i> (Succulent/ Bromeliad) | Induce lateral or basal branching | Configure | 1 to 50 ppm | Applied 2 to 3 times per week for 2 to 10 weeks as a foliar spray, or cuttings dipped 1 to 3 times for 1 to 24 hours. 25 to 50 ppm sprays and 1 hour dips greatly increased offsets. |
| TOMATILLO | To control plant growth | Sumagic | 2 to 10 ppm spray | See precautions listed with EGGPLANT. |
| TOMATO | To control plant growth | 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. |
| TROPICAL PLANTS (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. |
| TULIP | To control plant growth | Abide /A-Rest | 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. |
| | | Piccolo/Piccolo 10 XC /Bonzi/Paczol/Downsize | 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. |
| | | Piccolo /Bonzi/Paczol | 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. |
| | | Concise /Sumagic | 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. | | |
| Senescence inhibitor | Configure | 1 to 100 ppm | Applied via injecting bulbs or buds with 0.5 ml or 100 ppm solution, single foliar spray, or single soil drench. BA reduced bud blasting with 10 ppm being better than 1 ppm and the same as 100 ppm. BA reduced the time to flowering, increased the flower size, reduced the bulblet size, and hastened the exhaustion of the mother bulb. | |
| VERBENA, Annual | To control plant growth | Dazide /B-Nine | 2,500 to 5,000 ppm spray | |
| | | Piccolo/Piccolo 10 XC /Bonzi/Paczol | 15 to 30 ppm spray | |
| | | Citadel /Chlormequat E-Pro/Cyclocel | 800 to 1,500 ppm spray | Begin applications 7 days after pinching. Repeat as needed every 2 weeks. |
| | Concise /Sumagic | 15 to 30 ppm spray | | |
| To increase lateral branching | Augeo | 521 to 1,042 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. | |
| VERBENA CANADENSIS (Clump verbena) | Induce lateral or basal branching | Configure | 250 to 1000 ppm | Single foliar sprays immediately after pinching. 1000 ppm controlled shoot elongation by 19% |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|---|-----------------------------------|---|---|--|
| VERBENA 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. |
| VERBENA, Perennial | To control plant growth | Piccolo/Piccolo 10 XC/ Bonzi/Paczol | 120 to 160 ppm spray | |
| | | Piccolo/Piccolo 10 XC/ Bonzi/Paczol/Downsize | >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 | Dazide + Citadel/B-Nine + Cycocel | 2,000 to 3,500 ppm Dazide/B-Nine + 750 to 1,000 ppm Citadel/Cycocel applied as a tank-mix spray | See General Recommendations. |
| | | Piccolo | 8 to 12 ppm liner root soak | See BACOPA. Rate based on Michigan State University trials. |
| | | Citadel/Chlormequat E-Pro/ Cyclocel | 1,500 to 2,000 ppm spray | |
| | | Concise/Sumagic | 5 to 10 ppm spray | Apply as needed. |
| | | Dazide/B-Nine | 1,500 to 2,500 ppm spray | Do not apply within 2 weeks of a Florel or Collate application. |
| | | Florel/Collate | 250 to 300 ppm spray | Make last application 8 weeks before sale. |
| | Induce lateral or basal branching | Configure | 150 to 300 ppm | Single foliar increased lateral branching. |
| VERBENA X HYBRIDA | Induce lateral or basal branching | Configure | 30 to 300 ppm | Single foliar spray onto new cuttings. 30 ppm BA applied at cutting improved rooting after 12 days and improved branching after 24 days. |
| VERONICA | To control plant growth | Piccolo/Piccolo 10 XC/ Bonzi/Paczol | 20 to 40 ppm spray | |
| | | Concise/Sumagic | 20 to 40 ppm spray | |
| VERONICA LONGIFOLIA Icicle (Speedwell) | Induce lateral or basal branching | Configure | 600 ppm | A single foliar spray induced a short term increase in number of shoots and lateral branches. Multiple applications may improve response. |
| 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. |
| | Induce lateral branching | Configure | 50 to 800 ppm | Foliar spray or drench applied at 2 weeks after potting (WAP), 2+3 WAP, or 2+3+4 WAP. BA increased branching. |
| 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. |
| | Induce lateral or basal branching | Configure | 600 ppm | No response to a single foliar spray. Higher rates or multiple applications may improve response. |
| VIOLA | To control plant growth | Concise/Sumagic | 1 to 5 ppm spray | |
| WANDERING JEW | To control plant growth | Abide/A-Rest | 26 to 132 ppm spray | |

