Painted-Pot Technology:

A Novel Method of PGR and Pesticide Application

By Steve Nameth
and Claudio Pasian

One of these days, you could be purchasing pots pre-treated with all the PGRs and pesticides you need to grow quality plants while causing less harm to the environment.

Managing plant height, insects and mites, and the many diseases that affect greenhouse-grown bedding and potted plants are some of the many challenges that face today's growers. Most pest and plant growth problems are controlled by using a variety of methods, both cultural and chemical. Some insects and diseases respond very well to cultural controls, and in these cases, minimal or no chemicals need to be applied. However, plant growth is commonly regulated with the application of chemical-based plant growth regulators (PGRs). Even though today's grower takes a more integrated approach to controlling problems by employing a combination of cultural, biological and chemical controls to produce a high-quality product, the use of chemicals for greenhouse bedding plants, potted flowering plants and perennial production is still necessary. Though vital to successful production, most growers are aware they need to reduce the amount of chemical pesticides and PGRs that are applied to their crop. Less chemical equals less expense and less "headache." The issue of pesticide-breakdown products and where those products will eventually end up after they leave the greenhouse is something more and more growers have to address. In the very near future, growers will have to know exactly how much pesticide they have applied to their crops, as well as how much of the active ingredient is leaving the greenhouse through the drainage system. Whether the product eventually ends up in the grower's catch basin or the city sewer system, this information will need to be known. Too much runoff of a particular product could result in a fine or some other type of penalty.

Because of this, growers are going to have to pay closer attention to the amounts of pesticides and PGRs they apply to their crops. The less they use, the better. However, it's not that simple. The grower will have to balance using less product with the reality of

Top: Chrysanthemums treated with paclobutrazol incorporated into paint (100-200 ppm), no treatment, paint only and a standard drench; Bottom: Poinsettia treated with paclobutrazol incorporated into paint (100-200 ppm), no treatment and as a standard drench. (All photos courtesy of Steve Nameth) reduced disease and insect control and plant quality. For this reason, the development of novel methods of pesticide delivery that will achieve the same degree of disease, insect and mite control, and plant growth quality is being explored by university researchers worldwide.

This article will address some of the latest research concerning the use of painted-pot technology as a novel method of delivering PGRs, insecticides and fungicides to greenhouse potted crops.

PLANT GROWTH REGULATORS

In 1998, Drs. Claudio Pasian and Daniel Struve, The Ohio State University, published a paper in the journal *PGRSA Quarterly* entitled, "Paclobutrazol/Paint-Treated Containers Control *Dendranthema grandiflora* (Ramat) Height." Mum plants were grown in containers in which the interior surfaces were covered with a mixture of flat latex paint and a variety of PGR concentrations. The concentrations of paclobutrazol used were 0, 5, 10, 20, 40, 80, 100, 150, 160 and 200 mg/L of solution. These concentrations represented 0, 0.015, 0.03, 0.06, 0.12, 0.24, 0.3, 0.45, 0.48 and 0.6 mg of active ingredient per container. The growth of the mums in the painted pots was compared to those that received a standard drench of 0.24 mg of active ingredient (as per label instructions).

Results of this study showed that this method of application was just as effective as a traditional drench application in controlling plant height. In a follow-up paper, Dr. Pasian looked at how paint/paclobutrazol-coated containers controlled poinsettia growth. As with the mums, a highly significant linear relationship between the PGR/paint dosage and poinsettia plant height was observed. Both of these studies indicate the potential to use paint/PGR as a novel method of PGR delivery.

INSECTICIDES

In 1997, Drs. Pasian, Lindquist and Struve published ground-breaking research in the journal *HorTechnology*. In this paper, "A New Method of Applying Imidacloprid to Potted Plants for Controlling Aphids and Whiteflies," the researchers described the effectiveness of two application methods of this insecticide in controlling the melon aphid on mums and whiteflies on poinsettias. Like the other experiments, plants were grown in containers with their interior covered with a mixture of flat latex paint plus several concentrations of the insecticide (0, 10, 21, 42 and 88 mg/L) or treated with a granular ➧

Figure 1. Imidacloprid effect on aphid populations on mums; untreated control, paint application (0.03 mg active ingredient, 0.26 mg active ingredient) and standard granular application (10 mg active ingredient).

