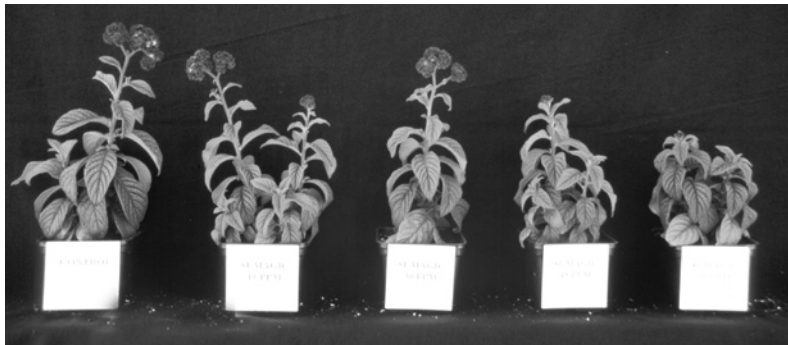


Selecting and Using Plant Growth Regulators on Floricultural Crops



Selecting and Using Plant Growth Regulators on Floricultural Crops

Joyce G. Latimer, Extension Specialist, Greenhouse Crops, Virginia Tech

Plant growth regulators (PGRs) are chemicals that are designed to affect plant growth and/or development. They are applied for specific purposes to affect specific plant responses. Although there is much scientific information on using PGRs in the greenhouse, it is not an exact science. Achieving the best results with PGRs is a combination of art and science – science tempered with a lot of trial and error and a good understanding of plant growth and development.

Optimizing Results

For best results, PGRs should be handled as production tools, like water and fertilizer. They should not be used as crutches for poor management of other cultural practices. PGRs should be an integrated part of your crop production cycle. They are most effective when applied at the appropriate times to regulate plant growth or development. In other words, growth retardants cannot "shrink" an overgrown plant. They must be applied before the plant is overgrown to avoid plant stretch. When planning PGRs in your production schedule, consider what you want to accomplish with the treatment.

- Do you want to reduce the growth rate of the plant, improve its color and general condition (toughness)? If so, you probably want a growth retardant such as B-Nine, Cycocel, A-Rest, Bonzi, or Sumagic.
- Do you want to increase plant branching for enhanced cutting production, or for a more bushy potted plant or hanging basket? If so, you probably want to use a branching agent or "chemical pincher" such as Atrimmec, Florel[®] Brand Pistill (Florel), or Off-Shoot-O.
- Do you want to enhance flower initiation or synchronize flowering? If so, you probably want to use Cycocel, Florel, GibGro, or ProGibb.

Answering these questions will indicate which type of PGR you need to use to accomplish your goal. It also will determine the most appropriate timing of the application. Then you will need to select a specific PGR in that class and determine the appropriate dosage and the appropriate application method for the selected application.

Read the Label

Plant growth regulators are classified as pesticides. Therefore, they are subject to all of the same USDA recordkeeping and Worker Protection Standard (WPS) rules as all of your other pesticides. Their use is governed by the manufacturer's label as with other

pesticides. The label not only contains information on restrictions, but also much information on how to use the product effectively.

- Is the chemical labeled for the crop you wish to treat? Most of the PGR labels have undergone recent revisions that apply to a broad range of similar crops not specifically listed on the label, with the user taking responsibility for determining appropriate rates. This provides label permission to use the compound on these crops without the manufacturer accepting the responsibility for the rate selection.
- Look for information on the effectiveness and on the side effects (phytotoxicity) of the chemical on your specific crop. B-Nine is considered to be a safe, short-term growth retardant with few phytotoxicity problems. However, it has little effect on growth of petunias and may burn treated leaves of kalanchoe. Begonias are extremely sensitive to Bonzi and Sumagic, and the label warns you to avoid overspray or drift on these crops.
- Notice any label warnings regarding the PGR's effect on plant flowering. Many branching enhancers delay flowering. Florel causes flower bud abscission prior to enhancing branching; therefore, it is not recommended within six to eight weeks of marketing. Side effects are frequently affected by the timing of the application; e.g., late applications of Bonzi or Sumagic can delay flowering of pansy, or, late applications of B-Nine or Cycocel can reduce bract size of poinsettias.

Plant Growth Regulators for Height Control

Most of the PGRs used in the greenhouse are used to regulate shoot growth of bedding plants, garden mums, poinsettias, and other containerized crops. These PGRs are referred to as "growth retardants." Typical growth retardants are B-Nine, Cycocel, A-Rest, Bonzi, and Sumagic (Table 1). These PGRs reduce plant height by inhibiting the production of gibberellins, the primary plant hormones responsible for cell elongation. Therefore, their effects are primarily on stem, petiole and flower stalk tissues. Lesser effects are seen in reductions of leaf expansion, resulting in thicker leaves with darker green color.

Other benefits of using these PGRs in plant production include improved plant appearance by maintaining plant size and shape in proportion with the pot. Plant growth retardants also increase the stress tolerance of plants during shipping and handling and retail marketing, thereby improving shelf-life and extending plant marketability.

Remember, growth retardants do not reduce plant size. They reduce the plant's growth rate. You must apply the growth retardant prior to the "stretch." Look for recommendations on the PGR label for time of application. These recommendations will be given in terms of plant development or plant size as opposed to production time. For example, the Sumagic label specifies that pansies should have attained a minimum height of four inches prior to application. The Bonzi label says that bedding plant plugs should be treated at the one to two true leaf stage and bedding plants (after transplanting) at two inches of new growth or when the plants reach marketable size.

Generally, growth retarding PGRs should be applied just prior to rapid shoot growth. This is usually one to two weeks after transplanting a plug, after the roots are established and as the plant resumes active growth; on pinched plants, it is after the new shoots are visible, just starting to elongate. This is where the art of plant growth regulation is most important. You must learn how your crop grows and when to intervene to obtain the desired results. Remember to note details of crop development in your records of PGR treatments. For example, due to the weather conditions, next year you may need to treat at seven days after transplanting instead of at the ten days after transplanting that you used this year. Gauge when rapid elongation will likely occur and treat to counter it.

Many growers use multiple applications of growth retardants to better control plant growth. A single application at a high rate early in the plant production cycle may be excessive if growing conditions are not as good as expected. An early application at a lower rate provides more flexibility, but the tradeoff is in the additional labor involved with a second application if it becomes necessary. Some growers improve crop uniformity by using multiple applications of lower rates to affect small corrections in plant growth.

Be aware that excessive rates of Bonzi or Sumagic can cause extremely persistent growth reductions in the flat or even in the landscape. It is always a good idea to evaluate the long-term effects of your treatments by growing some out for yourself and talking with your customers.

Be careful to avoid very late applications, especially of Bonzi or Sumagic as they may delay flower opening on bedding plants. However, drench applications of Bonzi have provided excellent control of poinsettia height very late in the production cycle without causing the reduction in bract size accompanying late spray applications. Learn the art of using PGRs for plant growth regulation.

Plant Growth Regulators for Lateral Branching

Another group of PGRs used in floricultural crops are those that enhance branching, including Florel, Atrimmec and Off-Shoot-O (Table 2). These PGRs are frequently called "chemical pinchers" because they generally inhibit the growth of the terminal shoots or enhance the growth of lateral buds, thereby increasing the development of lateral branches. They can be used to replace mechanical pinching of many crops. Often this increased branching also will reduce the overall height of the plant. The ethylene released inside the plant by Florel also inhibits internode elongation, keeping treated plants more compact than untreated plants. Florel also affects flowering (see below). If you are looking for enhanced branching, you must have sufficient growth on the plant to allow for sites of lateral development. They cannot enhance lateral branching if there are no laterals on the plant. Again, read the label for details of when to apply for optimum response.

You may need to consider combinations of PGRs. For example, if you apply Florel to enhance the branch development of 'Wave' petunias in a hanging basket, you will probably need to follow up with a treatment of a plant growth retardant like Bonzi to control the elongation of those new laterals. Always consider the side effects of treatments. As mentioned in Tables 1 and 2, some of these PGRs affect flowering which is critical to the successful production of floricultural crops.

Plant Growth Regulators for Flowering

Plant growth regulators can be used to enhance flowering (GibGro) or to remove flowers (Florel). To improve flowering, GibGro, which contains the growth promoter gibberellic acid, can be used to substitute for all or part of the chilling requirement of some woody ornamentals typically forced in the greenhouse, including azalea. [A broad use label was submitted for EPA approval in 2001 for Pro-Gibb (Valent USA) which would include camellia, hydrangea, and a variety of other floricultural crops.] Special attention must be given to the stage of flower bud development for successful treatment. In addition to overcoming dormancy, these compounds can improve flowering and/or bloom size of camellia, geranium, cyclamen, spathiphyllum, statice, and calla lily (see product labels for specific uses). Again, timing is critical since late applications, or excessive rates, may cause excessive plant stretching resulting in weak, spindly stems. Cycocel used to control stem height of hibiscus and geranium also improves early flowering.

