



PGRs and Nutrition: Boilermaking Solutions

DISCOVER WAYS TO IMPROVE EFFICIENCY THROUGH PGR APPLICATION AND PLANT NUTRITION.

By Roberto G. Lopez and Christopher J. Currey

In addition to the greenhouse environment, crop culture including fertilizers, substrates, and plant growth regulators (PGRs), has a large impact on our ability to grow high-quality greenhouse crops. If properly managed, these three inputs can complement a well-managed greenhouse environment and produce great greenhouse crops. However, plant growth regulation and mineral nutrition are often moving targets within a production season and year-to-year.

Plant Growth Regulators

Ask any grower what their major challenge was this spring and the answer will more than likely be plant growth regulation. We are all familiar with chemical PGRs and understand that our success or failure with using them can be attributed to many environmental and cultural issues. For example, did you know that your water quality (pH and alkalinity), fertilizer, or the components in your growing mix could influence the concentration and number of PGR applications you have to make? Research funded by Fine Americas, OHP, SePRO, Syngenta, USDA IR-4 and Valent USA at Purdue University is helping growers become more successful with PGRs as we evaluate new chemicals, commercial uses, application methods, formulations, and determine optimal concentrations for labeling.

Comparing PGRs with the Same Active Ingredient

Have you seen the list of PGRs with the same active ingredient (a.i) grow in recent years? One may ask: Are there any differences in the response between PGRs