Growth Regulators for Floricultural Crops in Greenhouses

| CROP | PURPOSE | CHEMICAL | RATE* | PRECAUTIONS AND REMARKS |
|---|-----------------------------------|--|--|--|
| WOODY LANDSCAPE PLANT (Not specifically listed in this table) | To control plant growth | Abide/A-Rest | 50 ppm spray | Drench volumes and mg a.i. vary with pot size. |
| | | | 0.25 mg a.i. (2 ppm) drench for a 6-in. pot; apply 4 fl. oz./6-in. pot | |
| | | 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 | |
| | Flower enhancer | Configure | 100 to 200 ppm | Single foliar spray. 100 ppm reduced time from bud emergence to flowering by 7 days. |
| | Senescence inhibitor | Configure | 90 to 225 ppm | Single foliar spray, followed by simulated shipping. No effect on senescence. |
| ZINNIA <i>Zinnia elegans</i> | Induce lateral or basal branching | Configure | 20 to 800 ppm | 1, 2, or 3 foliar sprays applied 1 week apart starting 1 week after potting seedlings. BA increased branching, decreased internode length. |
| 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. |

PGR Mixing Tool: PGR Mix Master Update

By Brian Whipker, North Carolina State University

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

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


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

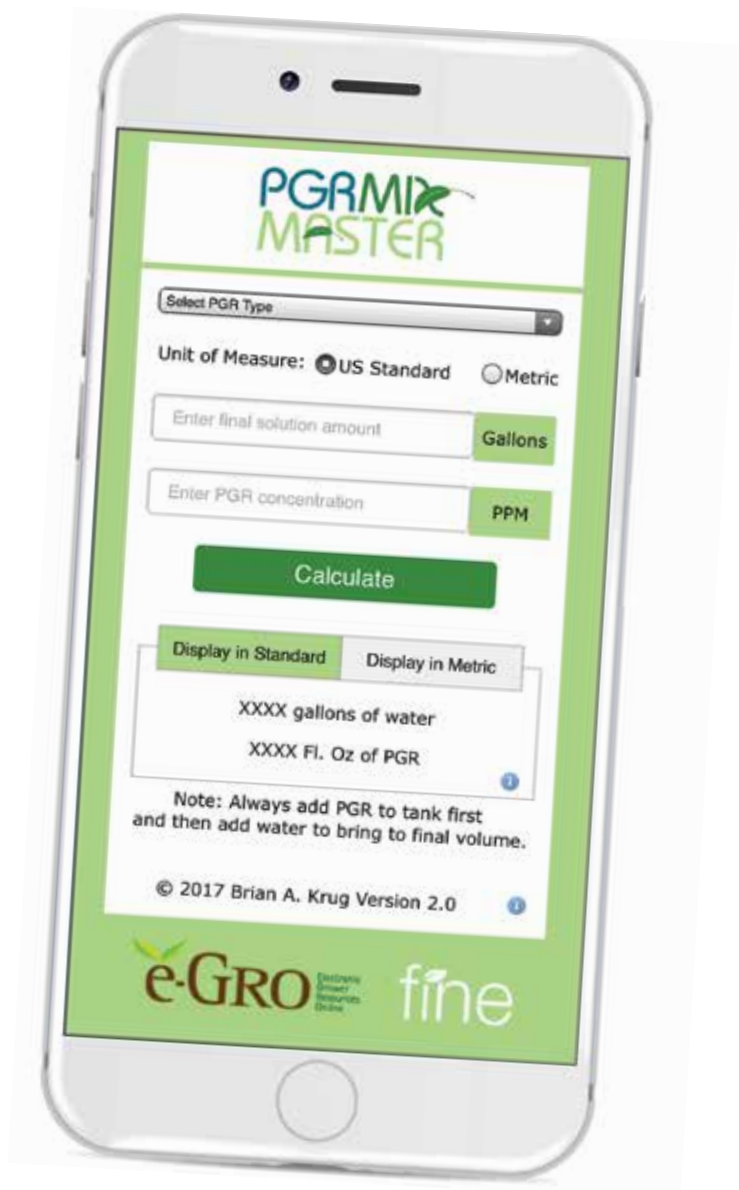
Steps for calculating PGR mixing rates

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

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

Installing PGR Mix Master on your phone

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



Evening Out Results with Piccolo 10XC

Brian Whipker, North Carolina State University

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

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

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

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

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

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

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

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

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

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

PGR Activity Influencing Factors



**Chemical
Species**

**Chemical
Concentration**

Cultivar

Application Type

**Application
Number**