Flower removal is especially desirable for stock plants maintained for cuttings of vegetatively propagated ornamentals, like geraniums, fuchsia, begonias, or lantana. Florel (ethephon) is the primary compound used for flower removal. Once ethephon is absorbed by the plant it is converted to gaseous ethylene, a natural plant hormone effective in many plant processes. Ethylene is the primary hormone responsible for flower senescence and fruit ripening. It is the "postharvest" hormone. With proper rates and timing, it will remove unwanted flowers from stock plants or from plugs or young bedding plants.

Flower removal diverts more energy into vegetative growth, increasing the number of laterals available for cuttings on stock plants, and promoting increased branching of plugs and finished plants, which increases fullness in hanging baskets or other containers. Early flower removal also allows synchronization of flowering of a container for a more dramatic appearance or for flowering on a specific marketing date. Since initiation and development of flowers requires time, Florel should not be used on crops within six to eight weeks of marketing.

Application Guidelines

Spray Applications. The pesticide label not only contains information on restrictions but also much information on using the product effectively. The label will identify the target tissue for that PGR – B-Nine is only effective as a foliar spray whereas Bonzi and Sumagic sprays must reach the stems or roots. When making spray applications, look at the physiological development of the plant to see that there is sufficient plant material at the correct stage of growth to make the treatment effective and to accomplish your goal. Generally, there should be sufficient foliage or stems to absorb the PGR. Uptake and effectiveness of a PGR also depend on selecting the application technique that will ensure proper coverage of the target tissue. B-Nine is not soil active and is fairly mobile in the plant. Therefore, a foliar spray application, wetting most of the foliage, will provide a fairly uniform reduction in growth of sensitive crops.

However, the triazoles, Bonzi and Sumagic, are absorbed primarily by stem tissue and then translocated upwards in the plant. Therefore, consistent and complete coverage of the stems is necessary for uniform effects. In other words, if the stem of one lateral receives an inadequate amount of spray, it will grow faster than the others, resulting in a poorly shaped plant, most noticeable in potted crops like poinsettia or chrysanthemum. The triazoles also are very "soil

active" which means they may be adsorbed to particles in the media and become available to the plant through root uptake. Therefore, drenching is a very effective application method for these chemicals in crops where it is economically feasible (see How to Apply Drenches below).

The label will provide a recommended application volume for sprays or drenches, especially for chemicals that are soil active. All foliar applications of PGRs should be applied on an area basis, i.e., uniformly spray the area where the plants are located with the recommended volume of solution. Do NOT spray individual plants or spray to reach a subjective target like "spray to glistening." Since every applicator will have a slightly different definition of these goals, there will be no way of recommending appropriate rates or obtaining predictable results. For soil active PGRs, dosage equals the concentration of the solution multiplied by the volume applied in the treated area. Therefore, to improve predictability, the label-recommended spray application rates are generally set at 2 qt. finished spray per 100 sq.ft., a comfortable walking pace for applicators with hand-held sprayers.

Since Bonzi and Sumagic are soil active, precautions should be taken to avoid over-application with sprays. Spray applications require more attention to detail, because overspray material lands or drips onto the medium. Remember that dosage equals concentration times volume. Figure 1 shows the effect of Sumagic application volume on growth of vinca (*Catharanthus roseus*) at four weeks after treatment. A 1 ppm spray solution of Sumagic was applied at the label recommended volume of 2 qt. per 100 sq. ft., at 3 qt. per 100 sq. ft., or at twice the label rate, 4 qt. per 100 sq. ft. This high volume application was comparable to the amount of spray you might apply "to runoff." These vinca plants were effectively treated with 0, 1, 1.5, or 2 ppm Sumagic (dose = concentration x volume).

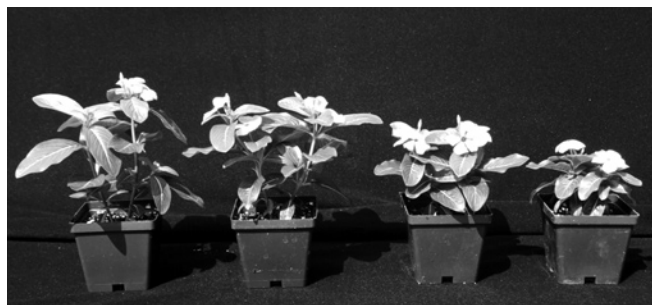


Figure 1. Effect of increasing volume of spray application on height control. Vinca (*Catharanthus roseus*) untreated (left) or treated with 1 ppm Sumagic at the label recommended volume of 2 qt. per 100 sq. ft., at 3 qt. per 100 sq. ft., or 4 qt. per 100 sq. ft. (left to right).

Recognizing that stem coverage is necessary for the triazoles, you may need to apply a higher than recommended volume to large or dense plants to obtain adequate coverage. In fact, the Bonzi label recommends 3 qt per 100 sq.ft. for "larger plants with a well developed canopy." Adjust the concentration you apply accordingly. This suggests the importance of record-keeping (see below).

Spray Equipment. To assure proper spray volumes, your compressed air sprayer should be equipped with a pressure gauge and regulator and you should consistently use the same nozzle for all PGR applications. Your sprayer should be calibrated by determining the output of the chemical with the selected nozzle at the selected pressure within a specified time period. Using this information, you can apply a known amount of material to a known area. Spray droplet size also affects response with smaller droplet sizes providing better coverage, but only up to a point. Mist or fog type applicators do NOT provide adequate volume for coverage of plant stems and have not been effective when used with compounds like Bonzi and Sumagic.

Applying Drenches. Drenches have several advantages over sprays. Drenches generally have less effect on flower or bract size and tend to provide longer lasting growth regulation than sprays. Drenches are easier to apply uniformly than sprays because the drench volume is easily measured, and when applied to moist media, it is easy to obtain good distribution of the PGR in the media. Therefore, the resulting growth regulation is frequently more uniform. The label specifies the recommended volumes for drench applications to different size pots or types of media. **Read the label.** In general, 4 fl. oz. of drench solution is applied to a six-inch "azalea" pot, and that volume is adjusted up or down with pot size to obtain a volume where about 10% of the solution runs out the bottom of the pot when the media is moist. Both the A-Rest and Bonzi labels provide the following volume recommendations for drench applications:

Pot diameter volume (inches)	Drench volume (fl. oz. per pot)	D r e n c h volume (ml per pot)
4"	2	60
5"	3	90
6"	4	120
8"	10	300
10"	25	750
12"	40	1200

Remember that the amount of active ingredient applied to plants using soil-active PGRs is a product of the concentration (ppm) of the solution and the volume applied. Label recommendations for drench applications give solution rates (in ppm) and volume recommendations. In some cases, drench application recommendations are given in terms of milligrams of active ingredient (mg a.i.) per pot. For Bonzi, the label provides mixing directions for mg a.i. solutions for Bonzi, or, you can use the NC State University "PGR Calculator" (See Resources below) to obtain solution directions for drench recommendations using this format.

Other methods of applying PGRs directly to the media have been developed and labeled. For example, Bonzi and A-Rest are labeled for chemigation or application through the irrigation system. These are generally limited to flood (sub-irrigation) or drip irrigation, not overhead sprinkler systems. Again, rates vary with the volumes used and method of application. Bonzi applied once by sub-irrigation requires 50% to 75% of the amount of Bonzi that is applied in a typical drench application. Read and exactly follow the label for chemigation applications.

Other Types of PGR Applications. Three other methods of providing a drench type application of soil-active PGRs on a more economical scale are being used by growers. One is **media surface application** sprays. These are spray applications made to the surface of the media of filled flats or pots. The treatment is applied at normal to high spray volumes, but since it is applied to the media surface it is activated by irrigation and is available to the plant in the root zone. Both Bonzi and Sumagic are labeled for this method of application. Rates are lower than used for sprays, but higher than used for drench applications.

A second method is called "**sprenches**" which is a high volume foliar spray that results in runoff into the media, providing a drench effect. Rates are lower than those recommended for sprays.

A third technique is called "**watering in**" where the PGR, A-Rest and Bonzi are currently labeled, is injected into the irrigation water and applied in each irrigation at very low rates of active ingredient.

All of these application methods use the relationship between rate and volume to provide the desired control and preferred application methods. Again, you must develop techniques that fit your production methods and your growth management preferences.

Beware of Bark. For all media applications, be aware that soil-active PGRs tend to be tied up by bark particles in the media which makes it less available to the plants. Therefore, if your media mix is high in bark you will need to compensate for this unavailability by adjusting your application rates up for any type of drench or media applications.

Growing Conditions. Look also for label recommendations on time of day or condition of the plant for optimum treatment response. Generally, a healthy, unstressed plant growing under low evaporative conditions, e.g., early in the morning or late in the afternoon, is most responsive to treatment. To maximize uptake, the chemical must remain in contact with the leaf long enough to be absorbed. This time varies for the different PGRs. Plants treated with B-Nine or Florel should not be overhead irrigated for at least 12 hours after treatment, but plants treated with Bonzi or Sumagic may be irrigated one hour after treatment. Spraying when the treatment will not dry quickly increases absorption of the active ingredients and increases the effectiveness of the treatment. Read the label for any warnings on how irrigation or environmental conditions will affect plant response to the PGR treatment.

