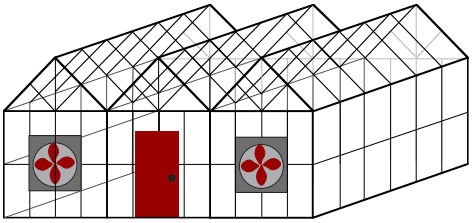

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Best Management Practices for Plant Growth Regulators Used in Floriculture

Douglas Bailey, Professor, and Brian Whipker, Extension Horticulture Specialist

Plant growth regulators (PGR's) are chemicals used on a wide range of floricultural crops. Products currently on the market (Table 1) are labeled for control of plant height (chemical growth retardants or CGR's such as A-Rest, B-Nine, Bonzi, Cycocel, Florel, and Sumagic), for stimulation of lateral branching (Florel), for substituting for a cold storage requirement (GibGro 4LS), or for promoting flower initiation or earlier flowering (B-Nine, Cycocel, Florel, and GibGro 4LS).

By far, the majority of plant growth regulators employed in floriculture are chemical growth retardants used for control of plant height. However, the application concepts and techniques are given below for all PGR's labeled for use on floricultural crops. While digesting the following text, keep in mind that chemical growth retardants (CGR's) are a class of plant growth regulators (PGR's); not all PGR's are CGR's.

Before applying a PGR, a grower should consider the reason for using the PGR. Recall that PGR's are applied to plants to regulate plant development and to stimulate a desired growth response. For example, chemical growth retardants are used to retard growth, resulting in shorter plants. A closer look at how CGR's work may help emphasize the importance of correct choice and use of PGR's.

Most of the available growth retardants are anti-gibberellins; i.e., they inhibit the synthesis of gibberellins such as gibberellic acid (GA_3) within the plant. Gibberellins stimulate cellular elongation, so without them, cells do not elongate as much, and plants do not grow as tall. Ethephon is not an anti-gibberellin; ethephon releases ethylene, which reduces elongation in some crops. Since CGR's, as do all PGR's, affect a specific process in the plant, it is essential they be applied in a manner that assures the most efficient response. Both monetary and environmental costs are too great to apply PGR's carelessly. This conscientious effort to use the minimum amount of chemical as effectively as possible is the basis for Best Management Practices. Best Management Practices for using PGR's can be divided into different categories: timing, target tissue, dosage, application technique, and environmental conditions.

Timing: Timing of PGR applications must be matched to the proper plant stage of development to achieve the desired goal. Usually the labels on the products will give good descriptive stages of plant development to assist with correct application timing.

For example, the GibGro label defines when to make applications. If GibGro 4LS is being used to partially substitute for cold storage of azaleas, plants should

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be at Stage 5 of floral development (i.e., style elongated and open) when treatment is initiated. Applying prior to this stage could result in abnormal flower development.

For most plants, apply CGR's such as A-Rest, B-Nine, Bonzi, Cycocel, Florel, and Sumagic after the plant has developed sufficient foliage (photosynthetic area, leaf area) to prevent excessive stunting of the plant's development. For example, a Bonzi spray on pansy plugs should not be made until three true leaves are present on the plants. Earlier applications may stop plant growth completely rather than merely reduce elongation. Apply CGR's just prior to rapid shoot elongation; e.g. after pinching and newly developing shoots are visible, but before shoot elongation has occurred. Remember that CGR's are chemical growth retardants not chemical plant reducers--they cannot shrink plant growth already present. Make your final application before the stage when floral size will be reduced. If growth retardants are applied too late, the size of the flowers can be reduced and floral development can be slowed. A good example would be bract size reduction and delay of bract color in poinsettia due to late application of A-Rest, B-Nine + Cycocel, Bonzi, Cycocel, or Sumagic.

Timing of a PGR application should be based on a physiological stage of plant development such as the number of leaves present, the length of shoots, or plant diameter, not chronological age such as 3 weeks after pinching. Recommendations given in terms of chronological age are merely guidelines that have been correlated to physiological stages and should only be used as rough estimates as to when to apply plant growth regulators. Also remember to read the label when deciding on timing for a PGR application. Many labels suggest the proper plant stage of development for chemical application.

Target: The target tissue or plant part to receive the chemical depends on the chemical and the plant species.

☞ Foliage and Stems: Chemicals can be sprayed on, or shoots can be dipped into a chemical solution at time of transplanting. If dipping shoots into a solution, use a consistent soaking time, such as 10 seconds. For sprays, remember that areas are sprayed not individual plants. Imagine yourself painting a wall with a roller. You want uniform coverage over the entire area--not heavy clumps (every time you pass over a plant). This is the only way to assure even coverage and consistent results. With many PGR's such as A-Rest, Bonzi, and Sumagic, spraying different volumes of the same concentration spray over a given area gives different levels of control. If growers "spray to runoff" or "spray to glistening", every grower will apply a different amount, and there is no way of predicting the results.