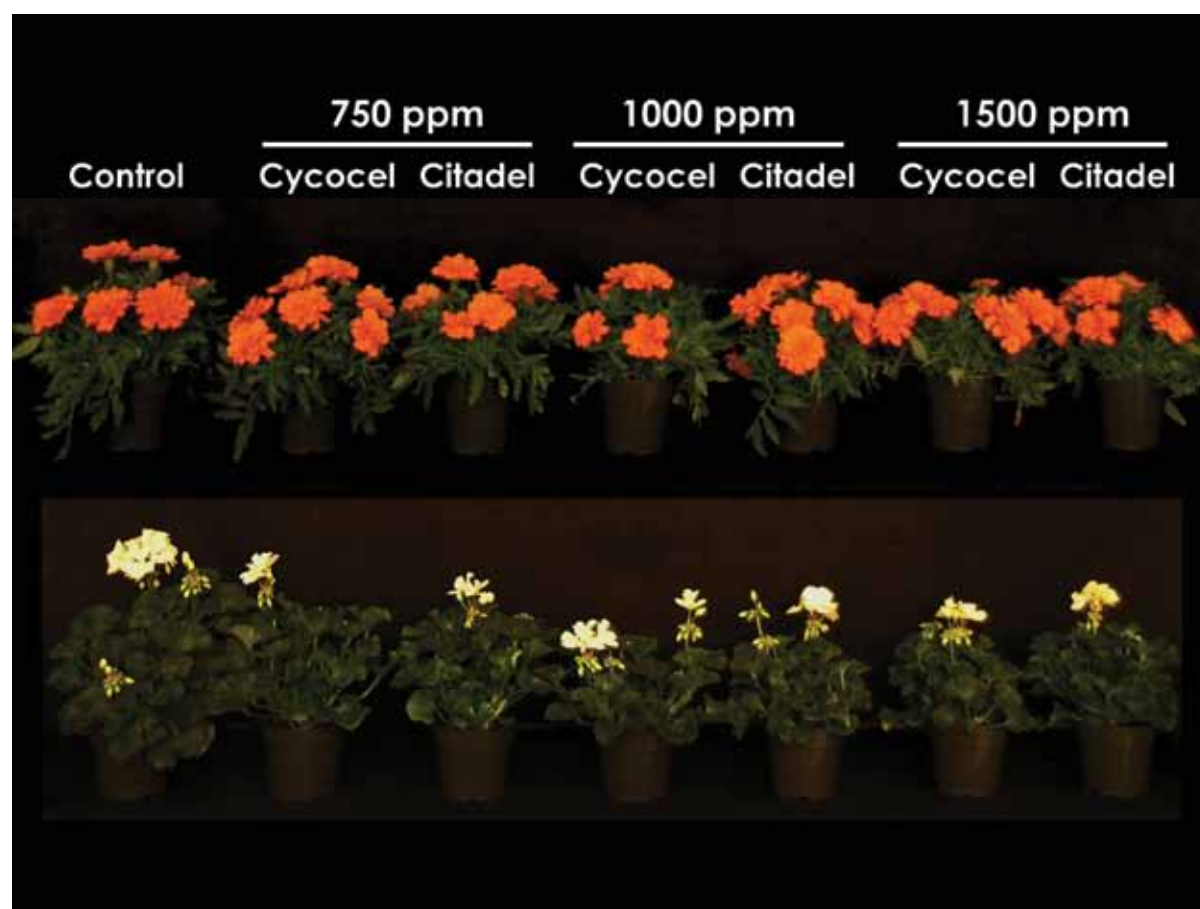


Figure 1. 'Durango Tangerine' marigold (top) and 'Merisnow' geranium (bottom) five weeks after being sprayed with Citadel or Cycocel (both chlormequat chloride) at 750, 1,000, or 1,500 ppm or left untreated (control).

with the same active ingredient? To address this question, we have performed numerous experiments and for nearly all species tested, there were no statistical differences in growth retardation between chemicals with the same active ingredient. For example, height

of 'Durango Tangerine' marigold and 'Merisnow' geranium five weeks after a spray application of 750-, 1,000- or 1500-ppm Cycocel or Citadel (both chlormequat chloride products) were similar (Figure 1). Therefore, when comparing products with the same

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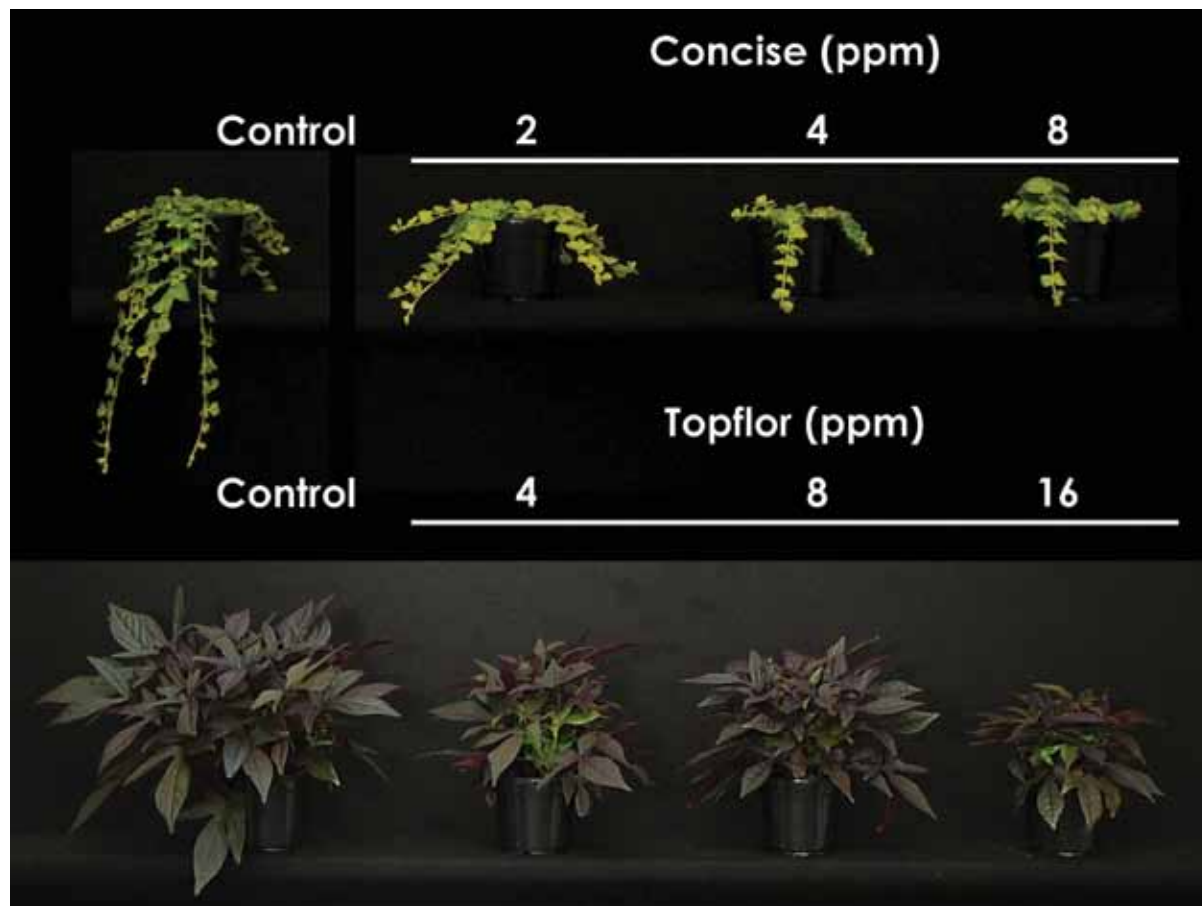


