AFE Research Reports

Ever wonder about how your contributions to the American Floral Endowment are spent? These three research reports will give you a taste.

By Steven F. Martinez

Since 1961, the American Floral Endowment (AFE) has invested $11 million in scientific research and educational programs. The Special Reports are a result of Endowment-funded scientific research projects at universities throughout the United States. The reports are written by some of the industry's most respected researchers and are set up to provide readers with a basic understanding of the projects, the results and how results can improve horticulture. They are intended to assist in the production of high-quality plants and flowers, improve the care and handling of flowers, and help increase profitability.

The Special Reports are part of the Endowment's Special Report Notebook Program, a project started several years ago to disseminate key scientific and educational research. Each year, donors receive new Special Reports, annual progress reports and, if available, consumer marketing articles. This information is inserted in a special three-ring binder called the Special Report Notebook and is an important reference tool. Special Report Notebooks may be obtained by making a contribution to AFE. Contributions to the Endowment are tax deductible as allowed by law and support the funding of scientific research for new knowledge and technology, fund educational programs to attract talented people to the floral industry, and support the only industry-based statistical/marketing research and data collection program.

The following are three Special Reports from the 2003 Notebook.

Effective Release of Natural Enemies

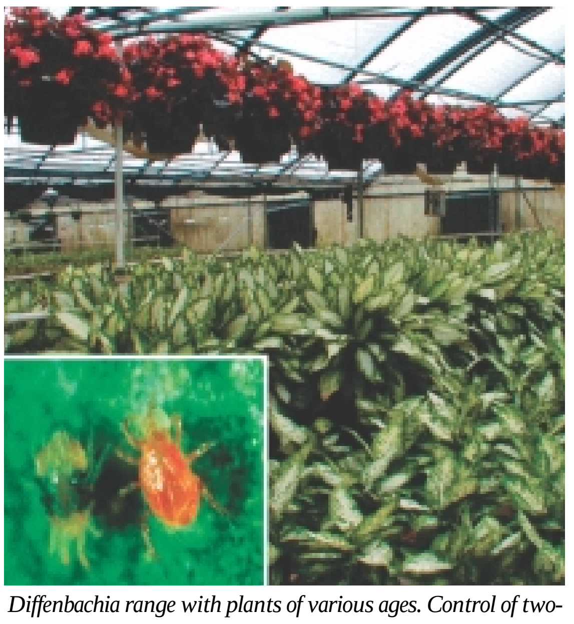
By Kevin Heinz, Texas A&M University

Biological control has been proposed as a method for controlling insect pests of floricultural crops for many years. Although effective across many pest-crop systems, the 3-10 fold increase in the monetary costs typically associated with biological control prevents some growers from embracing it as a regular practice.

Currently, approximately 50 species of parasitoids, predators and pathogens are available from commercial insectaries for use to control arthropod pests of greenhouse and nursery crops. Two questions are central to their efficient and economical use. When should biological control be initiated, and how should natural enemies be optimally released to maximize their efficacy? Answers to these questions are needed not only to make biological controls effective in the specific systems utilized but also for the general practice of biological control in greenhouse and nursery crops.

WHEN TO RELEASE FOR MITES

In a commercial greenhouse, plants infested with two-spotted spider mites (*Tetranychus urticae*) were arranged into three groups based on their planting date. Within each age group, plants were allocated to one of two treatment groups: biological control or grower derived chemical control program. Each age-by-treatment group was replicated four times. Two *Phytoseiulus persimilis* were released weekly per pot for the biological control treatments, while the grower applied insecticides as perceived in the chemical control treatments. In all three treatments (recently potted plants, plants in mid production and plants near harvest), releases of *P. persimilis* provided biological control of *T. urticae*. However, plants in mid-production and near harvest harbored moderate to high densities of mites prior to achieving successful biological control. Thus they had significant crop damage. In contrast, releases initiated at the beginning of the crop cycle yielded damage-free plants. Also, insect control was significantly greater than the chemical control program.