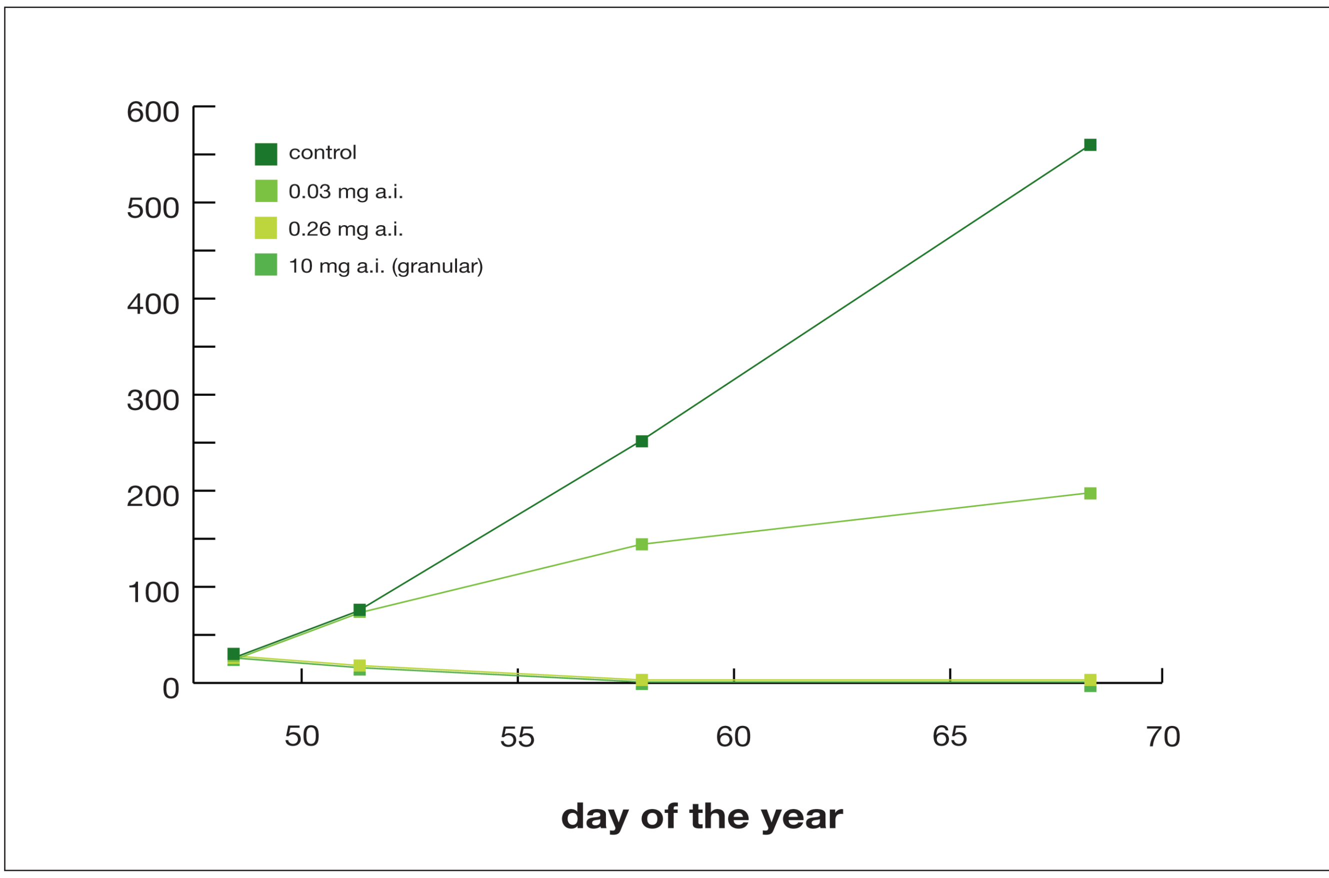

Figure 2. Imidacloprid effect on whitefly populations on poinsettia; untreated control, paint application (0.07 mg active ingredient, 0.27 mg active ingredient) and standard granular application (5 mg active ingredient).