Figure 2. 'Goldilocks' lysimachia (top) and 'Black Falls' sweet potato vine (bottom) six weeks after liners were dipped in solutions containing 2, 4, or 8 ppm uniconazole (Concise) or 4, 8 or 16 ppm flurprimidol (Topflor), respectively, for two minutes preceding planting or left untreated (control).

active ingredient, the decision on which PGR to choose should be based on other considerations such as comprehensiveness of the product label, customer support, company investment in research and development, and product cost.

Controlling Stem Elongation of Foliage Annuals with Liner Dips

Dipping trays of rooted liners and plugs into a PGR solution, or liner dip, is a newer method of efficiently applying root-absorbed PGRs that controls stem elongation after transplanting. The use of liner dips allows growers to efficiently apply the required PGRs to a large number of plants. It can also give growers the ability to treat individual plants with the PGR they need before combining them with other species or cultivars in a mixed container or basket. In our study, liners of foliage annuals were dipped into trays filled with solutions containing 8-, 16-, or 32-ppm ancymidol (Abide); 4-, 8-, or 16-ppm flurprimidol (Topflor); 4-, 8-, or 16-ppm paclobutrazol (Picololo); or 2-, 4-, or 8-ppm uniconazole (Concise); or deionized water (untreated control) for two minutes. We found that all PGR dips, at different concentrations, were effective for controlling stem length of 'Goldilocks' lysimachia and 'Black Falls' sweet potato vine (Figure 2).

Parboiled Rice Hulls and PGR Drenches

Research has shown that when bark, either fresh or composted, is included as a substrate component, it can reduce the efficacy of PGR drenches. However, the recent rise in popularity of rice hulls raised a question — do parboiled rice hulls affect the efficacy of PGR drenches? When we applied a 0.5-ppm substrate drench of paclobutrazol (Bonzi) to 'Delta Orange Blotch' pansy grown in 80 percent peat and either 20 percent perlite or 20 percent parboiled rice hulls, plants were 45 to 57 percent shorter, respectively, than the untreated control plants. However, when plants were grown in peat and bark and treated with 0.5 ppm Bonzi, they were only 22 percent shorter than untreated plants (Figure 3). As expected, the substrate containing bark reduced the efficacy of Bonzi and Concise drenches. However, there was no difference between stem length (calibrachoa) or plant height (pansy) between PGR treated plants grown in peat and perlite or peat and rice hull substrates.