Diffenbachia range with plants of various ages. Control of two-spotted spider mite (inset) may be controlled by properly timed releases of the predatory mite Phytoseiulus persimilis. *(Photos this report courtesy of Kevin Heinz)*

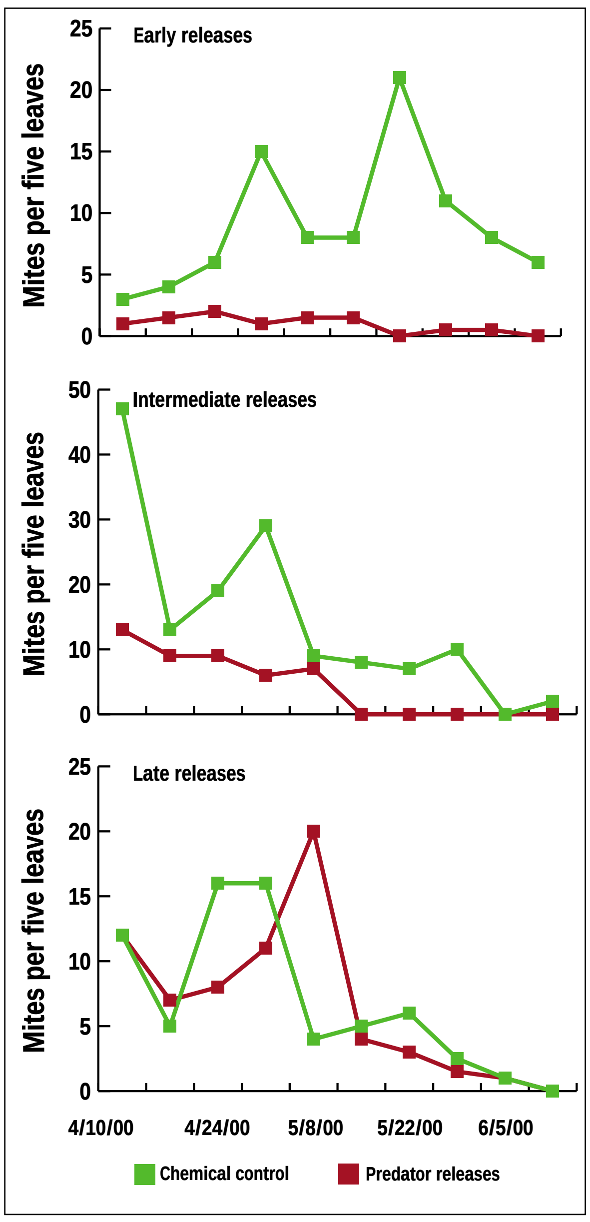
Cost for the biological control program was almost 10 percent less, and the level of control was greater than the weekly spray program used by the grower. Southwest greenhouse growers are now using regular releases of *P. persimilis* to control mite problems on foliage plants and miniature roses.

HOW TO RELEASE FOR APHIDS

Aphids are serious pests of floricultural crops worldwide. Because outbreaks can occur rapidly, aphid control requires that sufficient numbers of natural enemies be released and that natural enemies rapidly locate patches of infestation.

Greenhouse studies documented the ability of green peach aphids to spread over an area of 120 sq.ft. per day after infesting a single potted chrysanthemum. Natural enemies must be capable of spreading at least this rapidly to prevent local infestations from becoming problematic.

Figure 1. Biological control of T. urtica *by* P. persimilis *(dark line) relative to a grower derived chemical control program (light line). Biological control was most effective when initiated early. Thus, Diffenbachia plants relatively free of spider mite damage can be produced.*



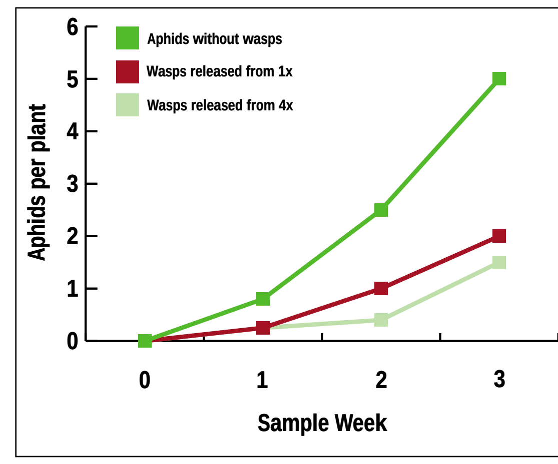
In greenhouse studies, green lacewing larvae, used as model predators, were incapable of navigating among potted chrysanthemums placed on solid benches. Although lacewing larvae voraciously consume aphids once discovered, successful biological control requires placement of lacewing larvae onto each individual plant infested with aphids.

