

# *Using PGRs for Height Control of Spring Crops*

Douglas Cox  
Stockbridge School of Agriculture  
University of Massachusetts  
Amherst

Spring greenhouse crop growers often look for a way to control the height or size of their plants. Plant height can be controlled by chemical PGRs, DIF or DIP methods of temperature control, pruning or shearing, low phosphorus fertilization, controlled irrigation, and careful variety selection and scheduling. The most reliable methods for growth control are chemical PGRs, the subject of this article, and DIF or DIP.

Chemical plant growth retardants (PGRs) are very useful tools for controlling the height of bedding plants and despite the current aversion to chemicals, PGRs remain the first choice of most growers. This article outlines what chemicals are available for spring crops, how they are applied, and some of the factors which affect the success of their use. For more information consult the growth regulator section of the *201-2018 New England Greenhouse Floriculture Guide*.

## **Causes of Too Tall Plants**

Achieving desirable plant height involves considering why plants tend to be too tall before starting on a PGR program. Spending the time and expense required to apply a PGR may not be necessary if the height problem can be corrected in other ways. There are number of reasons why bedding plants may stretch. The most common reasons for stretching are low light, too close spacing, and situations where there is a large difference between day and night temperature. Plants that are shaded by old plastic, neighboring plants, or hanging baskets tend to stretch. Lack of ventilation on clear days and resulting heating will increase the difference between the day and night temperature and cause plants to grow taller. Excessive height may also result if the plants were started too soon or tall cultivars were chosen instead of compact ones. Many of the factors interact to encourage development of tall plants (e.g., low light and poor ventilation).

PGRs may be helpful in overcoming some of these problems, but too much reliance on PGRs is potentially costly. PGR use should be a proactive rather than reactive part of growing plants. Also, because PGRs are treated as pesticides and have assigned re-entry intervals, frequent use of PGRs may disrupt other work in some greenhouse operations. Like pesticides, PGRs need to be used wisely and not as substitutes for good cultural practices.

## **Growth Retardants for Bedding Plants**

Plant growth regulators are most effective when applied at the appropriate times to regulate plant growth or development. Growth retardants cannot shrink overgrown plants. They must be applied before the plant is overgrown to prevent plant stretch. When planning PGRs in your production schedule, consider what you want to accomplish with the treatment. Table 1. shows the active chemical ingredients and the brand-names of current PGRs for bedding plants and other spring crops. PGRs for height control are antigibberellins which act by shortening the internodes of stems by inhibiting cell elongation.

**Table 1.** PGRs for spring crops.

<b>Ancymidol</b>	<b>Diaminozide</b>	<b>Flurprimidol</b>
Abide	B-Nine	Topflor (liquid)
A-Rest	Dazide	Topflor (granular)
<b>Chlormequat chloride</b>	<b>Paclobutrazol</b>	<b>Uniconazole-p</b>
Citadel	Bonzi	Concise
Cycocel	Downsize	Sumagic
	Florazol	
	Paczol	
	Piccolo	

Research has shown that when different products with the same active ingredient are applied at the same time, level, and application method the same plant response will result. Table 2 shows the best application method and the level chemical activity and duration of some PGRs.

**Table 2.** PGR application method and activity

Active ingredient	PGR example	Method	Activity
Ancymidol	A-Rest	Spray or drench	Moderate
Diaminozide	B-Nine	Spray	Low
Paclobutrazol	Bonzi	Spray or drench	High
Chlormequat chloride	Cycocel	Spray	Low
Uniconazole	Sumagic	Spray or drench	High
Fluriprimidol	Topflor	Spray or drench	Moderate

A foliar spray is the preferred method of applying PGRs to bedding plants in flats and plug trays and growth medium drenches can be used on pots. Drench applications of B-Nine have no effect on plants and Cycocel drench is less effective than a foliar spray. Sumagic can be applied as a pre-plant spray made to the surface of the growth medium. This may be a more efficient way of applying PGR, if applied uniformly.

The term "activity" refers to the general sensitivity of plants to the PGR and the duration of the growth inhibiting effect after application. The height of plants treated with low activity PGRs is less affected by variations in the spray or drench volume and the persistence of the growth inhibiting effect after application is short (2-3 weeks). Plants are very sensitive to high activity PGRs. Small variations in spray or drench volume can have significant effects on height. The growth inhibiting effect after application, especially by drench, is very persistent. What this all means is that the risk of overdosing is greater with Bonzi and Sumagic than A-Rest, B-Nine, or Cycocel. More attention to details of rate, application volume, timing, and possible reapplication is required to successfully use high activity PGRs.

### PGR Rates to Use

To choose a rate (ppm) to apply, check the label for the recommended rate for the plant you wish to treat or consult a crop production guide such as the *New England Greenhouse Floriculture Guide*. In the absence of a specific recommendation the grower should run a trial. A trial should be replicated and consist of a small number of plants rather than whole crop! The general rates commonly used for cellpacks, pots or other containers (Table 3) are the starting point for a trial. It's only common sense to test the lowest rates first, especially with Bonzi and Sumagic.