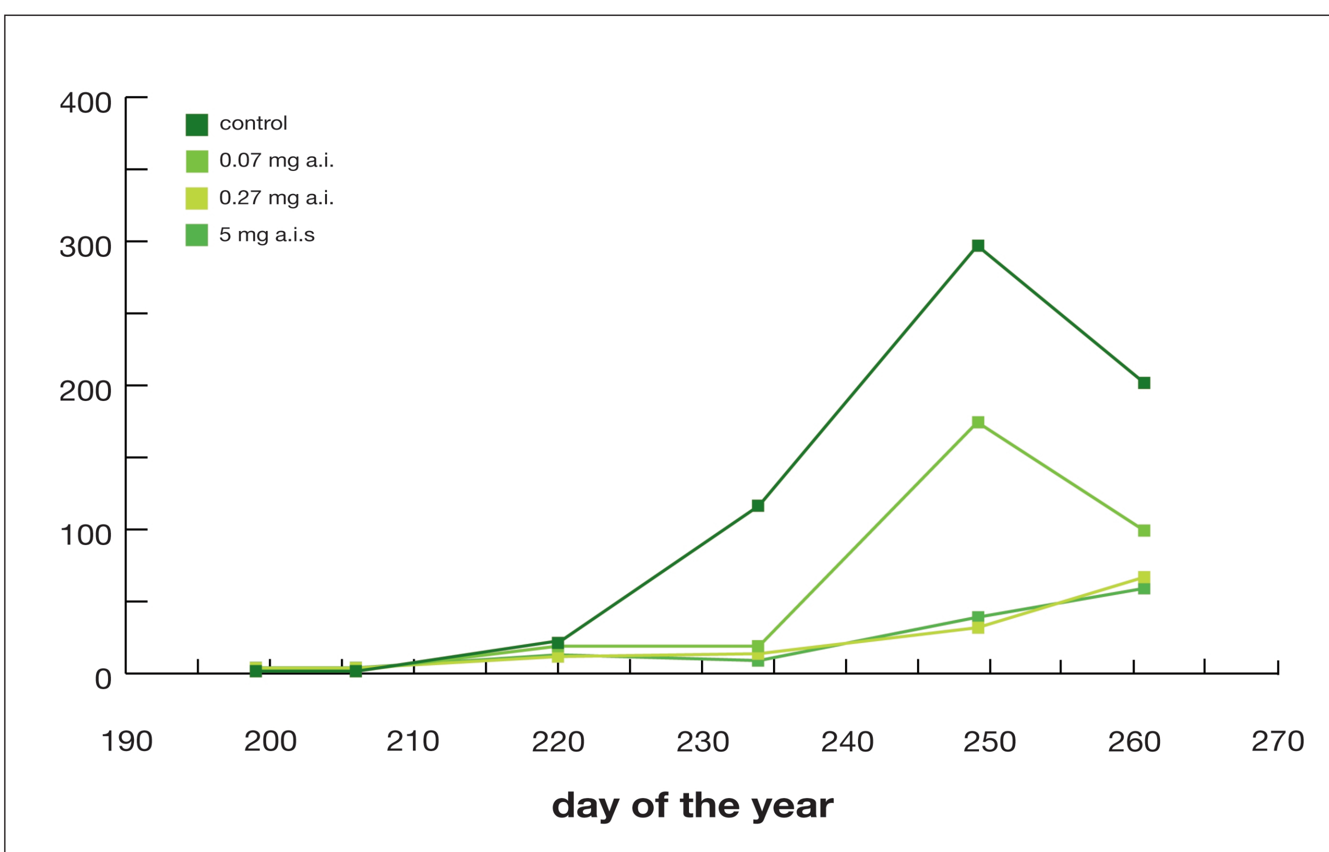

Figure 5. Roots of poinsettia untreated (far left) and treated with metalaxyl incorporated into paint (left of center-far right).

application of the insecticide at a rate of one percent active ingredient (10 mg active ingredient).

All imidacloprid treatments effectively reduced aphid survival for at least eight weeks, with the two most effective aphid treatments being the 1-percent granular application and the 88 mg/L (0.26 mg active ingredient) (see Figure 1, page 29). For the whiteflies, all insecticide treatments reduced whitefly nymph survival, with the 42 and 88 mg/L and the 1-percent granular treatments being equally effective in reducing whitefly nymphs on the lower poinsettia leaves (see Figure 2, page 29).

The importance of this work is very clear and highly significant: effective control with less active ingredient.

FUNGICIDES

With the excellent results of the PGR and insecticide research, it was only logical to explore the possible use of this technology as a method of fungicide delivery. For the fungicide project I cooperated with Dr. Pasian. This project was in partial fulfillment of the requirements necessary for our graduate student to receive a Ph.D. degree in Plant Pathology. Like the PGR and insecticide work, we used poinsettias. They were chosen for this study because of their high value as potted plants as well as their susceptibility to Pythium Root Rot disease. Plant material was kindly donated by the Paul Ecke Ranch, Encinitas, Calif.

The pathogen used in this study was *Pythium ultimum*. This particular fungus was isolated from a poinsettia with severe symptoms of root rot that was submitted to The C. Wayne Ellett Plant and Pest Diagnostic Clinic, The Ohio State University.