Irrigation Frequency

Light

Development Stage

Temperature

Fertilizer

Application Interval

Spacing

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

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

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

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

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

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



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

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

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

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

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

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

Additional Benefits of PGRs

Brian E. Whipker, North Carolina State University

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

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

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

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

1. Greener leaves

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

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

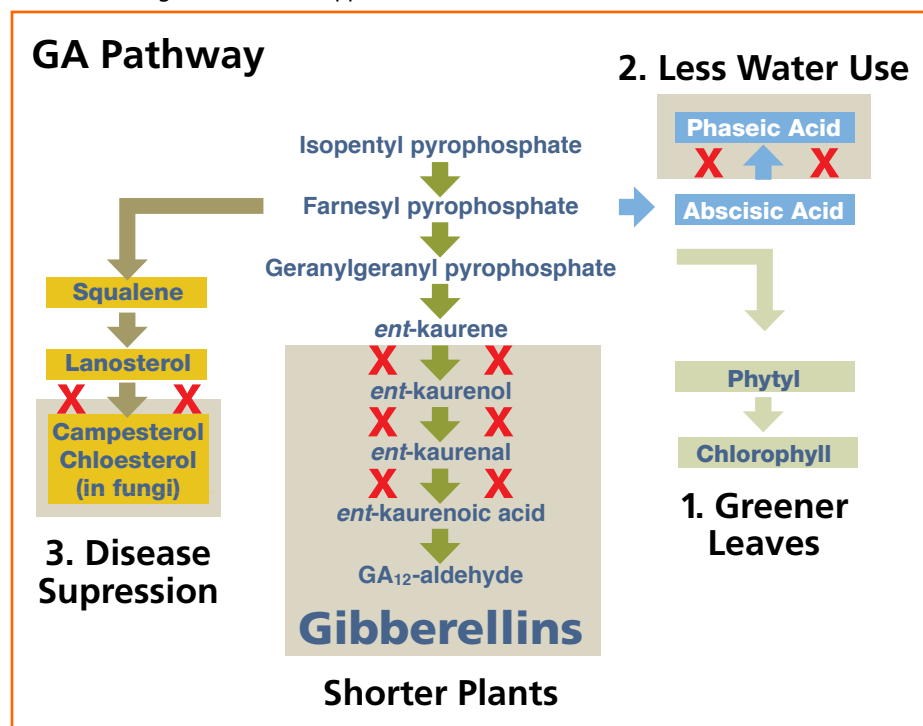
plying a PGR—which blocks the GA pathway—results in some secondary effects. In this case, an up-regulation, or increase, in the amount of chlorophyll produced by the plant (Figure 1).

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

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

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

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



2. Water use

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

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

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

3. Disease reduction

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

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

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

Finally, plants use less water, which helps avoid drought stress. There are additional benefits besides controlling excessive stretch when it comes to PGRs. This makes the use of PGRs a key component when it comes to best-management practices for floriculture crops. Please keep in mind that no plant growth regulators are labeled for control or suppression of plant diseases. 61