Treat All Recommendations as Starting Rates for Your Own Trials

The multitude of variations possible in application methods, cultivar and species grown, and growing conditions make it impossible to recommend specific rates for all operations. Table 3 provides labeled rates for the use of PGRs on annual bedding plants and other floricultural crops. Use the lower label rates for starting your own trials. There are a couple of general rules for using rate recommendations from other sources:

- 1) Southern growers use higher rates and more frequent applications than Northern growers. Rates for Virginia tend to be closer to the Southern rates.
- 2) Outdoor applications usually require higher rates or more frequent applications than for plants grown inside the greenhouse.

Recordkeeping

Making notes on your application methods and the results of your PGR treatments will allow you to improve the consistency of your own application methods and establish rates and volumes appropriate to your production system. Note the concentration and the volume applied, the stage of development of the crop (number of leaves, approximate height, presence of flowers), and the environmental conditions under which the PGR was applied. It is always helpful to keep a few untreated plants for comparison, especially if you are new to using PGRs.

Costs of PGRs

Also consider the cost of the various plant growth regulators in developing your production program. Table 4 provides an estimated cost of using various plant growth retardants on a given spray area of 1000 sq.ft. This area would include about 650 bedding plant flats or 4000 6-inch pots. This table lists only chemical costs. You will need to add your labor and equipment costs to calculate the PGR application costs in your operation. You also will want to consider the costs of multiple applications vs. single applications when determining which PGR to use in a given situation.

Conclusions and Rate Recommendations

Plant growth regulators are valuable production tools that can enhance product quality and marketability while reducing labor for pinching and/or pruning and plant maintenance. They must be used with proper attention to other cultural practices, especially proper fertility and irrigation management. Plant growth regulators cannot correct poor production practices.

Plant growth regulator recommendations for a wide variety of floricultural crops are listed in Table 3. These rates are label recommended rates and should be evaluated under your own growing conditions. For more information on rates for herbaceous perennials see VCE Publication 430-103, *Using Plant Growth Regulators on Containerized Herbaceous Perennials*.

Recommended Resource

For a ready resource on preparing PGR solutions, download the North Carolina State University Plant Growth Regulator Calculator from:

<http://www.ces.ncsu.edu/depts/hort/floriculture/software/pgr.html>

This Microsoft Excel spreadsheet allows you to enter your own PGR costs and calculate solutions based on the rate desired and the amount of area to be treated. The spreadsheet includes information on both spray and drench applications. It not only gives you the amount of PGR to mix per gallon or liter of water, but also provides the cost of the application based on the area or number of containers treated.

Appendix. Helpful conversions.

Volume

1 gallon (gal) = 128 fluid ounces (fl oz)

1 fl oz = 30 milliliters (ml)

1 gal = 3785 ml = 3.785 liters

1 cup = 48 teaspoons

1 tablespoon = 3 teaspoons

1 fl oz = 2 tablespoons = 6 teaspoons

Weight

1 ounce (oz) = 28.3 grams (g)

1 pound (lb) = 16 oz = 454 g

Concentration

1% = 10,000 ppm

1 ppm = 1 milligram (mg) per liter

Disclaimer

Commercial products are named in this publication for informational purposes only. Virginia Cooperative Extension does not endorse these products and does not intend discrimination against other products which also may be suitable.

Table 1. Plant growth regulators used to reduce plant height during the production of floricultural crops.

Trade name/ Common name	Application methods	Comments	Concerns
B-Nine daminozide Uniroyal Chemical Co.	Foliar spray Cutting dip	Apply uniformly to all foliage. No soil activity. Effective on a broad list of species, but low level activity and short residual; multiple applications generally required. Increased activity when tank mixed with Cycocel.	Safe, few incidences of phytotoxicity or overstunting. Do not overhead irrigate within 12 hr after treatment. Use weight to measure new WSG formulation because the volume measured will be different from the old SP formulation.
Cycocel chlormequat chloride Olympic Horticultural Products	Foliar spray Drench	Standard for geraniums, poinsettias, and hibiscus; enhances flowering of geranium and hibiscus. Recent label change allows use on a broad spectrum of crops. Activity is low, multiple applications generally required. Increased activity when tank mixed with B-Nine.	Causes discoloration of leaves especially with rates above 1500 ppm; phytotoxicity reduced in tank mix with B-Nine. Less effective under high temperature conditions.
A-Rest ancymidol SePRO Chemical Co.	Foliar spray Bulb dip Drench Chemigation Injection	Broad spectrum label. Very active on bedding plants (except geraniums and impatiens); commonly used on plugs. Moderate activity.	Very safe. Relatively expensive for many crops, but used extensively on plugs.
Bonzi paclobutrazol Uniroyal Chemical Co.	Spray Media spray Drench Bulb dip Chemigation Subirrigation	Apply uniformly to cover stems (not absorbed by leaves). Much more active than above PGRs; measure accurately. Spray procedure and uniformity greatly affects results. Very soil active as a drench.	Spray volume critical to establishing rates due to drench effect of runoff. Use higher rates under high temperature conditions. Late applications can reduce flowering. Phytotoxicity includes overstunting and may cause black spots on annual Vinca. Avoid drift onto non-target plants.
Sumagic uniconazole Valent USA	Spray Media spray Drench Bulb dip	Same chemical class as Bonzi but 8 to 10 times more active. Apply uniformly to cover stems (not absorbed by leaves). Spray procedure and uniformity greatly affects results. Very soil active as a drench.	Spray volume critical to establishing rates due to drench effect of runoff. Use higher rates under high temperature conditions. Late applications can reduce flowering. Phytotoxicity includes overstunting. Avoid drift onto non-target plants.

Table 2. Other plant growth regulators used in the production of floricultural crops.

Trade name/ Common name	Application methods	Comments	Concerns
Florel[®] Brand Pistill ethephon Monterey Chemical Co.	Foliar spray	Promotes lateral branching, thereby reducing stem elongation. Also aborts flowers; improves stock plant branching and cutting yield. Use early in crop cycle to increase branching and remove early flowers (6-8 wk before flowering). Induces flowering of bromeliads. Reduces height and stem topple of potted daffodils and hyacinths.	New broad use label approved by EPA. The pH of spray solution should be below 5.0. Has no drench activity. Use within 4 hours of mixing. Results less predictable under high temperature conditions. Do not treat plants under environmental stress conditions.
Atrimmec dikegulac sodium PBI Gordon	Foliar spray	Inhibits terminal growth, thereby promoting lateral development. Apply to actively growing plants with at least two nodes to provide sufficient lateral development.	May significantly delay plant development, especially at higher rates. Causes leaf chlorosis which may be persistent at high rates.
Fascination benzyladenine/ GA₄₊₇ Valent USA	Foliar spray	Growth promoter. Labeled for prevention of leaf yellowing and to delay flower senescence of Easter, oriental and <i>Lilium longiflorum</i> x asiatic (LA) hybrid lilies.	Effective dose strongly affected by volume (soil active). Thorough coverage required. Avoid application to plants under conditions of environmental stress.
Off-Shoot-O methyl esters of fatty acids Cochran Corp.	Foliar spray	Labeled for chemical pinching of actively growing azalea, cotoneaster, juniper, ligustrum, Rhamnus, and Taxus.	Ensure coverage of growing points.
GibGro gibberellic acid Agtrol International	Foliar spray	Growth promoter. Labeled for: substitution of cold to force flowering azaleas; to inhibit flower buds on vegetative azaleas; peduncle elongation of pompom mums; earlier flowering and increased yield of statice; induction of flowering of spathiphyllum.	Do not spray more than once. Over application or incorrect timing can cause weak stems and excessive stem elongation.

Table 3. Labeled rates for plant growth regulators*. Unless otherwise stated, the treatment noted is intended to control plant height during production.

