Considerations for the grower when using plant growth regulators

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Plant growth regulators (PGR's) are chemical compounds which alter plant growth and development through hormonal action. Plant growth regulators can be used to increase or retard plant height, prolong or break dormancy, or to promote rooting, branching and/or flowering.

Plant growth regulators represent just one part of a complete crop management system. Optimal crop performance is best achieved with a program of sound cultural practices in a carefully controlled environment. A growth regulator should be used to induce specific crop responses (i.e. reduce height or induce branching) which cannot be achieved through normal crop management. However, growth regulators are not a substitute for proper crop culture and accurate environmental control.

Any factor that affects the rate and quality of plant growth and development will influence the response of a plant to a plant growth regulator. All factors should be considered in a production system. For most PGR's the recommended dosage to be used for a crop will be presented as a range of values. The decision to work at the top or the bottom of a dosage range must be made by each individual grower. Growers must consider all of the factors affecting plant response to PGR's relative to the conditions in their own greenhouses.

Factors influencing plant response to chemical PGR's can be separated into three groups: **Plant Factors** which include (a) cultivar or variety, (b) physiological stage of plant development, (c) plant status, (d) plant size; **Environmental Factors** which include (a) weather (light and temperature), (b) medium composition, (c) water quality, (d) crop nutrition; and **Physical and Chemical Factors** which include (a) residual chemical effects (b) spray droplet size, (c) spray coverage. A brief discussion of each of these factors follows.

Cultivars vary greatly in growth habit, chemical and environmental sensitivity. Selecting the proper cultivar is the most important step in limiting the use of PGR's and in achieving satisfactory results. For example use genetic dwarfs, less vigorous, slow growing or naturally compact plants in lieu of chemicals if height control is important; use free branching cultivars if this growth habit is most desirable. Avoid using sensitive cultivars when possible (those which are easily injured by the chemical being applied) or use the low rate of the recommended range if a sensitive variety is used. Information on plant growth habit is available from plant producers and distributors. Additional information, not available through these channels, must be obtained by individual growers on a "try and see" basis.

The physiological stage of development refers to the actual amount of growth and development which has occured. Bud diameter, lateral shoot length, number of leaves and plant diameter all refer to physiological stages of development. Two weeks after transplant or pinch are not physiological measures of development. The rate of physiological development will be more rapid for vigorous cultivars grown under warm conditions with high light than for less vigorous cultivars produced under cool, darker growing conditions over the same period of time. Chemicals should be applied at the stage of development specified on the label. If the stage of physiological development is not specified, it is important for the grower to keep records to aid in future decision making. Plants treated too early in development or too late in development may not response properly. Stunting, damage or a total lack of control can result.

Plant status refers to the physical condition of a plant. Often this term is used in conjunction with water stress, i.e. wilted or nonwilted plants. Wilted leaves do not readily absorb chemicals applied as a spray. Applying growth regulators to wilted or soon-to-be-wilted plants will make uniform chemical control difficult. Irrigate plants prior to spraying. Only apply PGRs to turgid plants

Plant size. Simply put, larger plants require more chemical than smaller plants. To achieve the same level of control, a plant in a 6" pot will require more drench or spray than the same cultivar in a 4" pot produced under similar conditions.

The light and temperature environment directly affects chemical absorption immediately following a spray and also affects the long-term plant response to a PGR. Light/temperature conditions (weather) which favor the rapid drying of spray droplets on leaves will decrease chemical effectiveness. Less chemical will be absorbed. Apply chemicals during cloudy weather or pull shade cloth when spraying to maximize chemical uptake. Long-term cropping under high temperature/high light conditions will favor increased growth rates. Higher quantities of PGR are required and the plants will tend to metabolize or outgrow the PGR sooner. High temperature/low light conditions will increase stem elongation or stretch and produce poor plant quality. Using a growth retardant to overcome this problem is a good example of attempting to substitute chemical control for good management.

Growing medium composition directly affects the efficacy of certain medium drench applied growth retardants. The effectiveness of A-rest (ancymidol) rapidly decreases as the pine bark component of a medium increases above 25%. Indirectly growing medium composition influences plant response to PGRs by affecting plant vigor. Plants growing in poorly formulated or inappropriate media which reduce, retard or stunt growth will be especially sensitive to PGRs. The slower the rate of growth, the more severe the effect of the PGR will be and the longer the plant will take to resume normal growth.

Poor water quality (i.e. pH over 7 combined with high alkalinity–over 100 ppm calcium carbonate equivalents) may reduce the effectiveness of Florel.

Crop nutrition (rate of fertilization), along with tightly-controlled irrigation practices, has long been used to control crop growth and development. Crops produced with nutritional levels favoring maximum growth will require more PGR and will require less time to outgrow the chemical effects. Conversely, crops hardened by limited water and fertility may require little or no chemical control.

Residual chemical effect refers to the length of time a PGR remains active in the plant after application. With chemicals applied as drenches, residual chemical activity in the medium is also of concern. In general, chemicals such as B-Nine and cycocel lose most of their activity in 1 to 2 weeks. Bonzi, A-rest and sumagic will remain active considerably longer (3-4 weeks). The exact length of time a chemical remains active will depend on environmental and plant factors previously dis

cussed. Chemicals such as Bonzi which have low solubilities in water and which are very active at low concentrations, can remain active in the growing medium for periods ranging from several months to years.

Spray droplet size affects the coverage and penetration achieved with a chemical. The smaller the droplet size the greater the coverage (more drops per square inch of leaf surface) and the greater the effect of the chemical applied. However, extremely small drops (fog for example) produce greater drift, take a long time to settle (hours) and require air circulation to achieve good penetration.

Crop coverage refers to the volume of spray material applied per square foot of bench space. Crop coverage is critical. Be consistent. By varying chemical concentration, plant spacing and volume of delivery or coverage, a grower loses all means of comparison from crop to crop. Apply one gallon of solution per 200 square feet of bench space. Bigger plants, by virtue of greater leaf surface areas, will receive more total chemical than smaller plants.

All or most of these factors interact, making potential effects difficult to predict. Adequate recommendations do not always exist, and label recommendtions fail to address many of these important considerations. As a result, **the burden of testing cultivar/crop response to PGR treatments is on the grower.** Individual growers must evaluate the response under their own unique conditions. **Growers need to keep accurate records** and test plants on a limited basis in order to gain experience and assess the factors which most influence crop response in their greenhouse. Keep a record of each of the factors previously discussed. Simple techniques, such as recording weekly changes in plant height relative to a ruler or stake permanently placed in a pot, will help the grower accurately gauge crop response to a PGR application over time.