Effect of Water pH and Alkalinity on Efficacy of PGRs

In recent years, we have heard that the efficacy

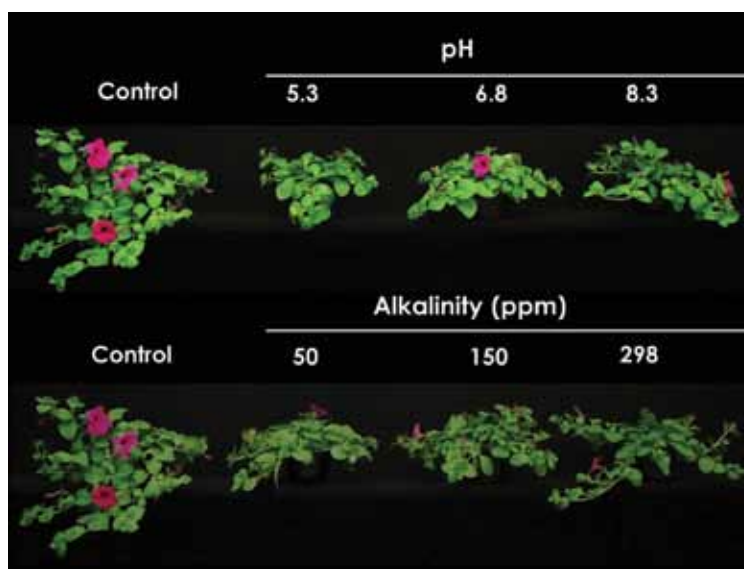
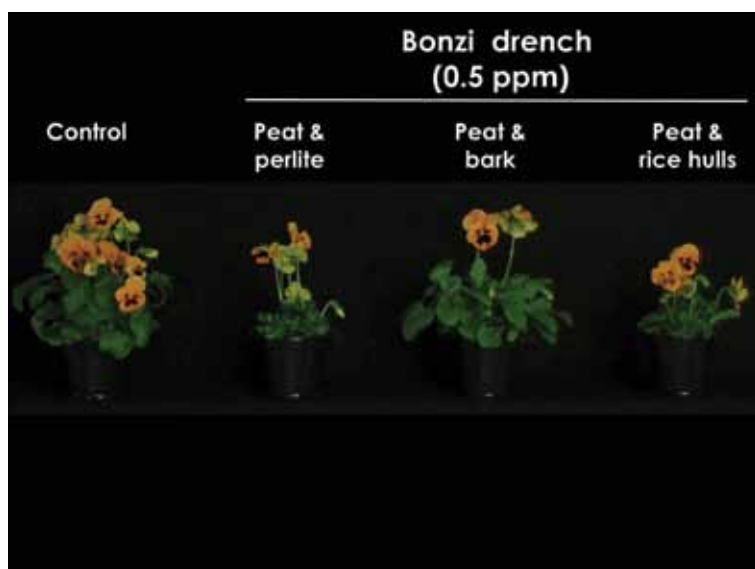


Figure 3. 'Delta Orange Blotch' pansy untreated and grown in a peat and perlite media (control) or grown in either: 1) peat and perlite; 2) peat, bark, perlite, and vermiculite; or 3) peat and rice hull media and treated with a 2.5 fl. oz. drench of 0.5 ppm paclobutrazol (Bonzi) solution.

Figure 4. 'Purple Wave' petunias sprayed with uni-conazole (Concise) solutions using water with varying pH (top) or alkalinity (bottom).