Proper coverage is essential for consistent results (see Application Technique section). For example, Bonzi and Sumagic are not very effective if only applied to plant leaves. Transport of Bonzi and Sumagic to the growing point in the plant is most effective if it is applied to the stem or if it is absorbed through the roots. If an insufficient application volume is used and stems are not wetted, poor height control will be the result. On the other hand, since root uptake is very effective, an over application of Bonzi or Sumagic using too large a volume will result in the excess spray dripping onto the substrate leading to root uptake of the chemical and causing too great a reduction in growth.

☞ Substrate: PGR's can be applied to the substrate (growth media or soil), if the root system is the target tissue. This is the same as a soil drench; drenches use larger volumes of solution per plant or pot, but usually at lower concentrations than a spray or dip. Drenches can take more time to apply than sprays, and require exact metering of volume delivered per pot for consistent control of elongation.

☞ Roots: PGR's can be applied directly to the roots or the underground portion of the plant such as bulbs, corms, or tubers, prior to planting.

An example is a Bonzi soak, which is labeled as a preplant treatment for freesias.

Dosage: Read the label; do not guess on dosage. Keep in mind that a dosage is the product of concentration of solution applied and volume of solution applied per area. If either are incorrect, results could be unpredictable and nonrepeatable. Take care to always apply the correct dosage to all plants treated.

Application Technique: As with the target tissue, the method of delivering a PGR depends on both the chemical used and the plant species to be treated. Table 1 lists labeled application techniques for PGR's in the application method and rates column.

☞ Dips: With some plants it is possible to dip the plant shoot, or underground portion (bulb, corm, tuber) into a growth retardant solution prior to potting. This method is labeled and is very effective for applying B-Nine to the shoots of rooted chrysanthemums just prior to potting. This method is fairly accurate, if each plant remains in the solution for the same amount of time, and if each plant has approximately the same size shoot or bulb. Unfortunately, this method is not feasible with many crops, and dipping plants in a common solution could result in the spread of disease organisms.

☞ Drenches: Applying a growth retardant in a drench form is fairly easy. Measure out a known amount of chemical, add it to a known volume of water, and apply a known volume of the drench to each pot or plant. As pot size increases, usually the volume of drench recommended also increases. If using a drench, make sure the volume and concentration of the solution are correct for the size pot to be treated. There are "drenching machines" available on the market that emit a set volume of drench then turn off for a short period of time prior to the next dose to allow applicators to place the nozzle into the next pot to receive the drench. Do not apply any plant growth regulator through an irrigation system, unless the label lists chemigation as a legal application technique. Currently, it is legal to apply A-Rest through drip, overhead boom, sprinkler, and flood (subirrigation) systems. Consult the label for specific application recommendations.

☞ Sprays: A spray application can be more difficult to apply evenly than a drench, but with attention to detail, is the method of choice. Some chemical labels recommend to "spray to runoff"; that is, spray each plant until spray visibly just begins to drip off of the foliage. Depending on the size of the plant, the sprayer's objectivity, and other factors, varying amounts of chemical will be applied to each plant. It is much safer and more accurate to base spray application on areas, not plants. Apply a known volume of spray evenly to a known area (square footage), regardless of how many plants are in that known area. The general recommendation for sprays is to apply $^1/_2$ gallon per 100 ft^2 of cropping area. This volume is sufficient to comfortably walk 25 feet while spraying a 4 foot-wide bench, thus the basis for the recommendation. If the area is sprayed evenly, it assures that each pot will receive the same amount of spray, regardless of how many containers are in the area.

To help with uniform distribution, the sprayer should be equipped with a pressure gauge and pressure regulator to assure uniform output. Unless the sprayer is emitting a constant volume, spray will not be applied evenly over plants.

Spray droplet size can affect spray distribution on the plants. In general, the smaller the droplet size, the more even the coverage and the greater the effectiveness (efficacy) of the chemical. Therefore it is possible that two growers applying the same treatment but with different spray nozzles could achieve different degrees of effectiveness. For consistency, try to use the same nozzle type for all PGR applications.

Spray adjuvants, compounds added to assist the action of the active ingredient, such as a wetting agent can affect PGR efficacy. Some PGR products such as A-Rest, Bonzi, and Sumagic advise against adding a wetting agent. B-Nine already contains a wetting agent and may

not require the use of an additional wetting agent. If a wetting agent is needed to allow a spray material to more thoroughly cover plant surfaces, such as with a Cycocel spray on poinsettias, use as little as possible to avoid phytotoxic side effects. Start off using a very low concentration and by experimenting with water on test plants, slowly increase the wetting agent concentration. Add only enough wetting agent to prevent droplets from beading up on the leaves; a higher concentration is unnecessary and could cause leaf burning.