Crop	Product	Application Method & Rate	Precautions & Remarks
Ageratum	A-Rest	7 to 26 ppm spray (3.4 to 12.6 fl oz/gal)	Plug culture and flat culture differ in recommended rates. The rates shown in this table include both plug (lower rates) and flat culture (higher rates) recommendations. Apply all foliar sprays of plant growth regulators using 0.5 gallon per 100 square feet of bench area unless otherwise directed by the label. Cycocel rates may be increased to 3,000 ppm (3.25 fl oz/gal) after extensive testing.
	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	
	Bonzi	5 to 45 ppm spray (0.16 to 1.44 fl oz/gal)	
	Cycocel	800 to 1,500 ppm spray (0.87 to 1.63 fl oz/gal).	
	Sumagic	20 to 30 ppm spray (5.12 to 7.68 fl oz/gal)	
Alternanthera (Joseph's-Coat)	A-Rest	25 to 132 ppm spray (12.1 to 64 fl oz/gal)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
		2 to 4 ppm drench for a 6 inch pot (1 to 2 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	
Alyssum	Bonzi	10 to 60 ppm spray (0.32 to 1.92 fl oz/gal)	See Ageratum.
	Sumagic	5 to 25 ppm spray (1.3 to 6.4 fl oz/gal)	
Amaryllis	Bonzi	200 ppm drench for a 6 inch pot (6.4 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
		100 ppm bulb soak (3.2 fl oz/gal)	Soak bulbs for 1 hour.
Aster	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	See Ageratum.
Azalea	A-Rest	26 ppm spray (12.6 fl oz/gal)	
	Atrimmec	3,124 to 6,248 ppm spray (2 to 4 fl oz/gal)	To increase lateral branching. Start treating rooted cuttings. May treat several times during first year of growth.
	B-Nine	1,500 to 2,500 ppm spray (0.24 to 0.39 oz/gal)	To promote flower initiation. Apply solution when new growth from final pinch is 1 to 2 inches long.
	Bonzi	100 to 200 ppm spray (3.2 to 6.4 fl oz/gal)	To control plant height and promote flower bud initiation, apply after final shaping, when new growth is 1.5 to 2 inches long. To reduce bypass shoot development, apply after bud set, when bypass shoots are barely visible.
		5 to 15 ppm drench for a 6 inch pot (0.16 to 0.48 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
	Cycocel	1,000 to 4,000 ppm spray (1.08 to 4.34 fl oz/gal)	To promote flower initiation. Optimum rates are generally between 1,000 and 2,000 ppm. Two to six multiple sprays may be needed. Apply first application when new growth is approximately 2 inches long.
	Florel	2,500 to 5,000 ppm spray (8 to 16 fl oz/gal)	To increase lateral branching. Apply at normal pinching times, up to 6-8 wk before bloom on finished plants or 2 wk before taking cuttings from stock plants.
	GibGro	265 to 1,055 ppm spray (1.06 to 4.2 fl oz/gal).	For partial or full substitution of cold. Spray timing, concentration, and number of applications vary with cultivar as well as intended degree of cold substitution. Consult the label for exact recommendations.
	GibGro	130 to 850 ppm spray (0.52 to 3.4 fl oz/gal)	To prevent flower bud initiation during vegetative growth. Apply two to three sprays at 2 to 3 week intervals after each pinch.
	Off-Shoot-O	Use a 3 to 5% spray solution (8.6 to 14 fl oz/gal) in greenhouses, use 5 to 7% (14 to 20 fl oz/gal;) outdoors. Apply as a foliar spray.	To promote lateral shoot growth on vegetative plants. Efficacy is related to relative humidity and temperature. Spray a few plants to check activity prior treating the entire crop; effects should be visible in about 1 hour. Be certain chemical covers shoot tip. Ineffective if microscopic flower buds are present.
Sumagic	10 to 15 ppm spray (2.56 to 3.84 fl oz/gal)	Apply at 1.5 quarts per 100 square feet of bench area at about 4 to 6 weeks after final pinch.	

*Adapted and updated from D. Bailey and B. Whipker. 1998. Height Control of Commercial Greenhouse Flowers. NC Coop. Ext. Serv. Horticulture Information Leaflet 528 and D. Bailey and B. Whipker. 1998. Best Management Practices for Plant Growth Regulators Used in Floriculture. NC Coop Ext. Serv. Horticulture Information Leaflet 529.

Table 3. Continued.

Crop	Product	Application Method & Rate	Precautions & Remarks
Bedding Plants (Not specifically listed in this table)	A-Rest	6 to 66 ppm spray (2.9 to 32 fl oz/gal). Use 15 ppm spray as a base rate and adjust as needed.	See Ageratum.
		1 to 2 ppm drench for a 4 inch pot (0.5 to 1 fl oz/gal of drench solution; apply 2 fl oz/4 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
	B-Nine + Cycocel	800 to 5,000 ppm B-Nine (0.13 to 0.79 oz/gal) + 1,000 to 1,500 ppm Cycocel (1.08 to 1.63 fl oz/gal) applied as a tank mix spray	It is recommended to use the highest rate of Cycocel that does not cause excessive leaf yellowing, and then adjust the B-Nine rate up and down within the labeled range to attain desired level of height control.
	Bonzi	5 to 90 ppm spray (0.16 to 2.88 fl oz/gal); recommended starting rate 30 ppm spray (0.96 fl oz/gal)	Users should 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.
		1 ppm drench for a 6 inch pot (0.03 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench applications are recommended only for bedding plants in 6 inch or larger containers. Not recommended for use on fibrous begonia or vinca.
	Cycocel	800 to 1,500 ppm spray (0.87 to 1.63 fl oz/gal)	Users should conduct trials on a small number of plants, adjusting the rates up to 3,000 ppm (3.25 fl oz/gal) as needed for desired final plant height and duration of height control.
	Sumagic	1 to 50 ppm spray (0.26 to 12.7 fl oz/gal)	Users should 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 inches).
		0.5 to 20 ppm spray to media surface (0.13 to 5.12 fl oz/gal)	
0.1 to 2 ppm drench (0.03 to 0.51 fl oz/gal)			
Bedding Plant Plugs (Not specifically listed in this table)	A-Rest	3 to 35 ppm spray (1.5 to 17 fl oz/gal); recommended starting range is 5 to 10 ppm spray (2.4 to 4.8 fl oz/gal)	See Ageratum.
		Drench plug flats with a 0.5 to 1 ppm solution (0.25 to 0.5 fl oz/gal)	For uniform application, use a subirrigation delivery system. Plug trays should not be excessively dry prior to the subirrigation treatment. Begin application at 1 to 2 true leaf stage.
	B-Nine	1,500 to 2,500 ppm spray (0.23 to 0.39 oz/gal)	Users should 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 first true leaf stage through the finishing stage.
	B-Nine + Cycocel	800 to 5,000 ppm B-Nine (0.13 to 0.79 oz/gal) + 1,000 to 1,500 ppm Cycocel (1.08 to 1.63 fl oz/gal) applied as a tank mix spray	It is recommended to use the highest rate of Cycocel that does not cause excessive leaf yellowing, and then adjust the B-Nine rate up and down within the labeled range to attain desired level of height control.
	Bonzi	1 to 20 ppm spray (0.03 to 0.64 fl oz/gal); recommended starting rate is 5 ppm spray (0.16 fl oz/gal)	Users should 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 1 to 2 true leaves prior to first application.
	Cycocel	400 to 1,500 ppm spray (0.43 to 1.63 fl oz/gal)	Users should conduct trials on a small number of plants, adjusting the rates as needed for desired final plant height and duration of height control.
	Sumagic	0.5 to 10 ppm spray (0.13 to 2.6 fl oz/gal) to foliage or media surface	Users should conduct trials on a small number of plants, adjusting the rate as needed for desired final plant height and duration of height control. Plugs can be especially sensitive to Sumagic.
Begonia	A-Rest	3 to 15 ppm spray (1.5 to 7.3 fl oz/gal)	See Ageratum.
	Atrimmec	781 to 1,562 ppm spray (0.5 to 1 fl oz/gal)	Elatior begonias only – To increase lateral branching, treat unpinched plants with 2 to 3-inch long shoots 8 to 10 weeks before finishing for sale.
	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	
	Florel	500 ppm spray (1.6 fl oz/gal)	To increase lateral branching, prevent flower initiation and development, and inhibit internode elongation. See text for recommendations.
Bleeding Heart	A-Rest	65 to 132 ppm spray (31.5 to 64 fl oz/gal)	Higher rates may be phytotoxic.
Bougainvillea	Atrimmec	1,562 ppm spray (1 fl oz/gal)	To increase lateral branching. Sprays should be applied to unpinched shoots when they reach 3 inches or to pruned plants 3 days after pruning. Avoid treating plants under stress.
Bromeliads	Florel	2,500 ppm spray (8 fl oz/gal)	To promote flower initiation.

Table 3. Continued.