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

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

Data source: Ahmad, Whipker and Dole, NCSU

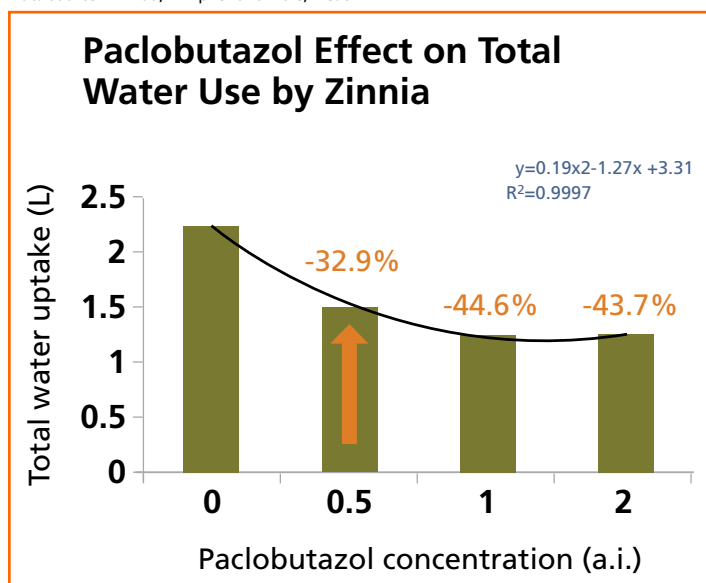


Figure 4. Based on a height control experiment, one can clearly see powdery mildew starting to infect the untreated plant on the left, while the plant on the right had been given a PGR drench about 4 weeks prior to this date and a powdery mildew infection had been reduced. PGRs will not provide season-long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

Collate Use Tips

By Brian E. Whipker, North Carolina State University

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

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

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

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

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

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

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

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

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

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

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

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

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

Effect of a Collate foliar spray on Coleus Oxford Street



Dilution Table

Formulated product per gallon of solution

| PPM AI | Abide/ A-Rest (milliliters) | Dazide/ B-Nine (grams) | Citadel/ Cycocel (milliliters) | Collate (milliliters) | Concise/ Sumagic (milliliters) | Piccolo/ Bonzi/ Paczol (milliliters) | Piccolo 10 XC (milliliters) | Topflor (milliliters) | Configure (milliliters) | Fresco/ Fascination (milliliters) |
|--------|-----------------------------------|------------------------------|--------------------------------------|--------------------------|--------------------------------------|---|-----------------------------------|--------------------------|----------------------------|---|
| 0.5 | 7 | | | | 4 | 0.5 | 0.05 | 0.48 | | |
| 1.0 | 14 | | | | 8 | 1.0 | 0.1 | 0.96 | | 0.23 |
| 5.0 | 72 | | | | 38 | 5.0 | 0.5 | 4.8 | | 1.14 |
| 10 | 143 | | | | 76 | 10 | 1.0 | 9.6 | | 2.27 |
| 25 | 359 | | | | 189 | 25 | 2.5 | 23.9 | | 5.68 |
| 30 | 430 | | | | 227 | 30 | 3.0 | 28.7 | | 6.81 |
| 40 | 573 | | | | 303 | 40 | 4.0 | 38.2 | | 9.08 |
| 50 | 717 | | | 0.8 | 379 | 50 | 5.0 | 47.8 | 9.0 | 11.35 |
| 100 | 1433 | | | 1.6 | 758 | 100 | 10.0 | 95.5 | 18 | 22.70 |
| 200 | | | 6.5 | 3.1 | | 200 | 20.0 | 191.0 | 36 | |
| 400 | | | 13 | 6.2 | | | | | 72 | |
| 500 | | | 16 | 7.8 | | | | | 90 | |
| 800 | | | 26 | 12.5 | | | | | 144 | |
| 1,000 | | 4.5 | 32 | 15.6 | | | | | 180 | |
| 1,250 | | 5.6 | 40 | 19.5 | | | | | | |
| 1,500 | | 6.8 | 48 | 23.5 | | | | | | |
| 2,000 | | 9.0 | 64 | 31.2 | | | | | | |
| 2,500 | | 11.1 | 80 | 39.3 | | | | | | |
| 5,000 | | 22.3 | | 79.4 | | | | | | |


