e-GRO Alert

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PGRs: Where to Start

Many greenhouse growers regularly use plant growth regulators or retardants (PGRs) to elicit desirable crop responses. Those new to using PGRs should consider their goals and several factors prior to making applications.

The MSU Extension floriculture team was visiting growers during week 14 (first week of April) and many growers were applying plant growth regulators/retardants (PGRs). Many were applying PGRs to prevent excessive elongation because of a recent string of cold, cloudy weather. Growers benefited from the relatively sunny and record-breaking warmth of February, which pushed growth of plants in the greenhouse, but that was followed by a series of cool, cloudy days in March and early April that prevented shipping and caused leggy growth.

Photo 1. Aggressive varieties may require several PGR applications to maintain quality and be proportional to their container sizes. Photo: Heidi Lindberg

These contrasting weather conditions make it challenging to keep plants on track for their desired finished heights. Greenhouse growers can apply one kind of PGRs, plant growth retardants, to aggressive varieties to prevent crops from being overgrown or unwieldy in their containers (Photo 1).

Recently, a grower asked, "I have never used PGRs, where do I even begin?" While there is a lot of information on PGRs for floriculture crops, it can be overwhelming to a grower who has never worked with them. Dr. Joyce Latimer (Virginia Tech) and Dr. Brian Whipker (North Carolina State University) developed an excellent resource, "Selecting and Using Plant Growth Regulators on Floriculture Crops" that provides an outstanding explanation of the types of PGRs used and their purpose in production. Let's go through some commonly asked PGR questions:

What are PGRs?

Plant growth regulators are chemicals that affect various growth processes of plants. These chemicals influence the synthesis of natural plant hormones or are direct forms of the hormones themselves. Plant growth retardants are a specific type of PGR that inhibit extension growth and subsequent plant height. There are other types of PGRs called plant growth regulators that elicit other growth responses including the promotion of extension growth when plants are too short due to an over-application of a PGR, greater branching, promotion of flower buds, or flower abortion. Considering the diversity of plant responses to PGRs, it's important to make sure an appropriate product is selected for the desired crop response.

Why use PGRs?

PGRs are used to influence plant growth to achieve desirable responses. Most commonly, plant growth retardants are used to prevent plants from getting too large for their containers (Photo 2). A standard goal is to have a plant that is 2 to 2.5 times the size of its container. Plants that are not proportional to their containers may be less attractive, more difficult to handle, or not accepted by a buyer. In addition, shipping plants that are too tall or gangly to retailers is messy and expensive, since fewer plants can fit on shipping carts or boxes. In contrast, plants that are stunted from an over-application of a PGR are not marketable (Photo 3).

Photo 2. Asiatic lily that was too tall for its container would have benefited from an application of a plant growth retardant. Photo: Heidi Lindberg

How do PGRs work?

PGRs either influence or elicit plant hormone responses in plants. To understand how PGRs work, you need to understand the general effects plant hormones have on plants:

- **Auxins** (IAA or IBA; promotion of apical dominance, adventitious rooting)
- **Gibberellins** (GA; stimulate cell division and elongation, break dormancy, speed germination)
- **Cytokinins** (BA; stimulate cell division, delay senescence, promote root growth)
- **Ethylene** (flower aging and drop (senescence), fruit ripening)
- **Abscisic acid** (ABA; inhibits plant growth, stress response/survival)

The most common PGRs used on ornamental crops utilize synthetic gibberellins (GA), cytokinins, and ethylene or inhibit the synthesis of GA.

Photo 3. Stunted oriental lily from an over-application of a plant growth retardant. Photo: Roberto Lopez

What product and rate should I apply?

Before choosing a PGR product, growers should understand the intended purpose of each PGR. The most common reason for using a PGR is that the crop is growing taller than expected and/or is outgrowing its container size. Table 1 reviews common goals of using PGRs, the category of PGR needed, how the PGR works, and example products in that category.

Table 1. Goals, types of PGRs and how they work, and example products to accomplish those goals. Synthesized and adapted from "Selecting and Using Plant Growth Regulators for Floriculture Crops" from Latimer and Whipker, 2019.