Crop	Product	Application Method & Rate	Precautions & Remarks
Browallia	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	See Ageratum.
Bulb Crops (Not specifically listed in this table)	A-Rest	25 to 50 ppm spray (12.1 to 24.2 fl oz/gal)	Drenches are more effective than sprays on most bulb crops.
		2 ppm drench for a 6 inch pot (1 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Users should conduct trials on a small number of plants, adjusting the rate as needed for desired final plant height and length of height control.
	Bonzi	100 ppm spray (3.2 fl oz/gal)	
		10 ppm drench for a 6 inch pot (0.32 fl oz/gal of drench solution; apply 4 fl oz per 6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
		20 ppm bulb soak (0.64 fl oz/gal)	Soak for 15 minutes. Users should 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.
	Sumagic	2.5 to 20 ppm spray (0.64 to 5.1 fl oz/gal)	Users should conduct trials on a small number of plants, adjusting the rate as needed for desired final plant height and length of height control. Treat when shoots average 3 inches tall and again at 6 inches if necessary.
		0.5 to 10 ppm spray to media surface (1.28 to 2.56 fl oz/gal)	
		1 to 3 ppm drench (0.26 to 0.77 fl oz/gal)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details. Application should be made when newly emerged shoots are 1 to 2 inches tall.
1 to 10 ppm bulb soak (0.26 to 2.6 fl oz/gal)		Soak for 1 to 5 minutes. Users should conduct trials on a small number of bulbs, adjusting the rate and soaking period as needed for desired final plant height.	
Caladium	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	See Ageratum.
	Bonzi	100 to 200 ppm spray (3.2 to 6.4 fl oz/gal)	First spray applications should be made when plants are 2 to 4 inches tall.
		2 to 16 ppm drench for a 6 inch pot (0.06 to 0.51 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	First drench applications should be made when plants are 1 to 2 inches tall. Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
		60 ppm tuber soak (1.9 fl oz/gal)	Soak tubers for 30 minutes prior to planting.
Calendula	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	
Calla Lily	Bonzi	5 to 15 ppm drench for a 6 inch pot (0.16 to 0.48 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	See Caladium.
		20 ppm rhizome/tuber soak (0.64 fl oz/gal)	Soak the rhizomes/tubers for 15 minutes prior to planting.
Celosia	A-Rest	7 to 26 ppm spray (3.4 to 12.6 fl oz/gal)	See Ageratum.
	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	
	Bonzi	5 to 45 ppm spray (0.16 to 1.44 fl oz/gal)	
	Cycocel	800 to 1,500 ppm spray (0.87 to 1.63 fl oz/gal)	
	Sumagic	10 to 20 ppm spray (2.56 to 5.12 fl oz/gal)	
Centaurea	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	
China Aster	A-Rest	7 to 26 ppm spray (3.4 to 12.6 fl oz/gal)	
Chrysanthemum, Cut	B-Nine	2,500 ppm spray (0.39 oz/gal)	To reduce "neck" stretching, spray upper foliage 5 weeks after start of short-day treatment.

Table 3. Continued.

Crop	Product	Application Method & Rate	Precautions & Remarks
Chrysanthemum, Potted	A-Rest	25 to 50 ppm spray (12.1 to 24.2 fl oz/gal)	Spray when axillary shoots following the pinch are 2.5 to 3 inches long.
		2 to 4 ppm drench for a 6 inch pot (1 to 2 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Apply when plants are 2 to 6 inches in height (about 2 weeks after pinch). Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
	B-Nine	1,000 ppm preplant foliar dip (0.16 oz/gal)	Rooted cuttings can be dipped in solution just 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 a flat, cover to prevent dehydration and hold overnight under cool conditions. Stick the next day.
		2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	Spray when new growth from pinch is 1 to 2 inches long. Some varieties may require another application 3 weeks later.
	Bonzi	50 to 200 ppm spray (1.6 to 6.4 fl oz/gal)	
		1 to 4 ppm drench for a 6 inch pot (0.032 to 0.128 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
	Sumagic	2.5 to 10 ppm spray (0.64 to 2.56 fl oz/gal)	Apply when length of breaks is 1.5 to 2 inches (about 7 to 14 days after pinching).
5 to 10 ppm dip for unrooted cuttings (1.3 to 2.6 fl oz/gal) 2.5 ppm dip for rooted cuttings (0.64 fl oz/gal)		Improves color and overall appearance. Follow dips with foliar sprays in lower rate range.	
Chrysanthemum, Garden	Florel	500 ppm spray (1.62 fl oz/gal)	To increase lateral branching, prevent flower initiation and development, and inhibit internode elongation.
	Sumagic	2.5 to 10 ppm spray (0.64 to 2.56 fl oz/gal)	
Clematis	A-Rest	25 to 132 ppm spray (12.1 to 64 fl oz/gal)	
		2 to 4 ppm drench for a 6 inch pot (1 to 2 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
Cleome	A-Rest	7 to 26 ppm spray (3.4 to 12.6 fl oz/gal)	See Ageratum.
	Cycocel	800 to 1,500 ppm spray (0.87 to 1.63 fl oz/gal)	
Coleus	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	See Ageratum.
	Bonzi	5 to 30 ppm spray (0.16 to 0.96 fl oz/gal)	
	Cycocel	800 to 1,500 ppm spray (0.87 to 1.63 fl oz/gal)	
	Sumagic	10 to 20 ppm spray (2.56 to 5.12 fl oz/gal)	
Columbine**	A-Rest	65 to 132 ppm spray (31.5 to 64 fl oz/gal)	See Ageratum. Apply when plants are well-rooted but prior to initiation of flowers.
		2 to 4 ppm drench for a 6 inch pot (1 to 2 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
Coneflower**	Sumagic	30 to 40 ppm spray (7.68 to 10.2 fl oz/gal)	
Cornflower** (Centaurea)	A-Rest	7 to 26 ppm spray (3.4 to 12.6 fl oz/gal)	See Ageratum.
	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	
Cosmos	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	See Ageratum.
Crossandra	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	See Ageratum.
Daffodil	Bonzi	20 to 40 ppm drench for a 6 inch pot (0.64 to 1.28 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	See Caladium.
		80 ppm bulb soak (2.56 fl oz/gal)	Soak bulbs for 1 hour prior to planting.
	Florel	2,000 ppm spray (6.47 fl oz/gal)	Reduces plant height and stem topple during flowering. Apply when shoots are 3-4 inches tall. See label for cultivar differences in rates.

Table 3. Continued.

Crop	Product	Application Method & Rate	Precautions & Remarks
Dahlia, Bedding Plant	A-Rest	7 to 26 ppm spray (3.4 to 12.6 fl oz/gal)	See Ageratum.
	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	
	Bonzi	5 to 45 ppm spray (0.16 to 1.44 fl oz/gal)	
	Cycocel	800 to 1,500 ppm spray (0.87 to 1.63 fl oz/gal)	
	Sumagic	10 to 20 ppm spray (2.56 to 5.12 fl oz/gal)	
Dahlia, Tuberous	A-Rest	2 to 4 ppm drench for a 6 inch pot (1 to 2 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
	Bonzi	10 to 40 ppm drench for a 6 inch pot (0.32 to 1.28 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	
		Greater than 40 ppm tuber soak (1.28 fl oz/gal)	
Delphinium**	A-Rest	35 to 132 ppm spray (17 to 64 fl oz/gal)	See Ageratum. Apply when plants are well-rooted but prior to initiation of flowering.
		2 to 4 ppm drench for a 6 inch pot (1 to 2 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	See Ageratum.
	Bonzi	30 to 60 ppm spray (0.96 to 1.92 fl oz/gal)	
Dianthus	A-Rest	7 to 26 ppm spray (3.4 to 12.6 fl oz/gal)	See Ageratum.
	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	
	Bonzi	10 to 60 ppm spray (0.32 to 1.92 fl oz/gal)	
	Cycocel	800 to 1,500 ppm spray (0.87 to 1.63 fl oz/gal)	
Dracaena	A-Rest	25 to 132 ppm spray (12.1 to 64 fl oz/gal)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
		2 to 4 ppm drench for a 6 inch pot (1 to 2 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	
Dusty Miller	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	See Ageratum.
	Sumagic	30 ppm spray (7.7 fl oz/gal)	
Easter Lily	A-Rest	30 to 132 ppm spray (14.5 to 64 fl oz/gal); 50 ppm (24.2 fl oz/gal) is most common rate	Apply when newly developing shoots are 2 to 3 inches in length; a second application when shoots average 6 inches in length may be needed.
		2 to 4 ppm drench for a 6 inch pot (1 to 2 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Single drench should be applied when shoots average 3 to 5 inches in length. Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
	Sumagic	3 to 15 ppm spray (0.8 to 3.8 fl oz/gal)	Apply when shoots average 3 inches tall.
		0.25 to 0.5 ppm drench for a 6 inch pot (0.065 to 0.13 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
Exacum	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	
Fatshedera	A-Rest	65 to 132 ppm spray (31.5 to 64 fl oz/gal)	Apply when plants are well-rooted and actively growing.
		2 to 4 ppm drench for a 6 inch pot (1 to 2 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
	Atrimmec	1,171 to 1,562 ppm spray (0.75 to 1 fl oz/gal)	To increase lateral branching. Sprays should be applied to unpinched shoots when they reach 3 inches or to pruned plants 3 days after pruning. Avoid treating plants under stress.

Table 3. Continued.