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

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

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

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

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

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

Enhancing Growth of Sempervivum with Configure

By Brian E. Whipker, North Carolina State University

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

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

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

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



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

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

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

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

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

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


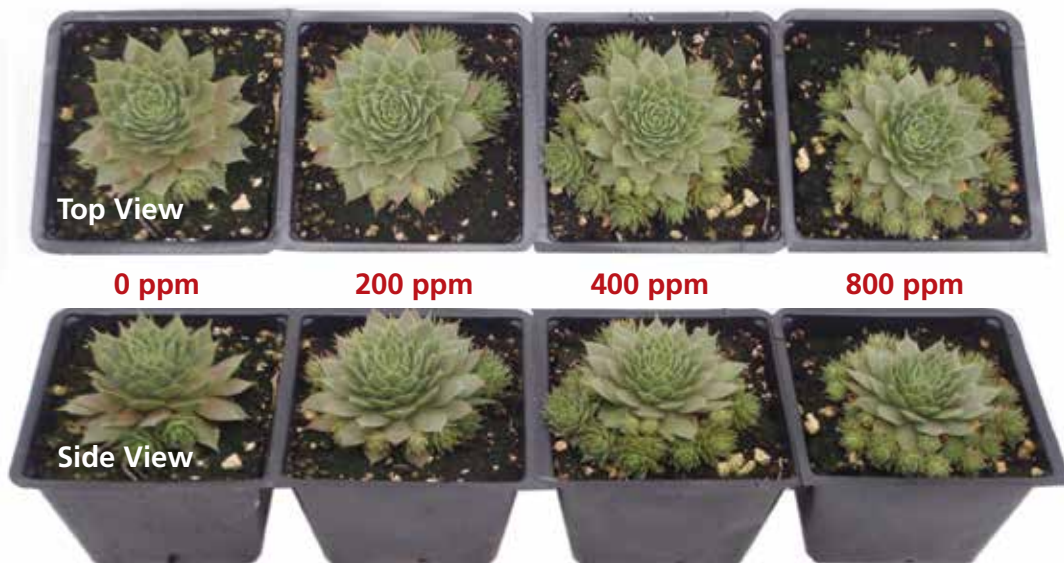
Configure foliar sprays will help to improve pot fill and offset production of sempervivum plants. Consider establishing a trial in your operation to determine the optimal recipes to follow for your greenhouse. 

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




Use of Piccolo 10XC on Poinsettias

By Brian E. Whipker, North Carolina State University

Piccolo 10XC is an improved paclobutrazol formula introduced by Fine Americas. It has the advantage of not settling in the jug because of its clear formulation and is also 10 times more concentrated, thus making it easy to mix large volumes.

This pictorial guide highlights the use of Piccolo 10XC on poinsettias. The experiment was conducted at North Carolina State University in Raleigh. Rooted plugs were transplanted into 6-in. azalea pots containing Fafard 1P on August 13, 2018 and pinched to five nodes on August 26, 2018.

The plants were irrigated as needed with a 150 ppm N fertilizer solution of 13-2-13 Cal-Mag. The temperature set points of 65F nights/75F days (18C/23C) were used. Piccolo 10XC foliar sprays were applied on September 29, 2018 at a normal recommended rate of 20 ppm, 40 ppm, plus an untreated control.

The degree of growth control can be observed in the photographs and provide insight when you use Piccolo 10XC. 



Piccolo 10XC (ppm)



Poinsettia Prestige Early, December 2



Piccolo 10XC (ppm)



Poinsettia Majestic Pink, December 2



Piccolo 10XC (ppm)



Poinsettia Premium Red, December 2



Piccolo 10XC (ppm)



Poinsettia Saturnus, December 2

Growers' Perspectives on Piccolo 10 XC





Piccolo has long been a top choice for growers looking for superior control, and Piccolo 10 XC takes that to the next level. Catoctin Mountain Growers uses the product nearly year-round, she says, in the spring on crops like petunias, calibrachoa and verbena, the fall on mums when necessary, and even on poinsettias for mini drenches.



Consistent Growth Control with No Settling – or Shaking

Piccolo® 10 XC is the world's first and only 4% paclobutrazol formulation for compact, consistent-quality plants as well as easier handling and mixing. With its crystal clear solution instead of a murky suspension, Piccolo 10 XC mixes quickly and evenly for unmatched consistency.

“The fact that it doesn't settle out is huge,” says Julie Iferd, head grower at Catoctin Mountain Growers in Detour, Maryland. “We started using it as soon as it came out – we were one of the early converters.”