Environmental Conditions: The efficacy of a PGR can be affected by ❶ the environment at time of application, ❷ the status of the plant at application, and ❸ post-application treatment of the plant.

A good example of an environmental factor affecting PGR efficacy is the effect substrate components can have on CGR's. A bark-containing substrate will reduce the efficacy of A-Rest and triazole growth retardants like Bonzi and Sumagic, when applied as a drench. Therefore, drenching may not be the application method of choice for these PGR's if using a bark-based substrate; or growers should account for the presence of bark when deciding on the concentration of PGR to use.

Another environmental factor of concern is the time of day selected for applying PGR's. Research with foliar sprays of nutrients has shown that the time of day chosen for an application can affect a plant's ability to absorb a chemical. Morning applications, when evaporation rates are low, are more desirable than later in the day. The longer the solution wets the tissue, the greater the chance for chemical uptake. If possible, make spray applications on a cloudy day to allow the chemical solution even more time to be absorbed prior to evaporation of the water from the surface of leaves and stems.

Plant water status can affect chemical efficacy. Plants should not be wilted or stressed at application. A turgid plant is more able to absorb and translocate a PGR than a wilted plant.

With respect to post-application handling of treated plants, B-Nine has been shown to require a long period of time (up to 4 hours) for complete absorption after a spray application. If the plants are watered (wetting the foliage) too soon after a B-Nine application, the unabsorbed chemical will be washed off and the efficacy of the B-Nine will be reduced. This is not true for rapidly absorbed PGR's such as A-Rest, Bonzi, and Sumagic, and plants either drenched or sprayed with these chemicals can be watered as soon as 1 hour after application without a reduction in chemical efficacy. The effects of post-application watering on Florel and GibGro efficacy are not known.

Best Management Practices for plant growth regulators do not end with the guidelines given above. For a total program, growers should always monitor the effectiveness of applied treatments to assure that the treatments are working and to help "fine-tune" the amount of chemical needed. Monitoring treatment effectiveness may indicate that less chemical is needed. Always leave a few untreated controls mixed in with the treated population. This allows comparisons for effectiveness of the PGR treatment. For growth retardants, monitor plant growth for the treated plants regularly to know when plants begin to "grow out" of the treatment and to help in deciding if and when another application is needed.

When used properly, chemical plant growth regulators are effective tools to help produce a high quality crop. When misused, they can reduce crop quality and increase production costs. Uniformity and consistency in application are crucial to attain predictable and desirable results.

Table 1 does not contain reference to Accel or Pro-Shear. Unfortunately, re-registration for both of these products will not be pursued, and neither will be available once current supplies are used. Benzyladenine (BA; the active ingredient of Pro-Shear) at 100 ppm is highly effective on

(Text continued on Page 16)

Table 1. Plant growth regulators labeled for use on floricultural crops in a greenhouse.

Crop	Purpose	Product	Application Method & Rate	Precautions & Remarks
Ageratum	To control plant height	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. Growers should refer to Horticulture Information Leaflet #528, Height Control of Greenhouse Crops, for application techniques and timing for growth regulators on floricultural crops. Contact floricultural specialists at NC State University for further application information.
		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	400 to 3,000 ppm spray (0.43 to 3.25 fl oz/gal)	
		Sumagic	20 to 30 ppm spray (5.12 to 7.68 fl oz/gal)	
Alternanthera (Joseph's-Coat)	To control plant height	A-Rest	25 to 132 ppm spray (12.1 to 64 fl oz/gal)	
			0.25 to 0.50 mg a.i. 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. Contact floricultural specialists at NC State University.
Alyssum	To control plant height	Sumagic	5 to 25 ppm spray (1.3 to 6.4 fl oz/gal)	See Ageratum.
Amaryllis	To control plant height	Bonzi	23.66 mg a.i. 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. Contact floricultural specialists at NC State University.
Aster	To control plant height	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	See Ageratum.
Azalea	To control plant height	A-Rest	26 ppm spray (12.6 fl oz/gal)	Contact floricultural specialists at NC State University.
	To promote flower initiation	B-Nine	1,500 to 2,500 ppm spray (0.24 to 0.39 oz/gal)	Apply solution when new growth from final pinch is 1 to 2 inches long.
		Cycocel	1,000 to 4,000 ppm spray (1.08 to 4.34 fl oz/gal)	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.
	To promote lateral shoot growth on vegetative plants	Off-Shoot-O	Use a 3 to 5% solution (8.6 to 14 fl oz/gal) solution in greenhouses; use 5 to 7% (14 to 20 fl oz/gal) outdoors. Apply as a foliar spray.	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.
	To increase lateral branching	Florel	2,471 to 4,943 ppm spray (8 to 16 fl oz/gal)	
	To control plant height, reduce bypass shoot elongation, and promote flower bud initiation	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.
			0.59 to 1.77 mg a.i. 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. Contact floricultural specialists at NC State University.
	To control plant height	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. Contact floricultural specialists at NC State University for further application information.
	For partial or full substitution of cold	GibGro	250 to 1,000 ppm spray (1 to 4 fl oz/gal)	GibGro 4LS has 24(c) registration for distribution and greenhouse use only within North Carolina. Spray timing, concentration, and number of applications varies with cultivar as well as intended degree of cold substitution. Consult the label for exact recommendations.
	To prevent flower bud initiation during vegetative growth	GibGro	100 to 750 ppm spray (0.4 to 3 fl oz/gal)	GibGro 4LS has 24(c) registration for distribution and greenhouse use only within North Carolina. Apply two to three sprays at 2 to 3 weeks intervals after each pinch.