Crop	Product	Application Method & Rate	Precautions & Remarks
Flowering/ Foliage Plants, Herbaceous Species (Not specifically listed in this table)	A-Rest	20 to 50 ppm spray (9.7 to 24.2 fl oz/gal)	Recommended starting rate for an A-Rest spray on a new herbaceous flowering or foliage species is 33 ppm (16 fl oz/gal).
		1 to 2 ppm drench for a 6 inch pot (0.5 to 1 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
	Bonzi	30 ppm spray (0.96 fl oz/gal)	Users should conduct trials on a small number of plants, adjusting the rate as needed for desired final plant height and length of height control.
		1 ppm drench for a 6 inch pot (0.032 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
	Cycocel	800 to 3000 ppm spray (0.87 to 3.25 fl oz/gal); suggested initial rate for small-scale trials is 1,250 ppm (1.36 fl oz/gal)	Optimum rate depends on species, desired amount of height control, and environmental conditions. 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</i> spp., Morning glory, <i>Pachystachys</i> , <i>Pilea</i> spp., Pentas, <i>Salvia</i> spp., Schefflera, <i>Sedum</i> spp., and Sunflower.
		2,000 to 4,000 ppm drench (2.17 to 4.34 fl oz/gal)	Drench volumes vary with pot size. See label for recommended volumes. Herbaceous species known to respond to Cycocel are listed above.
	Sumagic	5 to 40 ppm spray (1.28 to 10.2 fl oz/gal)	Users should 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 10 ppm spray to media surface (0.13 to 2.56 fl oz/gal)	
		0.1 to 1 ppm drench (0.026 to 0.26 fl oz/gal)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
Flowering/ Foliage Plants, Woody Species Not specifically listed in this table)	A-Rest	50 ppm spray (24.2 fl oz/gal)	
		2 ppm drench for a 6 inch pot (1 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
	B-Nine	2,500 to 7,500 ppm spray (0.39 to 1.18 oz/gal)	Two or more applications may be necessary if new growth begins to stretch or for enhanced coloration.
	Bonzi	50 ppm spray (1.6 fl oz/gal)	Users should conduct trials on a small number of plants, adjusting the rate as needed for desired final plant height and length of height control.
		2 ppm drench for a 6 inch pot (0.064 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
	Cycocel	800 to 3,000 ppm spray (0.87 to 3.25 fl oz/gal), suggested initial rate for small-scale trials is 1,250 ppm.	Optimum rate depends on species, desired amount of height control, and environmental conditions. Example woody species known to respond to Cycocel are <i>Baleria cristata</i> , Bougainvillea, Camellia, Gardenia, Fuchsia, Hollies, Hydrangea, Lantana, <i>Pseuderanthemum lactifolia</i> , Rhododendron, and Roses (potted).
		2,000 to 4,000 ppm drench (2.17 to 4.34 fl oz/gal of drench solution, apply 4 fl oz/6 inch pot)	Drench volumes vary with pot size. See label for recommended volumes. Woody species known to respond to Cycocel are listed above.
	Sumagic	20 to 50 ppm spray (5.1 to 12.7 fl oz/gal)	Users should conduct trials on a small number of plants, adjusting the rate as needed for desired final plant height and length of height control.
		1.5 to 20 ppm spray to media surface (0.38 to 5.1 fl oz/gal)	
0.5 to 2 ppm drench (0.13 to 0.52 fl oz/gal of drench solution, apply 4 fl oz/6 inch pot)		Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.	
Freesia	Bonzi	2 to 4 ppm drench (0.06 to 0.13 fl oz/gal of drench solution, apply 4 fl oz/6 inch pot)	To increase lateral branching. Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
		100 to 300 ppm corm soak (3.2 to 9.6 fl oz/gal)	Soak corms in the solution for 1 hour before planting.
Fuchsia	Atrimmec	781 to 2,343 ppm spray (0.5 to 1.5 fl oz/gal)	To increase lateral branching. Treat rooted cuttings with 2 to 3 pairs of leaves or as soon as branching becomes desirable, but not later than 10 to 12 weeks before finishing for sale.
	Florel	500 ppm spray (1.62 fl oz/gal)	To increase lateral branching, prevent flower initiation and development, and inhibit internode elongation.

Table 3. Continued.

Crop	Product	Application Method & Rate	Precautions & Remarks
Gardenia	A-Rest	50 ppm spray (24.2 fl oz/gal)	
		2 ppm drench for a 6 inch pot (1 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
	Atrimmec	2,343 to 4,686 ppm (1.5 to 3 fl oz/gal)	To increase lateral branching. Sprays should be applied to unpinched shoots when they reach 3 inches or to pruned plants 3 days after pruning. Avoid treating plants under stress.
	B-Nine	5,000 ppm spray (0.79 oz/gal)	Spray when plants are at two-thirds final marketing size.
Geranium (Pelargonium)	A-Rest	26 to 66 ppm spray (12.6 to 32 fl oz/gal)	See Ageratum. Not effective on finished plants.
	Atrimmec	1,562 ppm spray (1 fl oz/gal)	To increase lateral branching. Labeled for ivy geraniums only. Avoid treating plants under stress.
	Bonzi	10 to 30 ppm spray (0.32 to 0.96 fl oz/gal)	Apply to zonal geraniums when new growth is 1.5 to 2 inches long. Apply to seed geraniums approximately 2 to 4 weeks after transplanting.
	Cycocel	800 to 1,500 ppm spray (0.87 to 1.63 fl oz/gal) on zonal and ivy geraniums	First application should be made 2 to 4 weeks after planting plugs or rooted cuttings (after stems have started elongating). Multiple applications may be needed.
	Cycocel	1,500 ppm spray (1.63 fl oz/gal) on seed geraniums.	To promote earlier flowering in seed geraniums. Make two applications at 35 and 42 days after seeding. Treated plants should flower earlier, be more compact, and more well-branched than untreated plants.
	Florel	300 to 500 ppm spray (1.0 to 1.62 fl oz/gal)	To increase lateral branching, prevent flower initiation and development, and inhibit internode elongation. Use the lower concentration for ivy geraniums.
	Sumagic	3 to 8 ppm spray (0.77 to 2.05 fl oz/gal) for cutting geraniums and 2 to 4 ppm spray (0.51 to 1.02 fl oz/gal) for seed geraniums	See Ageratum.
Gerbera Daisy	A-Rest	25 to 132 ppm spray (12.1 to 64 fl oz/gal)	
		2 to 4 ppm drench for a 6 inch pot (1 to 2 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
	B-Nine	1,200 to 5,000 ppm spray (0.18 to 0.79 oz/gal)	
Gloxinia	B-Nine	1,250 ppm spray (0.19 oz/gal)	Phytotoxicity may occur at rates above 1,250 ppm.
Gomphrena	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	See Ageratum.
	Cycocel	800 to 1,500 ppm spray (0.87 to 1.63 fl oz/gal)	
Grape Ivy	Atrimmec	781 to 1,562 ppm spray (0.5 to 1 fl oz/gal)	To increase lateral branching.
Hibiscus**	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	
	Bonzi	30 to 150 ppm spray (0.96 to 4.8 fl oz/gal)	Application should be made when laterals are 1 to 4 inches long. Single applications control lateral growth for 3 to 6 weeks.
	Cycocel	200 to 600 ppm spray (0.22 to 0.65 fl oz/gal)	Multiple applications starting prior to first pinch are recommended. Start with 460 ppm in trials.
	Sumagic	10 ppm spray (2.6 fl oz/gal)	Treat within 7 days of pruning. Multiple applications may be required.
Holly	A-Rest	50 ppm spray (24.2 fl oz/gal)	
		2 ppm drench for a 6 inch pot (1 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
	Atrimmec	1,050 to 3,905 ppm spray (0.67 to 2.5 fl oz/gal)	Avoid spraying Japanese holly just before or during flowering period if berry display is desired. To increase lateral branching. Sprays should be applied to unpinched shoots when they reach 3 inches or to pruned plants 3 days after pruning. Avoid treating plants under stress.
Hollyhock**	Bonzi	30 to 50 ppm spray (0.96 to 1.60 fl oz/gal)	
	Sumagic	5 to 40 ppm spray (1.3 to 10.2 fl oz/gal)	
Hyacinth	Florel	1,000 to 2,000 ppm spray (3.24 to 6.48 fl oz/gal)	To reduce stem topple of potted hyacinths at time of full flower, apply foliar spray before florets have opened.

Table 3. Continued.