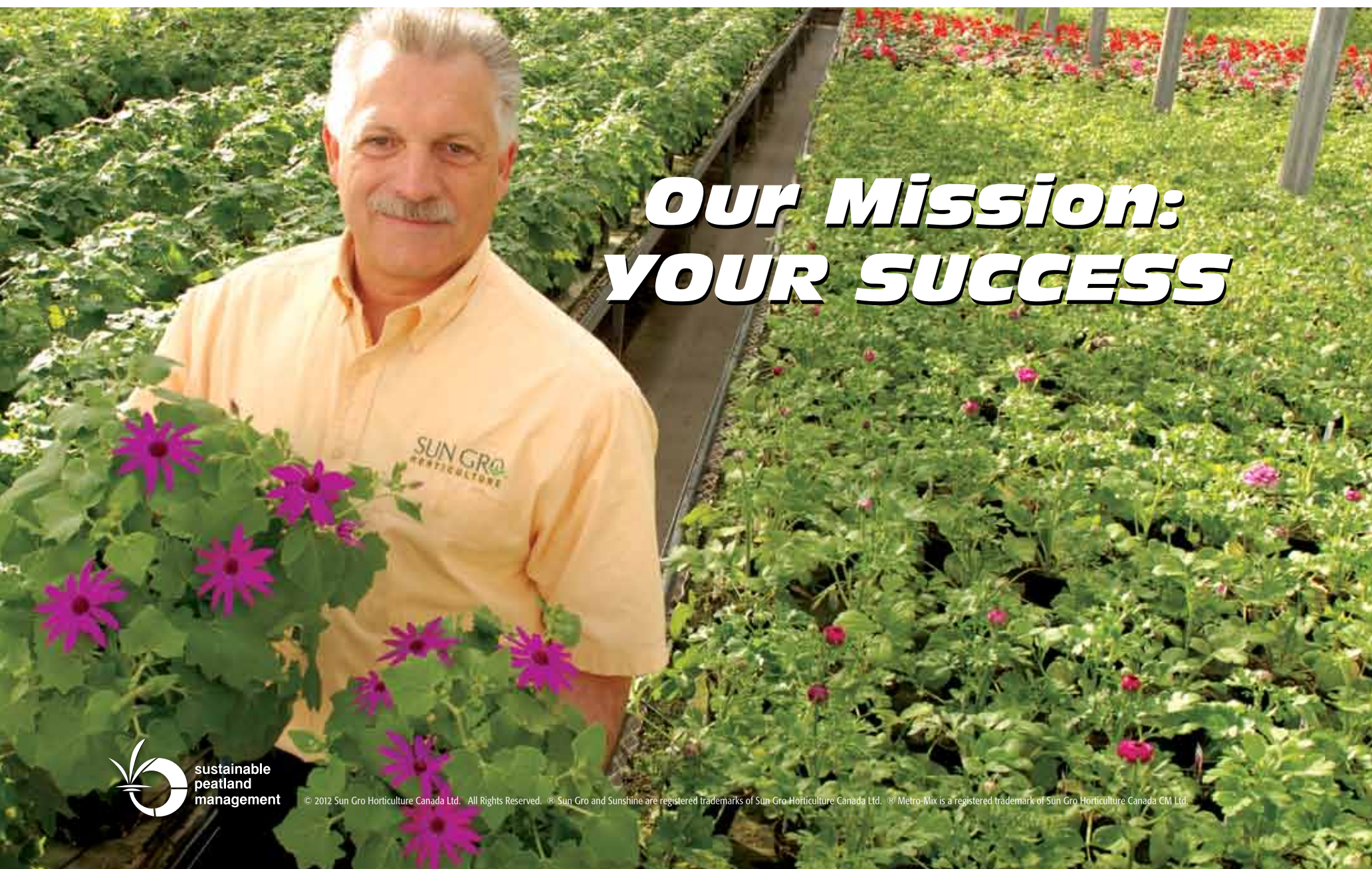
of herbicides and insecticides can be affected by the pH and/or alkalinity of the water used to make the solution. What about PGRs? We recently conducted an experiment to find out if the efficacy of Abide, 6-BA/GA₄₊₇ (Fresco), daminozide (B-Nine), and Concise was influenced by water alkalinity and pH. In Figure 4 we can see that Concise was effective in reducing stem elongation at all treatment rates as well as all pH and alkalinity levels

tested. However, it was most effective at the highest rate (40 ppm) when mixed in a water solution with the lowest alkalinity (50 ppm) or low pH (5.3). Additional experiments will be conducted to look at the effects of alkalinity and pH on other PGRs.