By comparison, studies with the parasitoid wasp *A. colemani* demonstrated that it could spread over an area of 147 sq.ft. per day. From these results, we determined that the most effective biological aphid control could be obtained by releasing *A. colemani* from points no greater than 12 feet apart within a potted chrysanthemum greenhouse.

The release technology developed was evaluated in commercial chrysanthemum greenhouses in terms of pest control, economic feasibility and grower acceptance. The effectiveness of natural enemy releases was determined by comparing aphid populations in grower-treated ranges with aphid populations in experimental ranges receiving natural enemy releases using a haphazard release method or an optimal distance. Each treatment was replicated three times. Natural enemies were released weekly into each of the ranges at a rate of one wasp per plant.

Movement capabilities of Aphidius colemani *(top with adjoining aphid mummy) and* chrysoperla rufilabris *larva (bottom) influence their ability to bring about biological control.*

Figure 2. Use of optimal release distance (4x) resulted in significantly greater aphid control than haphazard release (1x).



Use of the optimal release distances (4x) resulted in significantly greater aphid biological control than the haphazard method (1x) and in comparison to plots not receiving any wasps. Use of the optimal release rate cost the grower 1.2-1.3 times the cost of insecticide applications. In contrast, haphazard releases cost the grower 2-3 times the cost of insecticide applications. The quality of plants harvested from the optimal release distance were equivalent to those harvested from the insecticide check plots and significantly greater than plants harvested from the haphazard and no release plots.

Adaptation of this approach to other biological control programs should improve efficacy and reduce costs.

Managing Thrips and Whiteflies with Fungi

By Michael Brownbridge, Margaret Skinner and Bruce Parker, University of Vermont

Methods of plant protection are undergoing major changes as many of the "standard" pesticides are withdrawn from the market. Insect-killing fungi are an important new weapon in the IPM arsenal, but information describing their effective use is needed. In these studies, we tested two "off-the-shelf" sprayers for application of the fungus *Beauveria bassiana* for control of western flower thrips on chrysanthemum and silverleaf whitefly on poinsettia.

MATERIALS AND METHODS

Spray equipment. The sprayers tested were a high-volume hydraulic sprayer (Dramm Corp.) and an electrostatic sprayer (ESS).

Application. Plants were artificially infested with thrips or whiteflies and sprayed with BotaniGard WP at the recommended rate.

Chrysanthemums. Plants were sprayed every five days (total four treatments) using a standard spray gun at 200 psi or the ESS sprayer. Efficacy was evaluated by sampling thrips from flowers.

Poinsettia. Plants were sprayed using a five-nozzle extension lance, spraying up into the leaf canopy. Four sprays were applied at seven-day intervals. Whitefly populations were sampled every seven days. Spore deposition and persistence were determined using a leaf press technique.

RESULTS

Chrysanthemums were in flower at the start of the trial, a time when thrips populations can dramatically increase. Even so, compared to the untreated "checks," both sprayers suppressed the increase in thrip population. The high-volume spray provided better levels of control (See Figure 1, page 20), but high levels of thrips infection were obtained with both sprayers (See Figure 2, page 20).

Photos this report courtesy of Michael Brownbridge.

Interestingly, infected thrips were also recovered from the untreated check plants, indicating movement of infected insects from sprayed to non-sprayed areas. This natural "spread" may be an important benefit when using fungi in a control program.

Figure 1. Mean number of thrips per flower seven and 28 days after spraing with fungi.