Table 1, continued.

Crop	Purpose	Product	Application Method & Rate	Precautions & Remarks
Bedding Plants (Not specifically listed in this table)	To control plant height	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.
			0.06 to 0.12 mg a.i. 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. Contact floricultural specialists at NC State University.
		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	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.
			0.118 mg a.i. drench for a 6 inch pot (0.032 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 3,000 ppm spray (0.87 to 3.25 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	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.
Bedding Plant Plugs (Not specifically listed in this table)	To control plant height	A-Rest	3 to 35 ppm spray (1.5 to 17 fl oz/gal)	See Ageratum.
			Drench plug flats with a 0.5 to 1 ppm solution (0.25 to 1 fl oz/gal)	For uniform application, use a subirrigation delivery system. Plug trays should not be excessively dry prior to the subirrigation treatment.
		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	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)	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	To control plant height	A-Rest	3 to 15 ppm spray (1.5 to 7.3 fl oz/gal)	See Ageratum.
		B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	
Bleeding Heart	To control plant height	A-Rest	65 to 132 ppm spray (31.5 to 64 fl oz/gal	

Table 1, continued.

Crop	Purpose	Product	Application Method & Rate	Precautions & Remarks
Bleeding Heart, continued	To control plant height	A-Rest	0.25 to 0.50 mg a.i. 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. Contact floricultural specialists at NC State University.
Bromeliad	To promote flower initiation	Florel	2,471 ppm spray (8 fl oz/gal)	Contact floricultural specialists at NC State University.
Browallia	To control plant height	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)	To control plant height	A-Rest	25 to 50 ppm spray (12.1 to 24.2 fl oz/gal)	Drenches are more effective than sprays.
			0.25 mg a.i. drench for a 6 inch pot (2 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)	
			1.183 mg a.i. 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. Contact floricultural specialists at NC State University.
			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.
			1 to 3 ppm drench (0.26 to 0.8 fl oz/gal)	Drench volumes and mg a.i. vary with pot size. Contact floricultural specialists at NC State University.
			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	To control plant height	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.
			1.183 to 2.366 mg a.i. drench for a 6 inch pot (0.32 to 0.64 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.
Calla Lily	To control plant height	Bonzi	1.183 to 3.549 mg a.i. drench for a 6 inch pot (0.32 to 0.96 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	To control plant height	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	4 to 50 ppm spray (0.13 to 1.60 fl oz/gal)	
		Cycocel	400 to 3,000 ppm spray (0.43 to 3.25 fl oz/gal)	
		Sumagic	10 to 20 ppm spray (2.56 to 5.12 fl oz/gal)	
China Aster	To control plant height	A-Rest	7 to 26 ppm spray (3.4 to 12.6 fl oz/gal)	

Table 1, continued.