Goal	Type of PGR Needed	How it Works	Example Products
Inhibit elongation and regulate shoot growth to make plants more compact	Growth retardant	Inhibits production of gibberellins	Ancymidol (Abide or A-Rest) Daminozide (B-Nine or Dazide) Chlormequat chloride (Citadel or Altercel) Flurprimidol (Topflor) Paclobutrazol (Bonzi, Piccolo, or Pac O) Uniconazole (Concise or Sumagic)
Increase branching for fuller plants	Branching agent	Inhibit growth of terminal shoot and increase lateral branching	Ethephon (Collate, Florel) Benzyladenine (BA, Configure) Dikegulac sodium (Atrimmec) Methyl esters (Off-Shoot-O)
Abort flowers on stock plants, plugs and liners	Ethylene-generative compound	Develops into ethylene (responsible for flower senescence)	Ethephon (Collate, Florel)
Reduce lower-leaf yellowing on select crops (e.g., lilies and geraniums)	Gibberellin and cytokinin products	Delays leaf senescence	Benzyladenine and Gibberellins (Fascination or Fresco)
Increase leaf/stem elongation or promote growth of plants after growth retardant overdose	Gibberellin and cytokinin products	Promotes extension growth and increases plant height	Benzyladenine and Gibberellins (Fascination or Fresco)

First, growers new to PGRs should choose products that can accomplish their goals. Factors to consider include the plant species, desired growth response(s), duration of desired response, influence of environmental and cultural conditions, and time until shipping/sale. Some PGRs are more potent than others: a grower new to using PGRs may want to choose those that have a shorter lasting effect. Success with PGRs provides a list of PGRs in order of increasing activity or potency. For example, daminozide (B-Nine or Dazide) may be a good option for a new grower since it has relatively low activity, is applied as a foliar spray (has a shorter longevity), and rarely over-regulates plants when using a labeled rate.

PGRs, and especially plant growth retardants, are usually applied as a foliar spray, substrate drench, or a combination of the two (known as a sprench). Both the concentration of the PGR solution and the volume applied are important for applications, since the total amount of active ingredient is what ultimately influences the magnitude of a response. Sprays usually have a shorter-lasting effect than drenches. Be sure to apply the label-recommended volumes for each PGR; too little will not achieve the desired outcome and too much will have too strong of an effect.

Environmental conditions also influence the choice of product applied and its rate. Crops grown cool (winter and early spring) generally need lower concentrations and/or less potent products than ones grown at higher temperatures (late spring and summer).

When determining the rates of products to use, consult breeder culture sheets of specific varieties, the Ball Redbook Crop Production Handbook, the 2023-2024 PGR Guide for Annual Crops, or the 2024-2025 PGR Guide for Perennials (Photo 4). Also consider asking other growers and the PGR manufacturers or distributors that provide customer support. Performing your own small-scale trials of PGR applications at different rates on your crops, excellent recordkeeping, and previous experience will help growers develop their own PGR program for the future.

For more information on PGR research that has been performed at Michigan State University, visit the MSU Floriculture resources website (https://www.canr.msu.edu/floriculture/resources), click on “Height Management of Ornamentals”, then click on “Articles”.

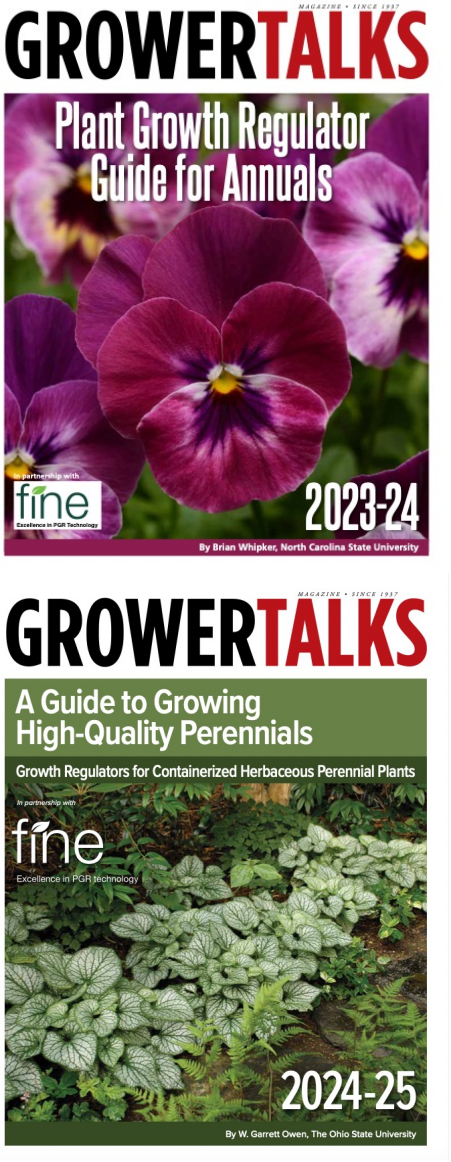

Photo 4. PGR Guides for Annual and Perennial Crops.

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