A True Solution – Not a Suspension

The Piccolo 10 XC formulation is a true solution – which means it creates a more stable, more consistent spray solution. And, even when growers mix stock tanks full of Piccolo 10 XC for later use, the clear solution Paclobutrazol doesn't settle out, either in the tank or the spray container.

“One of the biggest advantages by far is that most people would buy the old formulation in 2½ gallon jugs,” says Larry Jones of Southern Ag in Plant City, Florida. “If you didn't shake it, you got really uneven results – waves of plants instead of a razor line. With 10 XC, you're dealing with a little quart bottle that you don't even have to shake up.”

Without the need for agitators or mixers, growers can be confident that they will come as close to complete consistency as possible. “Piccolo 10 XC improves uniformity, especially when we're doing drenches,” says Julie. “It's just a far superior product.”





Higher Power, Less Waste

One quart of Piccolo 10 XC equals 2.5 gallons of regular Piccolo, so there is less product to store and handle and a lower carbon footprint for your operation. “All of those 2.5 gallon jugs would take up the space of a refrigerator,” Larry says. “Ten bottles of Piccolo 10 XC take up the space of a toaster.”

The higher concentration also translates to lower freight costs, he says. “With today’s trucking costs, it makes no sense to truck water in products that aren’t concentrated. Not having to ship as much is always better.”

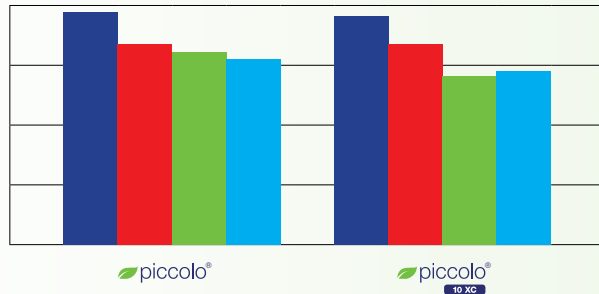
Because Piccolo 10 XC is concentrated and 10 times stronger, that also means growers have to use less of it to get the same control. “We use a lot of it, and there was no need for the plastic waste,” Julie says. “It’s our go-to choice of growth regulator.”

Piccolo 10 XC is a 4% paclobutrazol formulation that’s registered for bedding plants and plugs, flowering and foliage crops, bulb crops, perennials and woody ornamentals. See product label for specific varieties, and for more information, visit www.fine-americas.com.

Effect of a paclobutrazol spray on garden mum ‘Ashley’

Plant Ht. (cm) @ 14 Days After Treatment.

■ 0 ppm
■ 50 ppm
■ 100 ppm
■ 200 ppm



Source: Michigan State University.

Paclobutrazol Foliar Spray - Coleus

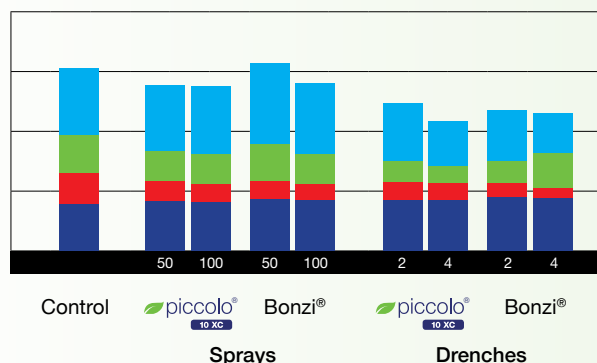


Source: North Carolina State University. Concentrations shown are in ppm.

Effect of paclobutrazol sprays & drenches on Celosia ‘New Look Scarlet’

Plant Ht. (cm)

■ Market
■ Week 2
■ Week 1
■ Week 0



Source: University of Florida IFAS.

fine

Excellence in PGR Technology

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10 XC

Our team has developed a collection of high-quality PGRs as diverse as your greenhouse.

Our PGR experts provide you with personalized, technical support and training.

We work with university researchers to bring you the latest PGR technology and developments.

Always read and follow label directions. Abide[®], Citadel[®], Collate[®], Configure[®], Concise[®], Florgib[®], Fresco[®] and Piccolo[®] are registered trademarks of Fine Agrochemicals, Ltd. Dazide[®] is a registered trademark of Fine Holdings, Ltd. © 2019 Fine Americas, Inc.

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