Crop	Purpose	Product	Application Method & Rate	Precautions & Remarks
Chrysanthemum, Cut	To reduce "neck" stretching	B-Nine	2,500 ppm spray (0.39 oz/gal)	Spray upper foliage 5 weeks after start of short-day treatment.
Chrysanthemum, Potted	To control plant height	A-Rest	25 to 50 ppm spray (12.1 to 24.2 fl oz/gal)	Contact floricultural specialists at NC State University.
			0.25 to 0.50 mg a.i. 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. Contact floricultural specialists at NC State University.
		B-Nine	1,000 ppm preplant foliar dip (0.16 oz/gal)	Contact floricultural specialists at NC State University.
			1,250 to 5,000 ppm spray (0.20 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)	Contact floricultural specialists at NC State University.
			0.118 to 0.473 mg a.i. 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. Contact floricultural specialists at NC State University.
		Sumagic	2.5 to 10 ppm spray (0.64 to 2.56 fl oz/gal)	Contact floricultural specialists at NC State University.
Chrysanthemum, Garden	To control plant height	Sumagic	2.5 to 10 ppm spray (0.64 to 2.56 fl oz/gal)	Contact floricultural specialists at NC State University.
	To increase lateral branching	Florel	500 ppm spray (1.619 fl oz/gal)	Florel applications will provide some growth retardant effects. A delay in flowering will also occur with the use of Florel. Read the label for restrictions on timing of applications.
Clematis	To control plant height	A-Rest	25 to 132 ppm spray (12.1 to 64 fl oz/gal)	
			0.25 to 0.50 mg a.i. 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. Contact floricultural specialists at NC State University.
Cleome	To control plant height	A-Rest	7 to 26 ppm spray (3.4 to 12.6 fl oz/gal)	See Ageratum.
		Cycocel	400 to 3,000 ppm spray (0.43 to 3.25 fl oz/gal)	
Coleus	To control plant height	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	See Ageratum.
		Bonzi	5 to 45 ppm spray (0.16 to 1.44 fl oz/gal)	
		Cycocel	400 to 3,000 ppm spray (0.43 to 3.25 fl oz/gal)	
		Sumagic	10 to 20 ppm spray (2.56 to 5.12 fl oz/gal)	
Columbine	To control plant height	A-Rest	65 to 132 ppm spray (31.5 to 64 fl oz/gal)	
			0.25 to 0.50 mg a.i. 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. Contact floricultural specialists at NC State University.
Coneflower	To control plant height	Sumagic	30 to 40 ppm spray (7.7 to 10.2 fl oz/gal)	
Cornflower (*Centaurea*)	To control plant height	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)	

Table 1, continued.

Crop	Purpose	Product	Application Method & Rate	Precautions & Remarks
Cosmos	To control plant height	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	See Ageratum.
Crossandra	To control plant height	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	See Ageratum.
Daffodil	To control plant height	Bonzi	2.366 to 4.732 mg a.i. 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
		Florel	1,000 to 2,000 ppm spray (3.24 to 6.47 fl oz/gal)	Contact floricultural specialists at NC State University.
Dahlia, Bedding Plant	To control plant height	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	400 to 3,000 ppm spray (0.43 to 3.25 fl oz/gal)	
		Sumagic	10 to 20 ppm spray (2.56 to 5.12 fl oz/gal)	
Dahlia, Tuberous	To control plant height	A-Rest	0.25 to 0.50 mg a.i. 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. Contact floricultural specialists at NC State University.
		Bonzi	1.183 to 4.732 mg a.i. drench for a 6 inch pot (0.32 to 1.28 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	
Delphinum	To control plant height	A-Rest	35 to 132 ppm spray (17 to 64 fl oz/gal)	See Ageratum.
			0.25 to 0.50 mg a.i. 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. Contact floricultural specialists at NC State University.
		B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	See Ageratum.
Dianthus	To control plant height	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 60 ppm spray (0.16 to 1.92 fl oz/gal)	
		Cycocel	400 to 3,000 ppm spray (0.43 to 3.25 fl oz/gal)	
Dracaena	To control plant height	A-Rest	25 to 132 ppm spray (12.1 to 64 fl oz/gal)	
			0.25 to 0.50 mg a.i. 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. Contact floricultural specialists at NC State University.
Dusty Miller	To control plant height	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	To control plant height	A-Rest	50 ppm spray (24.2 fl oz/gal)	Contact floricultural specialists at NC State University.

Table 1, continued.

Crop	Purpose	Product	Application Method & Rate	Precautions & Remarks
Easter Lily, continued	To control plant height	A-Rest	0.25 to 0.5 mg a.i. 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. Contact floricultural specialists at NC State University.
		Sumagic	10 to 25 ppm spray (2.56 to 6.4 fl oz/gal)	Contact floricultural specialists at NC State University.
			0.03 to 0.06 mg a.i. 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. Contact floricultural specialists at NC State University.
Exacum	To control plant height	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	
Fatshedera	To control plant height	A-Rest	65 to 132 ppm spray (31.5 to 64 fl oz/gal)	
			0.25 to 0.50 mg a.i. 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. Contact floricultural specialists at NC State University.
Flowering/Foliage Plants, Herbaceous Species (Not specifically listed in this table)	To control plant height	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).
			0.125 to 0.25 mg a.i. 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. Contact floricultural specialists at NC State University.
		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.
			0.118 mg a.i. 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. Contact floricultural specialists at NC State University.
		Cycocel	800 to 4,000 ppm spray (0.87 to 4.34 fl oz/gal)	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, *Gynura aurantiaca*, Ivy, Kalanchoe, *Lilium* spp., Morning glory, Pachystachys, *Pilea* spp., Pentas, *Salvia* spp., Schefflera, *Sedum* spp., 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.
		Sumagic	5 to 40 ppm spray (1.3 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.
			0.1 to 1 ppm drench (0.026 to 0.26 fl oz/gal)	Drench volumes and mg a.i. vary with pot size. Contact floricultural specialists at NC State University.
Flowering/Foliage Plants, Woody Species (Not specifically listed in this table)	To control plant height	A-Rest	50 ppm spray (24.2 fl oz/gal)	
		A-Rest	0.25 mg a.i. 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. Contact floricultural specialists at NC State University.
		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.