The fungicide used in this study was metalaxyl. This fungicide was chosen because of its systemic nature in the target plant, for its high degree of control efficacy against Pythium, and its widespread use history in the greenhouse industry. For this project, three different rates of metalaxyl were used: one-half the manufacturer's recommended rate, the recommended rate and two times the recommended rate. These rates amounted to the application of 5.6, 11.2 and 22.4 mg of active ingredient per potted poinsettia. ➧

There were six disease/paint/fungicide treatments used in this experiment: 1) minus Pythium, minus paint and minus fungicide; 2) plus Pythium, minus paint, minus fungicide; 3) minus Pythium, plus paint, minus fungicide; 4) plus Pythium, plus paint, minus fungicide; 5) plus Pythium minus paint, plus fungicide; and 6) plus Pythium, plus paint, plus fungicide. These paint treatments were compared to the standard method of fungicide drenching using the same amount of active ingredient (one half the labeled rate = 5.6; full rate = 11.2; and twice the labeled rate = 22.4 mg). The standard drenches were applied to the potted poinsettias at one and five weeks after planting. There were five replications of each treatment and experiments were arranged in a completely randomized block design. The rate response to the fungicide was determined by regression analysis using SAS.

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Poinsettia plants were planted in Scotts Metro Mix 360 in 4-inch plastic pots that had been painted on the inside with 100 ml of white interior flat latex paint into which the metalaxyl had been mixed at the rates detailed above. The painted pots were allowed to dry for 24 hours before planting. Immediately following planting, the plants were fertilized with a 14-14-14 slow-release fertilizer. Potted plants were inoculated with Pythium using a method described by Pasian, Varela-Ramirez and Nameth (in “Digital video technology as a means of quantifying root rot,” published in a 1999 issue of *HortScience*), and placed in a greenhouse under a controlled environment.

The amount and severity of Pythium Root Rot was assessed visually in each plant using a disease severity index from 1-6, where 1 = no root rot, 2 = mild root rot (less than one-third of the roots rotted), 3 = intermediate root rot (one-third to two-thirds rotted), 4 = severe root rot (greater than two-thirds of the roots rotted), 5 = severe root rot and crown infection and 6 = plant death. The amount and severity of root rot were also determined using a digital imaging method developed by Pasian in the paper mentioned above.

THE RESULTS

Based on the results of two complete experiments, there were no significant differences in the control of Pythium-induced root rot of poinsettias when either method of fungicide application was employed. In other words, the incorporation of the fungicide into the paint was just as effective as using a standard fungicide drench. These results are important in that root rot disease control was not compromised by employing the painted-pot method. This compares favorably to the previous painted-pot research with growth regulators and insecticides. In this research there were also no significant differences between fungicide rate treatments (one-half, versus full, versus twice the labeled rate) in controlling Pythium Root Rot. However, in both experiments the manufacturer's recommended rate (full rate) resulted in the best control. Since the same amount of active ingredient was applied to the plant's root system either by paint incorporation or by conventional drenching, a comparison could not be made as to whether or not the painted method could be used to reduce the amount of fungicide needed to get adequate disease control. With the insecticide research this was shown to be the case.

Also, irrigation leachates collected from both methods of application were collected and analyzed with high-pressure liquid chromatography (HPLC) to determine the amount of metalaxyl coming out of the bottom of the pot. These results indicated that there were no significant differences in the amount of metalaxyl in the leachate of the two types of application methods.

A BASIS FOR FURTHER RESEARCH

In conclusion, novel methods of PGR, insecticide and fungicide application will need to be continually explored as growers become more and more accountable for what goes in and comes out of each pot. Incorporating paclobutrazol, imidacloprid and metalaxyl into paint and painting the interior of a pot proved to be just as effective in controlling plant growth, insects and root rot when compared to the traditional drench method. The potential for this method of PGR and pesticide application needs to be investigated in greater detail.

Imagine that as a grower, you could purchase pots that were already coated with PGR and/or pesticide at the effective rate of active ingredient. This has the potential to be much safer, particularly when pesticides are used that confer a high degree of danger when handled in the conventional manner.

Further work will need to be conducted that takes a look at significantly reducing the rate of chemicals in the paint but still maintains efficacy. This, in turn, will allow for less product to be leached out of the bottom of the container. And in this day and age, that can only be a good thing. GPN

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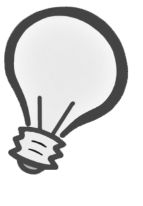

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