**Table 3.** PGRs for cell packs and pots.

PGR example	Rates (ppm) & Methods	Uses & Precautions
A-Rest	6-66, spray 1-4, drench	15 ppm for spray trials, 1 ppm drench for trials.
B-Nine	2500-5000, spray	Repeat apps. On some species. Two apps. At ½ to ⅔ label rates may be better than the full rate. Apply during cloudy weather or late in the day.
Bonzi	5-90, spray 0.5-1, drench	15 ppm for spray trials. Apply to stems. For most vigorous species, but not begonia or annual vinca.
Cycocel	800-1500, spray	1250 for trial. 800-1500 ppm for most species but as 300 may be needed. No more than 6 apps. Per crop cycle.
Sumagic	1-50, spray 0-1.2 drench 0.5-2, preplant soil spray	5-15 ppm for spray trials. For most vigorous species, but not begonia. Apply PSS right before transplanting while mix is moist. 2 qt./100 sq. ft.
Topflor	0.5-80, spray 0.25-4, drench	Test at low rates. Repeat apps. May be needed at 21 day intervals.

## **PGR Response to Environmental and Situational Factors**

### **Applying PGRs**

Environmental and situational factors effect the response of plants to PGRs. PGRs are most effective when applied under conditions of high humidity, cool temperatures, minimal air movement, and low light. Especially for sprays, these conditions slow evaporation of PGR solution from the leaves. Apply on cloudy days.

The rate of PGR to use depends on a number of factors. High PGR rates would be used when growing temperature, light, and vigor of plant are high, spacing is close, application is late, or when other ways of reducing growth (e.g., DIF, DIP, low P,) are in use. Low rates would be used when opposite conditions are true. Other factors like fertility level, EC, and irrigation practices may affect the choice of a PGR rate. If one of these factors encourages growth more PGR may be needed or if one of these factors causes plant stress or in some manner holds back plant growth a lower PGR rate would be best.

Normally PGRs are applied early in the growth of bedding plants and seedlings. Timing is related to stage of plant development and not weeks from seeding or transplanting. Timing can be fairly specific for some species and the product label or other reference should be checked. In general plugs are treated when they have developed their first set of true leaves. Young plants are generally treated after transplanting when they begin to grow or when they are 2" tall or 2" wide.

PGRs must be applied uniformly to result in uniform inhibition to plant growth. For bedding plants in cell packs, PGRs are applied by foliar spray application at low rates; drench application is mostly used for bedding plants in pots and hanging baskets.

### **Success with Spray Applications**

- Always apply sprays to recently watered plants.
- Don't use a wetting agent unless recommended to by the label.
- Don't water from overhead until the PGR dries.
- The most uniform response results from multiple applications at low rates.
- Apply sprays at a consistent volume per 100 ft<sup>2</sup> based on product label (2-3 qt.).

### **Success with Drench Applications**

- Plants with good root systems and no water stress are best for drenching. A poor root system may limit the uptake of chemical.
- Apply a consistent volume of drench to each pot based on diameter and product label instructions. Drench solution should be applied so each plant is treated equally and the resulting growth inhibition will be the same.
- Drenches should be applied uniformly to the surface to evenly moisten the medium. Drench volume depends on size of pot (see product label or NE Guide).
- Uniform drench application is most important for large containers for multiple plants.

### **PGRs and Mixed Containers**

PGR use is a special challenge when containers contain multiple plants with different levels of vigor. Prior to planting treat plug trays with a liner dip lasting 5 to 30 minutes to allow the plugs to absorb the chemical. For the liner dip the best chemicals are those which can be applied by drench. Spray treatments can be done two different ways: plant the variety to be treated in the final container, spray, and later plant the untreated species in the final container or grow the species to be treated in small pots, spray, and then add to the final container

closer to finish. Recommended liner dips are Bonzi at 4-16 ppm, Sumagic at 2-8 ppm, or Topflor at 3-12 ppm.

### **“Holding” Plants in Spring Prior to Sale**

Great spring weather can cause some plants to grow too well. PGRs can't make tall plants short, only cutting back can, but PGRs can be used to "hold" the plants. The best way is to apply PGR foliar sprays, rather than a drench, because sprays have a shorter residual life. Apply these sprays at the high end of the normal concentration range. Do not drench or use excessive spray rates; the risk is that the growth suppression will carry over into the landscape. Do not use Cycocel because of the risk of phytotoxicity.

### **Correcting Overapplication of a PGR**

Causes of PGR overdose include excess rate, mistakes in preparation, or overspray. Of course, careful application of antigibberellin PGRs at the start is the best way of avoiding overdose. However, overdosed plants will begin to grow when sprays of gibberellin-containing PGRs like Fascination and ProGibb are applied. Use low concentrations of Fascination at 2-5 ppm or ProGibb 4% at 1-2 ppm weekly until growth stimulation is satisfactory. Be careful, higher rates of gibberellins may stimulate growth so much that the final quality of the plants will be reduced to the same degree as plants overdosed with antigibberellin PGRs alone.

### **References**

2017-2018 New England Greenhouse Floriculture Guide. New England Floriculture, Inc.

Michigan State Univ. Plant Growth Regulator Website. [flor.hrt.msu.edu/PGRs/](http://flor.hrt.msu.edu/PGRs/)