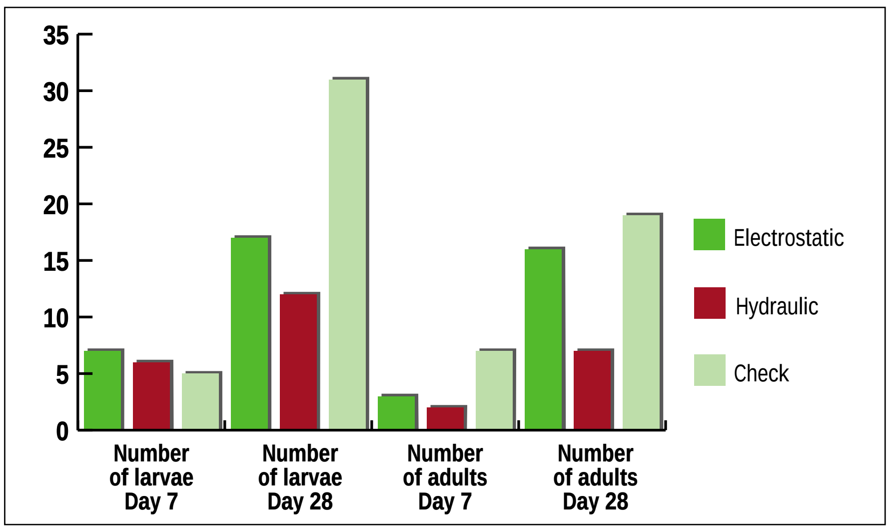
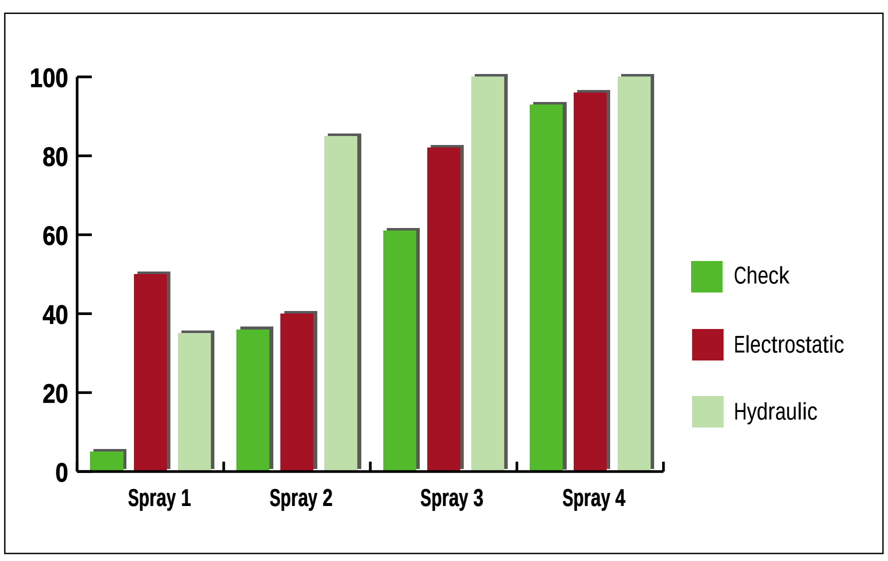


Figure 2. Percent infection in thrips sampled from flowers after spraying with fungi.



On poinsettia, high-volume sprays successfully suppressed the whitefly population (See Figure 3, below). Greater efficacy may have resulted from better targeting of spores to the underside of the lower leaves where the highest whitefly populations are found. Spore counts taken directly from the leaf surface confirmed this. Spores remained viable throughout the spray process and remained viable on the leaves for less than six days.