Table 1, continued.

Crop	Purpose	Product	Application Method & Rate	Precautions & Remarks
Flowering/Foliage Plants, Woody Species, continued	To control plant height	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.
			0.237 mg a.i. 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. Contact floricultural specialists at NC State University.
		Cycocel	800 to 4,000 ppm spray (0.87 to 4.34 fl oz/gal)	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 *Baleria 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.
		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.
			0.5 to 2 ppm drench (0.13 to 0.52 fl oz/gal)	Drench volumes and mg a.i. vary with pot size. Contact floricultural specialists at NC State University.
Freesia	To control plant height	Bonzi	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	To increase lateral branching	Florel	500 ppm spray (1.619 fl oz/gal)	Florel applications will provide some growth retardant effects. A delay in flowering will also occur with the use of Florel. Read the label for restrictions on timing of applications.
Gardenia	To control plant height	A-Rest	50 ppm spray (24.2 fl oz/gal)	
			0.25 mg a.i. 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. Contact floricultural specialists at NC State University.
		B-Nine	5,000 ppm spray (0.79 oz/gal)	
Geranium	To control plant height	A-Rest	26 to 66 ppm spray (12.6 to 32 fl oz/gal)	See Ageratum.
		Bonzi	5 to 20 ppm spray (0.16 to 0.64 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)	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.
		Sumagic	3 to 6 ppm spray (0.77 to 1.54 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.
	To promote earlier flowering in seed geraniums	Cycocel	1,500 ppm spray (1.63 fl oz/gal)	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.
	To increase lateral branching	Florel	300 to 500 ppm spray (1.619 to 3.24 fl oz/gal)	Labeled for zonal and ivy geraniums. Use the lower concentration for ivy geraniums. Florel will also provide some growth retardant effect. A delay in flowering will also occur with the use of Florel. Read the label for restrictions on timing of applications.
Gerbera Daisy	To control plant height	A-Rest	25 to 132 ppm spray (12.1 to 64 fl oz/gal)	

Table 1, continued.

Crop	Purpose	Product	Application Method & Rate	Precautions & Remarks
Gerbera Daisy, continued	To control plant height		0.25 to 0.50 mg a.i. 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. Contact floricultural specialists at NC State University.
		B-Nine	1,200 to 5,000 ppm spray (0.18 to 0.79 oz/gal)	
Gloxinia	To control peduncle length	B-Nine	1,250 ppm spray (0.19 oz/gal)	Phytotoxicity may occur at rates >1,250 ppm.
Gomphrena	To control plant height	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	See Ageratum.
		Cycocel	400 to 3,000 ppm spray (0.43 to 3.25 fl oz/gal)	
Hibiscus	To control plant height	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 months.
		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.
Holly	To control plant height	A-Rest	50 ppm spray (24.2 fl oz/gal)	
			0.25 mg a.i. 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. Contact floricultural specialists at NC State University.
Hollyhock	To control plant height	Sumagic	5 to 40 ppm spray (1.3 to 10.2 fl oz/gal)	
Hyacinth	To reduce stem topple	Florel	1,000 ppm spray (3.24 fl oz/gal)	Contact floricultural specialists at NC State University.
Hybrid Lily	To control plant height	Bonzi	250 to 500 ppm spray (8.0 to 16.0 fl oz/gal)	See Caladium.
			1.183 to 2.366 mg a.i. drench for a 6 inch pot (0.32 to 0.64 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	
		Bonzi	20 to 30 ppm bulb soak (0.64 to 0.96 fl oz/gal)	Soak bulbs in the solution for 15 minutes prior to planting.
		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	To control plant height	A-Rest	50 ppm spray (24.2 fl oz/gal)	
			0.25 mg a.i. 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. Contact floricultural specialists at NC State University.
		B-Nine	2,500 to 7,500 ppm spray (0.39 to 1.18 oz/gal)	Contact floricultural specialists at NC State University.
Hypoestes	To control plant height	Cycocel	400 to 3,000 ppm spray (0.43 to 3.25 fl oz/gal)	See Ageratum.
Impatiens	To control plant height	A-Rest	10 to 44 ppm spray (4.8 to 21.3 fl oz/gal)	See Ageratum.
		Bonzi	5 to 45 ppm spray (1.44 to 2.02 fl oz/gal)	
		Sumagic	5 to 10 ppm spray (1.28 to 2.56 fl oz/gal)	
Jerusalem Cherry	To control plant height	Cycocel	400 to 3,000 ppm spray (0.43 to 3.25 fl oz/gal)	See Ageratum.