Crop	Product	Application Method & Rate	Precautions & Remarks
Hybrid Lily	Bonzi	200 to 500 ppm spray (8.0 to 16.0 fl oz/gal)	See Caladium.
		4 to 30 ppm drench for a 6 inch pot (0.13 to 0.96 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	
		5 to 30 ppm bulb soak (0.16 to 0.96 fl oz/gal)	
	Sumagic	2.5 to 10 ppm spray (0.6 to 2.6 fl oz/gal)	
		1 to 10 ppm bulb soak (0.26 to 2.6 fl oz/gal)	Soak bulbs in the solution for 1 to 5 minutes prior to planting.
Hydrangea	A-Rest	50 ppm spray (24.2 fl oz/gal)	
		2 ppm drench for a 6 inch pot (1 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
	B-Nine	5,000 to 7,500 ppm spray (0.79 to 1.18 oz/gal)	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 at higher rate for summer when regrowth after pinching is 1 to 2 inches long.
Hypoestes	Cycocel	800 to 1,500 ppm spray (0.87 to 1.63 fl oz/gal)	See Ageratum.
Impatiens	A-Rest	10 to 44 ppm spray (4.8 to 21.3 fl oz/gal)	See Ageratum.
	Bonzi	0.5 to 45 ppm spray (0.02 to 1.44 fl oz/gal)	
	Sumagic	5 to 10 ppm spray (1.28 to 2.56 fl oz/gal)	
Jerusalem Cherry	Cycocel	800 to 1,500 ppm spray (0.87 to 1.63 fl oz/gal)	See Ageratum.
Kalanchoe	Atrimmec	1,042 to 2,343 ppm spray (0.67 to 1.5 fl oz/gal)	To increase lateral branching, more compact growth with a greater number of inflorescences, treat 2 days after pinching main shoot..
	B-Nine	1,200 to 5,000 ppm spray (0.18 to 0.79 oz/gal)	Phytotoxicity possible if B-Nine accumulates in cupped areas of certain cupped-leafed varieties.
Lantana	Atrimmec	781 to 1,562 ppm spray (0.5 to 1 fl oz/gal)	To increase lateral branching. Sprays should be applied to unpinched shoots when they reach 3 inches or to pruned plants 3 days after pruning. Avoid treating plants under stress.
	Florel	500 ppm spray (1.62 fl oz/gal)	To increase lateral branching, prevent flower initiation and development, and inhibit internode elongation.
Liatris**	A-Rest	25 to 132 ppm spray (12.1 to 64 fl oz/gal)	
		2 to 4 ppm drench for a 6-inch pot (1 to 2 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details
	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	
Lipstick Vine	Atrimmec	521 to 1,042 ppm spray (0.33 to 0.67 fl oz/gal)	To increase lateral branching. Sprays should be applied to unpinched shoots when they reach 3 inches or to pruned plants 3 days after pruning. Avoid treating plants under stress.
Lisianthus	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	
Marigold	A-Rest	13 to 33 ppm spray (6.3 to 16 fl oz/gal)	See Ageratum.
	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	
	Bonzi	5 to 60 ppm spray (0.16 to 1.92 fl oz/gal)	
	Cycocel	800 to 1,500 ppm spray (0.87 to 1.63 fl oz/gal)	
	Sumagic	10 to 20 ppm spray (2.56 to 5.12 fl oz/gal)	
Monarda**	Bonzi	60 to 160 ppm spray (1.92 to 5.12 fl oz/gal)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details
		Greater than 4 ppm drench for a 6 inch pot (0.13 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	
	Sumagic	15 to 30 ppm spray (3.8 to 7.7 fl oz/gal)	

Table 3. Continued.

Crop	Product	Application Method & Rate	Precautions & Remarks
Monstera	A-Rest	25 to 132 ppm spray (12.1 to 64 fl oz/gal)	
		2 to 4 ppm drench for a 6 inch pot (1 to 2 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
Montbretia	Bonzi	20 to 30 ppm corm soak (0.64 to 0.96 fl oz/gal)	Soak corms in the solution for 15 minutes prior to planting.
Nasturtium	Cycocel	800 to 1,500 ppm spray (0.87 to 1.63 fl oz/gal)	
Nepthytis, Green & Green Gold	A-Rest	25 to 132 ppm spray (12.1 to 64 fl oz/gal)	
		2 to 4 ppm drench for a 6 inch pot (1 to 2 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
New Guinea impatiens	Bonzi	0.25 to 15 ppm spray (0.01 to 0.48 fl oz/gal)	
	Florel	300 ppm spray (1 fl oz/gal)	To increase branching and reduce premature flowering. Do not apply within 8 weeks of desired flower date.
Ornamental Cabbage and Kale	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	Use the higher rates for more vigorous cultivars. Multiple applications may be needed.
	Sumagic	2.5 to 8 ppm spray (0.6 to 2.1 fl oz/gal)	Use the higher rates for more vigorous cultivars.
Ornamental Peppers	Bonzi	20 ppm foliar spray (0.64 fl oz/gal)	
	Sumagic	5 to 15 ppm spray (1.3 to 3.8 fl oz/gal)	
Ornamental Vegetables	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	Use the higher rates for more vigorous types / cultivars like 'Red Bor' Kale. Multiple applications may be needed.
	Sumagic	10 to 25 ppm spray (2.6 to 6.4 fl oz/gal)	Use the higher rates for more aggressive types / cultivars.
Pansy	A-Rest	3 to 15 ppm spray (1.5 to 7.3 fl oz/gal)	See Ageratum.
	Bonzi	1 to 15 ppm spray (0.03 to 0.48 fl oz/gal)	
	Sumagic	1 to 6 ppm spray (0.26 to 1.54 fl oz/gal)	
Petunia	A-Rest	10 to 26 ppm spray (4.8 to 12.6 fl oz/gal)	See Ageratum.
	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	
	Bonzi	5 to 45 ppm spray (0.16 to 1.44 fl oz/gal)	
	Sumagic	25 to 50 ppm spray (6.4 to 12.8 fl oz/gal)	
Philodendron	A-Rest	25 to 132 ppm spray (12.1 to 64 fl oz/gal)	
		2 to 4 ppm drench for a 6 inch pot (1 to 2 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
	B-Nine	2,500 to 7,500 ppm spray (0.39 to 1.18 oz/gal)	
Phlox**	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	See Ageratum.
Pilea	A-Rest	25 to 132 ppm spray (12.1 to 64 fl oz/gal)	
		2 to 4 ppm drench for a 6 inch pot (1 to 2 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.

Table 3. Continued.

Crop	Product	Application Method & Rate	Precautions & Remarks
Poinsettia	A-Rest	0.5 to 4 ppm drench for a 6 inch pot (0.25 to 1 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volume and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
	B-Nine	2,000 to 3,000 ppm spray (0.31 to 0.47 oz/gal)	Not effective in NC State University studies.
	B-Nine + Cycocel	800 to 2,500 ppm B-Nine (0.13 to 0.39 oz/gal) + 1,000 to 1,500 ppm Cycocel (1.08 to 1.63 fl oz/gal) 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, growers should use the lower rates. Too late of an application can delay flowering and reduce bract size.
	Bonzi	10 to 30 ppm spray (0.32 to 0.96 fl oz/gal)	
		0.25 to 3 ppm drench for a 6 inch pot (0.064 to 0.128 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drenches generally have less of an effect on bract size than sprays. Drench volume and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
	Cycocel	800 to 1,500 ppm spray (0.87 to 1.63 fl oz/gal)	For natural season crops in VA, do not apply Cycocel after mid-October. Late applications can reduce bract size and delay flowering.
		3,000 to 4,000 ppm drench (3.25 to 4.34 fl oz/gal of drench solution)	Drench volume and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
Sumagic	2.5 to 10 ppm spray (0.64 to 2.56 fl oz/gal)		
Portulaca	A-Rest	7 to 26 ppm spray (3.4 to 12.6 fl oz/gal)	See Ageratum.
	Sumagic	15 to 30 ppm spray (3.8 to 7.7 fl oz/gal)	
Pothos	A-Rest	25 to 132 ppm spray (12.1 to 64 fl oz/gal)	
		2 to 4 ppm drench for a 6 inch pot (1 to 2 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
	B-Nine	2,500 to 7,500 ppm spray (0.39 to 1.18 oz/gal)	
Purple coneflower**	Sumagic	30 to 40 ppm spray (7.7 to 10.2 fl oz/gal)	
Purple Passion (<i>Gynura aurantiaca</i>)	A-Rest	25 to 132 ppm spray (12.1 to 64 fl oz/gal)	
		2 to 4 ppm drench for a 6 inch pot (1 to 2 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
Salvia**	A-Rest	10 to 26 ppm spray (4.8 to 12.6 fl oz/gal)	See Ageratum.
	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	
	Bonzi	5 to 60 ppm spray (0.16 to 1.92 fl oz/gal)	
	Cycocel	800 to 1,500 ppm spray (0.87 to 1.63 fl oz/gal)	
	Sumagic	5 to 10 ppm spray (1.28 to 2.56 fl oz/gal)	
Schefflera	A-Rest	25 to 132 ppm spray (12.1 to 64 fl oz/gal)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
		2 to 4 ppm drench for a 6 inch pot (1 to 2 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	
	Atrimmec	3,124 ppm spray (2 fl oz/gal)	
	B-Nine	2,500 to 7,500 ppm spray (0.39 to 1.18 oz/gal)	
Shasta Daisy**	Sumagic	15 to 30 ppm spray (3.8 to 7.7 fl oz/gal)	
Snapdragon	A-Rest	10 to 26 ppm spray (4.8 to 12.6 fl oz/gal)	See Ageratum.
	Bonzi	10 to 90 ppm spray (0.32 to 2.88 fl oz/gal)	
	Sumagic	25 to 50 ppm spray (6.4 to 12.8 fl oz/gal)	

Table 3. Continued.