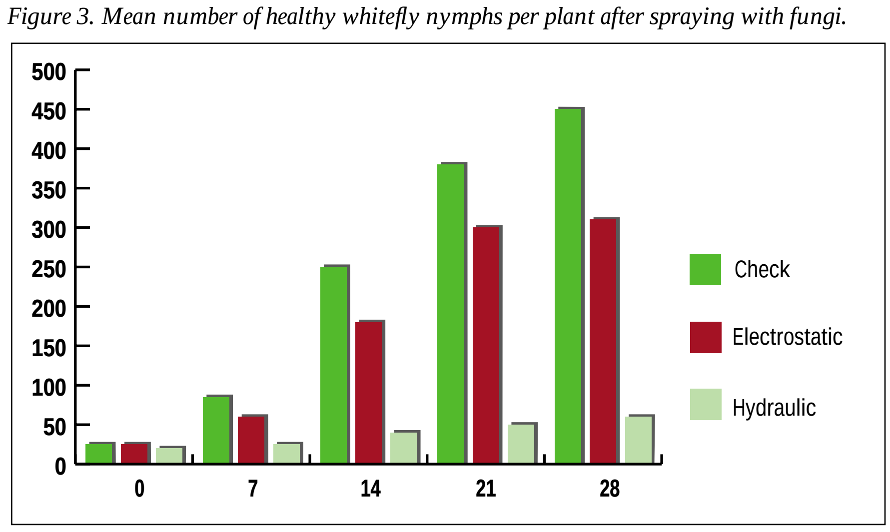
CONCLUSIONS

Under grower conditions, control measures would be applied before pest populations reached the levels used in these trials. Thus, fungi are best used as preventatives. Increased levels of thrip and whitefly control were obtained with the hydraulic sprayer, probably because of better targeting of the pests. Also, the higher spray volume may have provided better leaf coverage and movement of the spores to infestation sites in flowers and infection sites on the insects.

IMPACT TO THE INDUSTRY

(1) Plants must be scouted regularly so that fungal sprays can be initiated before pest populations reach outbreak levels. ➧

Figure 3. Mean number of healthy whitefly nymphs per plant after spraying with fungi.



(2) Growers can use fungi within an IPM strategy to regulate thrips and whiteflies. Their unique mode of action makes them ideal for use in resistance management.

(3) Targeted spray applications using a high-volume sprayer appear to provide the best levels of control.

(4) When fungi are used within an IPM program, pesticide residues on plants handled by retailers and wholesalers will be significantly reduced.

Management of a New Powdery Mildew on Poinsettia

By M. Daughtrey, Cornell University, and J.M. Byrne and M.K. Hausbeck, Michigan State University

In 1988, a new powdery mildew first appeared on poinsettia crops in North America. Few powdery mildew fungicides were labeled for use on poinsettia, and the biology of the fungus, an Oidium species, was relatively unknown. Research was initiated to obtain information critical for disease management.

MATERIALS AND METHODS

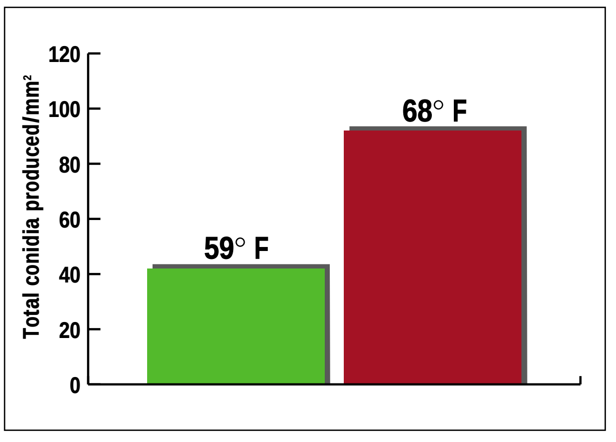
Fungicides. Sixteen preventive fungicide treatments were compared on poinsettia 'Freedom Red'. Powdery mildew inoculum was introduced 48 hours after the first fungicide treatment on October 14. Colonies were counted weekly on four previously selected leaves and bracts of each plant.

Infection was studied in relative humidity (RH) chambers providing 35-92 percent RH at 59, 68 and 77° F. Inoculated leaf disks were incubated for 48 hours, stained with "cotton blue" and examined microscopically.

Spore production. The effect of temperature on spore production was measured using leaf disks held on agar disks in petri dishes for 14 days at 59 or 68° F. Spore numbers and chain length were counted microscopically.

