Plant Growth Regulators: Potential Uses in the Nursery Industry

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INTRODUCTION

Plant growth regulators (PGRs) are chemical compounds which alter plant growth and development through hormonal action and are annually used on over 2.5 million acres worldwide on a diversity of crops (Thomas, 1982). Most applications of PGRs are to high-value horticultural crops to enhance crop quality or aid in more efficient crop management (Gianfagna, 1987). Specific uses of PGRs on floricultural crops include: promotion and retardation of growth, promotion of flower initiation and development, inhibition or promotion of flower and/or foliage abscission, and enhancement of lateral shoot development (Larson, 1985). While PGRs are used less extensively in the nursery industry (except for auxins, which increase root development in the propagation of cuttings), greater potential benefits may occur with their wider use. Possible uses in the nursery industry include: growth suppression to produce a plant form for a given market or to reduce the frequency of pruning, and enhanced branching to improve plant quality or propagation material. Potential exists for greater use of PGRs in the landscape to reduce growth rates and/or improve plant quality.

CAUTIONS

On numerous occasions growers have asked me to recommend PGRs for specific situations that were better addressed through sound cultural practices. PGRs are not a substitute for proper crop culture and accurate environmental control. On other occasions growers and I have experienced seemingly inconsistent results when using PGRs. It should be understood that any factor that affects the rate and quality of plant growth and development will potentially influence a plant's response to a PGR. McAvoy (1989) has written an excellent article discussing these factors which are summarized below:

I. Plant factors.
- Cultivar.
- Physiological stage of plant development.
- Plant status (physical condition of plant).
- Plant size.

II. Environmental factors.
- Light and temperature.
- Growing medium.
- Water quality.
- Crop nutrition.

III. Physical and chemical factors.
- Residual chemical effect.
- Spray droplet size.
- Crop coverage.

Over the past 9 years I have conducted extensive research with PGRs. Some of this work is summarized below. Due to space constraints, generalizations occasionally are made; however, a more detailed discussion is given in the referenced articles.

GROWTH INHIBITION

Bonzi (paclobutrazol) was tested on several container-grown nursery crops in a 72-week study. The magnitude of growth inhibition was directly correlated with application rate. Spray application appears to have more potential uses in the nursery due to less chemical persistence compared to drenches. The values which follow the species listed below are: rates that suppressed shoot growth and minimum time period of growth suppression. Species include: *Euonymus japonicus* 'Microphyllus' (Japanese euonymus)—1000 to 2000 ppm, 17 weeks; *Ilex cornuta* 'Dwarf Burford' (dwarf Burford holly)—250 to 1000 ppm, 72 weeks; *I. crenata* 'Compacta' (compacta Japanese holly)—500 to 2000 ppm, 72 weeks; *Juniperus conferta* 'Blue Pacific' (shore juniper)—1000 to 2000 ppm, 17 weeks; *Photinia* ×*fraseri* (photinia)—250 to 2000 ppm, 72 weeks; *Rhododendron* 'Hino-crimson' (Hino Crimson azalea)—50 to 2000 ppm, 72 weeks; *R.* 'Formosa' (Formosa azalea) and *Ligustrum japonicum* 'Aureo-marginatum' (Japanese privet)—250 to 2000 ppm, 72 weeks (Keever et al., 1990).

Sumagic (uniconazole) on container-grown *Camellia sasanqua* 'Shishi Gashira' (sasanqua camellia): shoot growth was either unaffected or was inhibited by single foliar sprays, while flower number was increased. A 5 ppm spray increased flower number 53% without affecting plant size, while a 20 ppm spray increased flower number 113% but reduced plant size by 21% (Keever and McGuire, 1991).

Sumagic on *Elaeagnus pungens* 'Fruitlandii' (thorny eleagnus): 500 to 1500 ppm foliar sprays were ineffective on established, field-grown plants; 15 to 45 mg a.i.per plant drenches suppressed growth for at least two seasons. Reduced pruning was needed to remove rank shoots (Keever and West, 1992).

Sumagic on ×*Cupressocyparis leylandii* (leyland cypress): 200 to 500 ppm foliar sprays or 5 to 15 mg a.i. per pot drenches provided short-term growth retardation in containerized plants. Neither sprays (500 to 1500 ppm) nor drenches (15 to 45 mg a.i. per plant) inhibited growth of established, field-grown plants (Keever and West, 1992).

Sumagic on *Trachelospermum asiaticum* (Asiatic jasmine): a single 75 to 200 ppm spray provided less than 6 weeks of shoot suppression; a 300 to 900 ppm spray provided season-long control.

Sumagic on *Gelsemium sempervirens* (Carolina jessamine): 150 to 900 ppm foliar spray suppressed shoot growth during the season of application; drenches of 1 to 20 mg a.i. per pot provided control for at least a year.

Sumagic on *Mandevilla* ×*amoena* 'Alice du Pont' (mandevilla): single 5 to 20 ppm spray applications controlled shoot elongation for 3 to 4 weeks; multiple 5-20 ppm sprays provided long-term control. Single 30-120 ppm sprays distorted foliage (Deneke et al., 1992).

Cutless (flurprimidol) on *Buddleja davidii* 'Royal Red' (butterfly-bush): a 62.5 ppm spray controlled shoot elongation for less than 120 days, while 125 to 250 ppm sprays provided longer control without affecting flowering. Sprays of 500 ppm or greater caused excessive shoot suppression and reduced inflorescence number and

size (Keever and Gilliam, 1994).

Cutless on *Ilex* China Girl® (China Girl holly): 500 ppm controlled growth during the season of application; 1000 ppm or greater inhibited growth for at least 2 growing seasons (Keever et al., 1994).

BRANCHING

Branching of the species listed below was increased by the foliar spray treatments of selected PGRs:

Ilex crenata 'Helleri' (Heller holly): 125 to 1000 ppm BA (Keever and Foster, 1990a).

Ilex vomitoria 'Stoke's Dwarf' (dwarf yaupon): 1000 ppm BA (Keever and Foster, 1990a).

Photinia ×fraseri (photinia): 1500 to 2500 ppm BA, 2000 to 5000 ppm Promalin (Keever and Foster, 1990a).

Nandina domestica 'Harbor Dwarf' (dwarf nandina): 1000 to 2500 ppm BA, 5000 ppm Promalin (Keever and Foster, 1990a); 50 to 200 ppm ASC-66952 (Keever, 1993).

Vinca minor (lesser periwinkle): 1000 ppm Promalin (Foley and Keever, 1993).

Pyrus calleryana 'Bradford' (Bradford pear): increased branching and wider crotch angles with 300 to 450 ppm BA or 600 to 900 ppm Promalin (Keever et al., 1993).

Hosta sieboldiana (blue hosta): enhanced offset formation with 2000 to 3000 ppm BA (Keever, 1994).

SPROUT CONTROL

Basal sprouts (basal shoot formation) of *Lagerstroemia* 'Natchez' and *L. indica* 'Country Red' (crapemyrtle) were controlled with 0.75 to 1.0% NAA (Tre-Hold). Minor height and shoot dry weight suppression occurred (Keever and Foster, 1990b).

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