Lower Leaf Yellowing of Geranium

Most geranium cuttings propagated by U.S.

growers are harvested from plants grown in Mexico or Central America and shipped to the United States for rooting. However, geraniums are sensitive to ethylene generated during shipping, as well as carbohydrate depletion. This results in the yellowing and loss of lower leaves of geranium cuttings during propagation. Research at Purdue, along with Clemson, Michigan State and University of Florida, is looking at



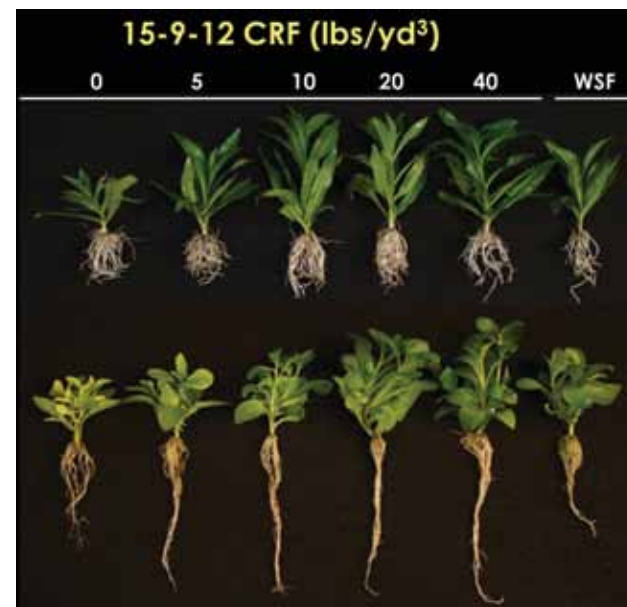
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Figure 5. Geraniums in propagation with no sprays (top) and geraniums propagated at the same greenhouse four years later with a 2.5 ppm GA₄₊₇ and BA (Fascination).



Figure 6. 'Sundancer Pink' angelonia (top) and 'Cascadia Marshmallow Pink' petunia (bottom) cuttings propagated in media containing 0, 5, 10, 20, or 40 pounds per cubic yard or under mist containing 50-ppm nitrogen from a water-soluble fertilizer (WSF).



remedying this problem. Applying a foliar spray containing gibberelins (GA₄₊₇) and a cytokinin (benzyladenine; BA) such as Fascination or Fresco can suppress the yellowing of older leaves, reducing the possibility of diseases as well as labor for “cleaning up” cuttings (Figure 5). As with potted Easter lilies, using a foliar spray containing GA and BA can improve the post-harvest

life of lower geranium leaves during propagation and subsequent production.

Controlled-Release Fertilizers During Propagation

During vegetative propagation, cuttings must replenish the mineral nutrient levels that are diminished as roots are developing.

Therefore, many growers use water-soluble fertilizers (WSF) applied through the mist. However, the potential for leaching and runoff is very high during propagation since mist is frequently applied to maintain cuttings. We thought that using controlled-release fertilizers (CRF) would provide an alternative method to fertilize cuttings. Although all cuttings

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had satisfactory root growth, shoot growth improved with CRF fertilization (Figure 6). Furthermore, tissue nutrient concentration levels


increased to adequate levels using 10 pounds of CRF per cubic yard or more. Though this may seem like a high rate, the cost of CRF for

a standard 105-cell tray is less than a dime. While we are conducting further studies, it appears CRF may be an acceptable way to deliver mineral nutrients to cuttings while potentially reducing loss of nutrients through leaching and runoff.