Table 1, continued.

Crop	Purpose	Product	Application Method & Rate	Precautions & Remarks
Kalanchoe	To control peduncle length	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	To increase lateral branching	Florel	500 ppm spray (1.619 fl oz/gal)	Florel applications will provide some growth retardant effects. A delay in flowering will also occur with the use of Florel. Read the label for restrictions on timing of applications.
Liatris	To control plant height	A-Rest	25 to 132 ppm spray (12.1 to 64 fl oz/gal)	
			0.25 to 0.50 mg a.i. 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. Contact floricultural specialists at NC State University.
		B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	
Marigold	To control plant height	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	10 to 60 ppm spray (0.32 to 1.92 fl oz/gal)	
		Cycocel	400 to 3,000 ppm spray (0.43 to 3.25 fl oz/gal)	
		Sumagic	10 to 20 ppm spray (2.56 to 5.12 fl oz/gal)	
Monarda	To control plant height	Sumagic	15 to 30 ppm spray (3.8 to 7.7 fl oz/gal)	
Monstera	To control plant height	A-Rest	25 to 132 ppm spray (12.1 to 64 fl oz/gal)	
			0.25 to 0.50 mg a.i. 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. Contact floricultural specialists at NC State University.
Montbretia	To control plant height	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	To control plant height	Cycocel	400 to 3,000 ppm spray (0.43 to 3.25 fl oz/gal)	
Nepthytis, Green & Green Gold	To control plant height	A-Rest	25 to 132 ppm spray (12.1 to 64 fl oz/gal)	
			0.25 to 0.50 mg a.i. 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. Contact floricultural specialists at NC State University.
Pansy	To control plant height	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	To control plant height	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)	
		Sumagic	25 to 50 ppm spray (6.4 to 12.79 fl oz/gal)	

Table 1, continued.

Crop	Purpose	Product	Application Method & Rate	Precautions & Remarks
Philodendron	To control plant height	A-Rest	25 to 132 ppm spray (12.1 to 64 fl oz/gal)	
			0.25 to 0.50 mg a.i. 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. Contact floricultural specialists at NC State University.
Phlox	To control plant height	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	See Ageratum.
Pilea	To control plant height	A-Rest	25 to 132 ppm spray (12.1 to 64 fl oz/gal)	
			0.25 to 0.50 mg a.i. 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. Contact floricultural specialists at NC State University.
Poinsettia	To control plant height	A-Rest	0.06 to 0.25 mg a.i. drench for a 6 inch pot (0.25 to 1 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Contact floricultural specialists at NC State University.
		B-Nine	2,000 to 3,000 ppm spray (0.31 to 0.47 oz/gal)	Not effective in our 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)	Contact floricultural specialists at NC State University.
			0.237 to 0.473 mg a.i. drench for a 6 inch pot (0.064 to 0.128 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	Drench volume and mg a.i. vary with pot size. Consult the label for recommended volumes.
		Cycocel	800 to 1,500 ppm spray (0.87 to 1.63 fl oz/gal)	For natural season crops in N.C., do not apply cycocel after Nov. 1. 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 varies with pot size. Consult the label for recommended volumes.
		Sumagic	2.5 to 10 ppm spray (0.64 to 2.56 fl oz/gal)	Contact floricultural specialists at NC State University.
Portulaca	To control plant height	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	To control plant height	A-Rest	25 to 132 ppm spray (12.1 to 64 fl oz/gal)	
			0.25 to 0.50 mg a.i. 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. Contact floricultural specialists at NC State University.
Purple Coneflower	To control plant height	Sumagic	30 to 40 ppm spray (7.7 to 10.2 fl oz/gal)	
Purple Passion (*Gynura aurantiaca*)	To control plant height	A-Rest	26 to 132 ppm spray (12.6 to 64 fl oz/gal)	
			0.25 to 0.50 mg a.i. 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. Contact floricultural specialists at NC State University.

Table 1, continued.