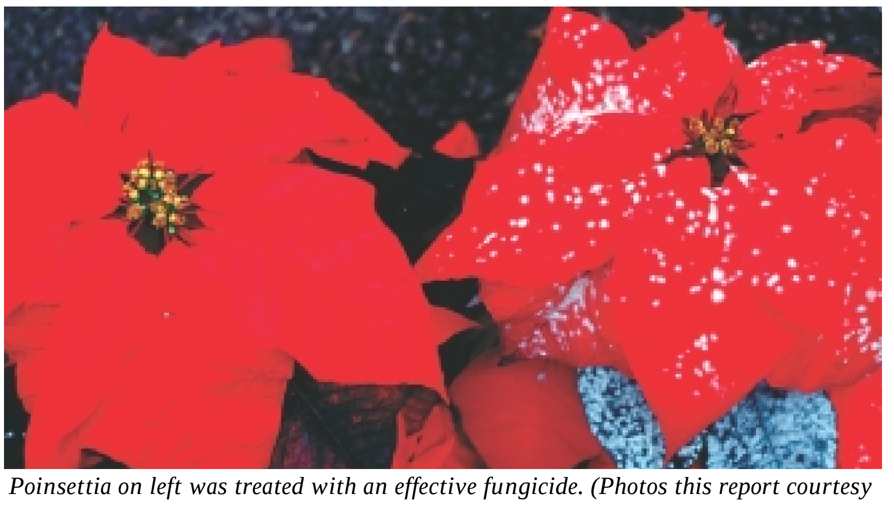
Symptoms of infection. Symptoms of powdery mildew are often latent until fall, when greenhouse temperatures become lower than 86° F. Colonies on leaf undersurfaces may be hard to detect. Careful scouting and early detection are essential for precise management of powdery mildew on poinsettias.

Figure 1. Effect of temperature on spore quantity.



CONCLUSIONS

Greenhouse Control Study. Untreated controls developed 12 colonies per



Poinsettia on left was treated with an effective fungicide. (Photos this report courtesy of Margery Daughtrey) leaf and 22 colonies per bract by December 10. No powdery mildew was observed on plants treated every 14 days with sterol biosynthesis inhibitors Systhane 40WP, Terraguard 50WP and Strike 25TOF or with Pipron 84.4 EC or Nutrol applied every seven days (applied with Latron B-1956 spreader-sticker). Excellent suppression was also obtained with 3336F + Latron B-1956, Phyton 27 21.8EC, Milsana 114UBF/FL and ZeroTol 27 percent applied every seven days and with Cygnus 50WDG, Compass 50WG and Heritage 50WG applied every 14 days.

Most treatments were free from phytotoxicity, but some bract spotting was observed with ZeroTol and Milsana. Residue was moderate to heavy in 3336F, Milsana and Nutrol treatments. Residue in treatments with 3336F used alone was reduced by alternating treatments of 3336F and First Step.

MICROSCOPY STUDIES

Environmental effects on infection. Infection was most efficient at 68° F and RH of 35-50 percent. All steps in the infection process were slower at 59° F. Earlier studies showed that 86° F inhibits infection.

Environmental effects on sporulation. Sporulation began nine days after inoculation. The spore chains were longer at 68° F than at 59° F. Only 50 percent as many spores were produced at 59° F as at 68° F.

IMPACT TO INDUSTRY

(1) Knowing the effects of temperature on this powdery mildew allows growers to manipulate environmental conditions to slow the development of an epidemic. Less inoculum will be produced if temperatures are temporarily lowered from 68-59° F. This allows environmental control to be used as one component of an IPM program that also uses scouting and appropriate fungicides.

(2) Growers may utilize the appropriately registered fungicides found to be effective in this control trial to significantly reduce disease. Growers can choose materials with demonstrated low residue and minimal chance of phytotoxicity. In order to reduce fungicide residue, growers may be able to use the strategy of alternating a high-residue material with a bicarbonate.

(3) Retailers and wholesalers have a reduced risk of purchasing poinsettias with powdery mildew. Because it thrives at moderate humidities, this particular powdery mildew may become much more visible during retail or in churches, homes or lobbies. Thus, careful management in greenhouse production is critical for retail performance. GPN

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