Crop	Product	Application Method & Rate	Precautions & Remarks
Spathiphyllum	GibGro	265 ppm spray (1.06 fl oz/gal)	To induce flowering; apply one full coverage spray during non-seasonal bloom period (June through January). Some cultivars exhibit distorted blooms, increased petiole length, and narrow leaves.
Speedwell** (Veronica)	Bonzi	20 to 40 ppm spray (0.64 to 1.28 fl oz/gal)	
	Sumagic	20 to 40 ppm spray (5.1 to 10.2 fl oz/gal)	
Sunflower	Cycocel	800 to 1,500 ppm spray (0.87 to 1.63 fl oz/gal)	
Tulip	A-Rest	1 to 4 ppm drench for a 6 inch pot (0.5 to 2 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
	Bonzi	5 to 40 ppm drench for a 6 inch pot (0.16 to 1.28 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
		2 to 5 ppm bulb soak (0.064 to 0.16 fl oz/gal)	Soak bulbs for 1 hour prior to planting.
Verbena**, bedding	Atrimmec	521 to 1,042 ppm spray (0.33 to 0.67 fl oz/gal)	To increase lateral branching. Treat unpinched seedlings or plants from cuttings 1 day after manual pinching.
	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	See Ageratum.
	Bonzi	5 to 30 ppm spray (0.16 to 0.96 fl oz/gal)	
	Cycocel	800 to 1,500 ppm spray (0.87 to 1.63 fl oz/gal)	
	Florel	500 ppm spray (1.62 fl oz/gal)	To increase lateral branching, prevent flower initiation and development, and inhibit internode elongation.
	Sumagic	15 to 30 ppm spray (3.84 to 7.68 fl oz/gal)	
Vinca (Catharanthus)	A-Rest	5 to 18 ppm spray (2.4 to 8.7 fl oz/gal)	See Ageratum.
	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	
	Cycocel	800 to 1,500 ppm spray (0.87 to 1.63 fl oz/gal)	
	Sumagic	0.5 to 0.75 ppm spray to media surface (0.13 to 0.20 fl oz/gal)	
Vinca Vine (Vinca spp.)	Florel	500 ppm spray (1.62 fl oz/gal)	To increase lateral branching, prevent flower initiation and development, and inhibit internode elongation.
Viola	Sumagic	1 to 5 ppm spray (0.26 to 1.28 fl oz/gal)	See Ageratum.
Wandering Jew	A-Rest	26 to 132 ppm spray (12.6 to 64 fl oz/gal)	
Woody Landscape Plants (Not specifically listed in this table)	A-Rest	50 ppm spray (24.2 fl oz/gal)	
		2 ppm for a 6 inch pot (1 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details.
	Bonzi	100 ppm spray (3.2 fl oz/gal).	Users should conduct trials on a small number of plants, adjusting the rate to achieve desired height and length of control.
		4 ppm drench for a 6 inch pot (0.128 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volumes and mg a.i. vary with pot size. See text for discussion of drench applications. See label for details
	Sumagic	10 to 50 ppm spray (2.56 to 12.8 fl oz/gal)	
1 to 2 ppm drench (0.26 to 0.52 fl oz/gal)			
Zinnia	A-Rest	7 to 26 ppm spray (3.4 to 12.6 fl oz/gal)	See Ageratum.
	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	
	Bonzi	5 to 45 ppm spray (0.16 to 1.45 fl oz/gal)	
	Cycocel	800 to 1,500 ppm spray (0.87 to 1.63 fl oz/gal)	

**For additional information on perennial species, see "Using Plant Growth Regulators on Containerized Herbaceous Perennials" by J.G. Latimer, H.L. Scoggins, and T.J. Banko. Va Coop Ext Pub # 430-103.

Table 4. Chemical costs for growth retardant sprays and drenches*.

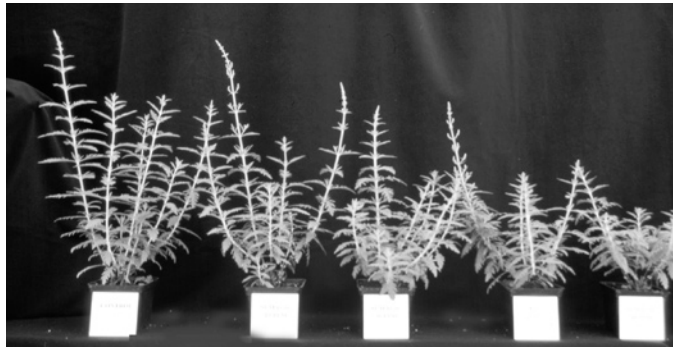
Chemical and cost ^z	Spray applications			Drench applications			
	Conc. applied (ppm)	Amount of chemical needed for 5 gallons of spray ^y	Cost per 1000 ft ² of bench area sprayed ^x	Milligrams of active ingredient per 6 inch pot	Conc. applied (ppm)	Fluid oz. of chemical needed for 5 gallons of drench solution	Cost per 100 six inch pots
A-Rest \$56 per quart	2	4.8 fl oz.	\$8.40	0.125	1.1	2.56	\$2.80
	5	12.1 fl oz.	\$21.18	0.25	2.1	5.12	\$5.60
	10	24.2 fl oz.	\$42.35	0.375	3.2	7.68	\$8.41
	26	2.0 quarts	\$112.00	0.50	4.2	10.24	\$11.21
	33	2.5 quarts	\$140.00	NOTE: A-Rest drench figures are based on applying 4 fluid oz. of drench per 6 inch pot.			
	66	5 quarts	\$280.00				
B-Nine \$353 per 5 pounds	750	0.59 oz.	\$2.60				
	2,500	1.97 oz.	\$8.69				
	5,000	3.92 oz.	\$17.30				
Bonzi \$106 per quart	2	0.32 fl oz.	\$1.06	0.1183	1	0.16	\$0.33
	5	0.80 fl oz.	\$2.65	0.2366	2	0.32	\$0.60
	10	1.60 fl oz.	\$5.30	0.4832	4	0.64	\$1.33
	20	3.20 fl oz.	\$10.60	0.5915	5	0.80	\$1.66
	30	4.80 fl oz.	\$15.90	1.1835	10	1.60	\$3.31
	45	7.20 fl oz.	\$23.85	1.7744	15	2.40	\$4.97
	60	9.60 fl oz.	\$31.80	2.3659	20	3.20	\$6.63
				NOTE: Bonzi drench figures are based on applying 4 fluid oz. of drench per 6 inch pot.			
Cycocel \$70 per quart	750	4.07 fl oz.	\$8.90	354.88	2,000	10.8	\$22.25
	1,500	8.13 fl oz.	\$17.78	532.32	3,000	16.2	\$33.37
	2,000	10.84 fl oz.	\$23.71	709.76	4,000	21.7	\$44.49
				NOTE: Cycocel drench figures are based on applying 6 fluid oz. of drench per 6 inch pot.			
Florel \$19 per quart	500	8.09 fl oz.	\$4.80				
	1,000	16.18 fl oz.	\$9.61				
Sumagic \$97 per quart	2	2.56 fl oz.	\$7.76	0.03	0.25	0.32	\$0.62
	5	6.40 fl oz.	\$19.40	0.06	0.51	0.65	\$1.23
	10	12.80 fl oz.	\$38.80	0.12	1.01	1.3	\$2.46
	15	19.20 fl oz.	\$58.20	0.24	2.03	2.6	\$4.92
	20	25.60 fl oz.	\$77.60	0.36	3.04	3.90	7.38
	30	38.40 fl oz.	\$116.40	NOTE: Sumagic drench figures are based on applying 4 fluid oz. of drench per 6 inch pot.			

^zCosts were averaged from three sources. Price will vary with supplier and quantity ordered.

^yAssuming an application rate of 2 quarts per 100 ft², this amount of spray will treat 1,000 ft² of bench area.

^xAssuming an application rate of 2 quarts per 100 ft² of bench area. The cost per pot or flat can be calculated by dividing the figures in this column by the number of pots or flats per 1,000 ft².

*Adapted from D. Bailey and B. Whipker. 1998. Height Control of Commercial Greenhouse Flowers. NC Coop. Ext. Serv. Horticulture Information Leaflet 528.



PUBLICATION 430-102

www.ext.vt.edu

Produced by Communications and Marketing, College of Agriculture and Life Sciences,
Virginia Polytechnic Institute and State University, 2009

Virginia Cooperative Extension programs and employment are open to all, regardless of race, color, national origin, sex, religion, age, disability, political beliefs, sexual orientation, or marital or family status. An equal opportunity/affirmative action employer. Issued in furtherance of Cooperative Extension work, Virginia Polytechnic Institute and State University, Virginia State University, and the U.S. Department of Agriculture cooperating. Rick D. Rudd, Interim Director, Virginia Cooperative Extension, Virginia Tech, Blacksburg; Alma C. Hobbs, Administrator, 1890 Extension Program, Virginia State, Petersburg.