Crop	Purpose	Product	Application Method & Rate	Precautions & Remarks
Salvia	To control plant height	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	400 to 3,000 ppm spray (0.43 to 3.25 fl oz/gal)	
		Sumagic	5 to 10 ppm spray (1.28 to 2.56 fl oz/gal)	
Schefflera	To control plant height	A-Rest	25 to 132 ppm spray (12.1 to 64 fl oz/gal)	
			0.25 to 0.50 mg a.i. 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. Contact floricultural specialists at NC State University.
Shasta Daisy	To control plant height	Sumagic	15 to 30 ppm spray (3.8 to 7.7 fl oz/gal)	
Snapdragon	To control plant height	A-Rest	10 to 26 ppm spray (4.8 to 12.6 fl oz/gal)	See Ageratum.
		Bonzi	5 to 90 ppm spray (0.16 to 2.88 fl oz/gal)	
		Sumagic	25 to 50 ppm spray (6.4 to 12.79 fl oz/gal)	
Spathiphyllum	To induce flower initiation	GibGro	250 ppm spray (1 fl oz/gal)	GibGro 4LS has 24(c) registration for distribution and greenhouse use only within North Carolina. One application should be made during the non-seasonal blooming period, typically June through January.
Speedwell (Veronica)	To control plant height	Sumagic	20 to 40 ppm spray (5.1 to 10.2 fl oz/gal)	
Sunflower	To control plant height	Cycocel	400 to 3,000 ppm spray (0.43 to 3.25 fl oz/gal)	
Tulip	To control plant height	A-Rest	0.125 to 0.5 mg a.i. 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. Contact floricultural specialists at NC State University.
		Bonzi	0.591 to 4.732 mg a.i. 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.
			2 to 5 ppm bulb soak (0.064 to 0.16 fl oz/gal)	Soak bulbs for 1 hour prior to planting.
Verbena	To control plant height	B-Nine	2,500 to 5,000 ppm spray (0.39 to 0.79 oz/gal)	See Ageratum.
		Cycocel	400 to 3,000 ppm spray (0.43 to 3.25 fl oz/gal)	
	To increase lateral branching	Florel	500 ppm spray (1.619 fl oz/gal)	Florel applications will provide some growth retardant effects. A delay in flowering will also occur with the use of Florel. Read the label for restrictions on timing of applications.
Vinca (*Catharanthus*)	To control plant height	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	400 to 3,000 ppm spray (0.43 to 3.25 fl oz/gal)	

Table 1, continued.

Crop	Purpose	Product	Application Method & Rate	Precautions & Remarks
Vinca, continued	To control plant height	Sumagic	1 to 3 ppm spray (0.26 to 0.77 fl oz/gal)	See Ageratum.
Vinca Vine (*Vinca spp.*)	To increase lateral branching	Florel	500 ppm spray (1.619 fl oz/gal)	Florel applications will provide some growth retardant effects. A delay in flowering will also occur with the use of Florel. Read the label for restrictions on timing of applications.
Viola	To control plant height	Sumagic	1 to 5 ppm spray (0.26 to 1.28 fl oz/gal)	See Ageratum.
Wandering Jew	To control plant height	A-Rest	26 to 132 ppm spray (12.6 to 64 fl oz/gal)	
Woody Landscape Plants (Not specifically listed in this table)	To control plant height	A-Rest	50 ppm spray (24.2 fl oz/gal)	
			0.25 mg a.i. 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. Contact floricultural specialists at NC State University.
		Bonzi	0.473 mg a.i. drench for a 6 inch pot (0.128 fl oz/gal of drench solution; apply 4 fl oz/6 inch pot)	See Bedding Plants
			100 ppm spray (3.2 fl oz/gal)	
Zinnia	To control plant height	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	400 to 3,000 ppm spray (0.43 to 3.25 fl oz/gal)	

(Continued from Page 4)

holiday cactus in stimulating branching when applied during the vegetative phase and is effective in increasing the number of flower buds when applied during reproductive conditions; but no product is labeled for this use. Accel (N-Benzyl-9-[2-tetrahydropyranyl]adenine [BPA] is the active ingredient) was labeled for increasing lateral branching in carnation and roses, but will not be available after current supplies are depleted.

Research on floricultural crops has shown many other potential uses for PGR's, such as gibberellic acid (GA_3) substituting for cold storage of hydrangea and hastening flowering of cyclamen; however, only those uses listed on a product label can be implemented legally. Plant growth regulators are regarded as pesticides, and it is a violation of Federal and State Law to use these products in a manner inconsistent with their labeling. Hopefully, expansion of current labeling will be possible in the future to allow growers to take advantage of research results showing more efficient cropping and higher quality plants through best management utilization of plant growth regulators.

Recommendations for the use of chemicals are included in this publication as a convenience to the reader. The use of brand names and any mention or listing of commercial products or services in this publication does not imply endorsement by the North Carolina Cooperative Extension Service nor discrimination against similar products or services not mentioned. Individuals who use 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 and examine a current product label before applying any chemical. For assistance, contact an agent of the North Carolina Cooperative Extension Service in your county.