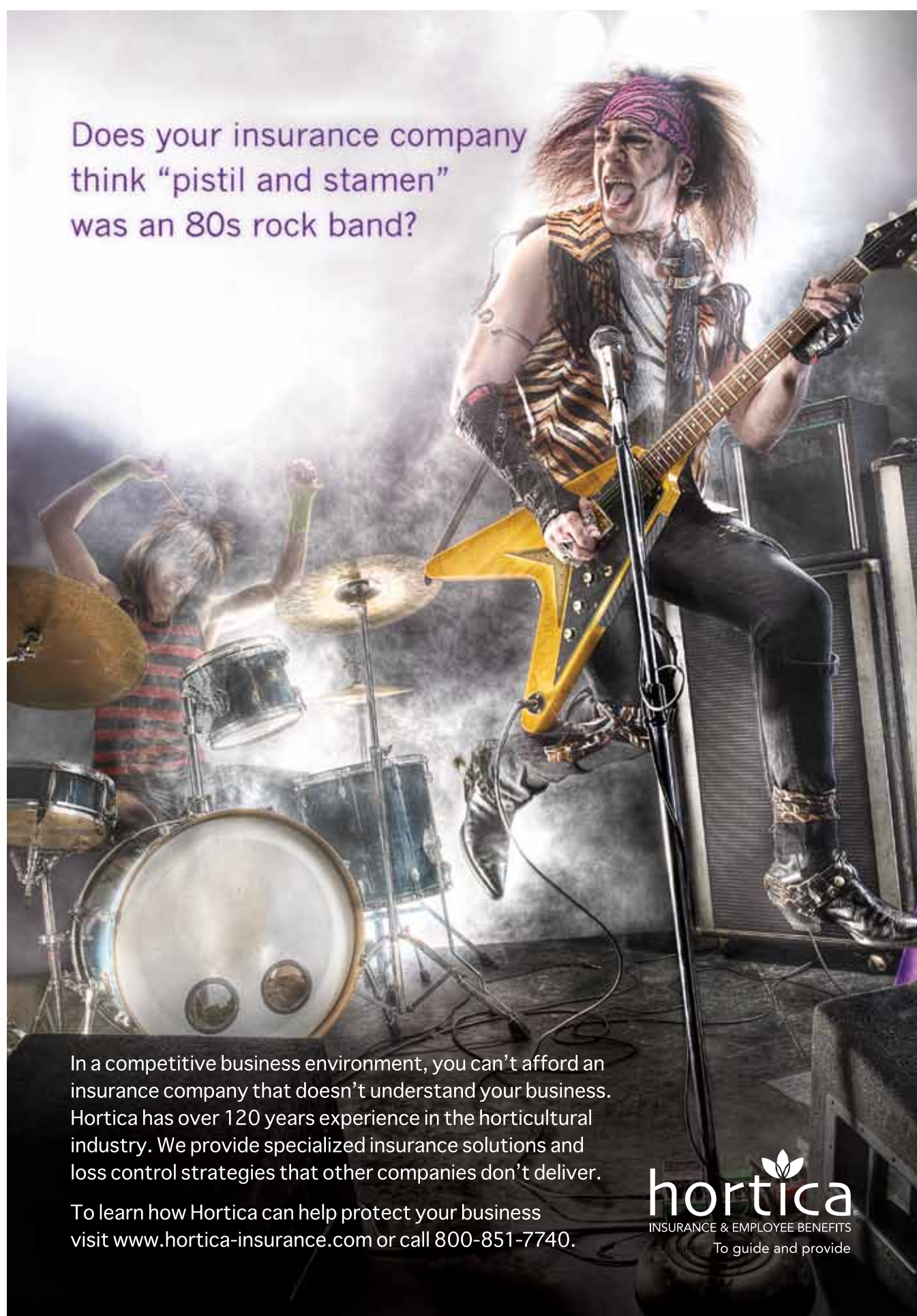
Controlled-Release Fertilizers During Finishing

CRFs have been largely adopted by the nursery industry, but they have their place in the greenhouse too. Have you considered using CRFs, but feel you're giving up control to a fertilizer prill? Research at Purdue, Cornell and University of New Hampshire is finding that proper use of CRFs can lead to more efficient fertilization, less nutrient leaching, and reduced need for PGRs. At the OFA Short Course, we'll cover suggested rates, what to do when you have high alkalinity and which crops work best with CRFs as well as their effect on root-zone pH and EC.

The Future

As oil prices increase, the costs of inputs such as PGRs and fertilizers will undoubtedly increase. Therefore, the goal of the Floriculture and Ornamentals group at Purdue University is to find research-based solutions that increase the efficiency of inputs and profitability of greenhouse producers. Whether at Purdue or another land grant university, the importance of industry, association, and grower support of floriculture research programs is more important than ever and no donation is too small. 

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