

The Indiana Flower Grower

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Sustainability Research at Purdue University

By Roberto Lopez, Assistant Professor and Floriculture Extension Specialist, Purdue University

Dear Indiana floriculture greenhouse growers, horticultural businesses, distributors, and organizations,

Greetings from Purdue University. Jennifer Dennis and I are excited to inform you that we have received a grant from the Purdue University College of Agriculture Mission-Orientated Grants Program and Ball Horticulture Company for sustainability research. The mission-oriented competitive grant program funds research and extension efforts that address one of the seven key initiatives outlined in the Indiana State Department of Agriculture's Strategic Plan: http://www.in.gov/isda/files/In_strategic_plan_final.pdf

Our grant was titled: Greenhouse Grower and Consumer Perception of Sustainably Grown Floriculture Crops. We will examine consumer attitudes and willingness to pay a price premium at local garden centers across Indiana for sustainably produced bedding plants. We are also conducting a grower survey to determine barriers to entry, and perceptions of sustainability. If you are interested in this project please contact me.

Growers Column - Change Equals Opportunity

By Mark Rempe, Sales Manager, Heartland Growers, Inc.

Indiana Flower Grower's are in a changing market place. The economy is changing. The consumer has less discretionary income. Our competition is changing and our customer base is changing. Is all of this change good or bad for us as growers? Does this change bring doom or opportunity to us? The Indiana Flowers Growers have the opportunity to join the 2009 Indiana Green Expo (IGE) Educational Program and Trade Show on January 12 and 13. The leaders of the Indiana Flower Growers Association (IFGA) have considered the merits of this opportunity and realize that this potential change brings new opportunities for our organization.

The IGE is a show that groups landscapers, municipality heads, parks and recreation managers, and golf course maintenance managers. They combine their organizations at one location for a unified trade show with their specific educational seminars. It is held in January at a time when most greenhouse owners and their employees can attend. Green Expo is held in the Indianapolis Convention Center. The Indiana flowers growers can join this trade show and be exposed to new opportunities. We have the opportunity to meet new customers and observe new ways of doing business. We could network individually or collectively, and can learn that our industry intersects with other industry sectors, thus creating new customers equaling new opportunity. These opportunities and customers are located throughout the state of Indiana. Some of these will include museum landscape contractors in Elkhart to a city parks buyer from Evansville. Others could be, college landscape managers, golf course maintenance managers, commercial business property managers and parks managers. The Indiana Flower Grower can still have the opportunity to see and be part of the Expo; yet have our own separate identity. We can have meetings appropriate to our needs, attend other seminars and have our own banquet independently from the others. We can take care of old and existing business while being exposed to a new, expanded market place.

In this changing market place, any business needs to change to stay ahead. Growers are no exception. We need to explore opportunity where ever it may be, individually and collectively. The Indiana Green Expo offers this opportunity. I hope to see you there, and I'll buy you a cup of coffee.

IFGA Board Update

**By Steve DeWald, and Larry Houser, Vice President
and President of The Indiana Flower Growers Association (IFGA)**

Dear IFGA Members,

The IFGA board met on February 13, 2008 at Purdue University and unanimously decided to join the Indiana Green Expo (IGE) for 2009. The many positive points that Mark Rempe highlighted in the growers column were some of the deciding factors. This industry event will take place on January 12 and 13 at the Indiana Convention Center in Indianapolis in conjunction with the Indiana Nursery and Landscape Association (INLA) and the Midwest Regional Turf Foundation (MRTF). This event will supplement the educational conference that has traditionally been held in Mid-October in West Lafayette. This year's annual IFGA meeting is scheduled for October 8 and 9th in West Lafayette. Over the next few months we will determine the exact format of the new IFGA annual meeting. Proposed changes include, a scaled down educational component, IFGA scholarship winner recognition, discussions of needs and directions of future IFGA activities, tour of Purdue's floriculture research facilities including the new garden and poinsettia trials, and of course the traditional golf outing, banquet, and grower of the year award presentation. One recurring concern about us joining the IGE is that we will lose our identity. The board believes that the October annual meeting and other proposed activities such as a bus tour of some regional greenhouses, trials or gardens would help maintain our identity and unity as an organization.

An increasing component of the IFGA as well as Dr. Roberto Lopez's role as floriculture extension specialist will be via Internet communication such as his quarterly newsletter and a new floriculture web site. The site is still in the development stage, but it is still very impressive. The board discussed briefly how to use some of our nearly \$35,000 positive cash balance, kudos to Dr. Allen Hammer on accumulating such a nice balance. We agreed on two \$500 scholarships in the name of Dr. Hammer. Additionally, we challenged Dr. Lopez to consider ways that we could support his research and extension program, including the funding of a student to help increase our e-mail data base, a key component of our commitments to internet based communication. The Floriculture site could also serve for members to list crops currently for sale and available to other members. We agreed a goal of IFGA should be to help its members support one another's businesses.

Are you a member of the IFGA? What are the benefits? Membership gives you a reduced rate to the annual conference and IGE conferences (those attending both get an additional \$25 discount for IGE), newsletter, support Purdue Floriculture scholarships and research. If you would like to become a member, please contact Colleen Martin at 765 494-1306 or by e-mail: martinck@purdue.edu

Officers of Flower Grower Associations in Indiana and Ohio

| Association | Pres./ Chair. | Vice Pres. | Sec./Treas. | Web site/ E-mail |
|-----------------------------------|--------------------------|-------------------|----------------------------------|---|
| Indiana Flower Growers (IFGA) | Larry Houser | Steve DeWald | Colleen Martin/ Roberto Lopez | http://hort2.agriculture.purdue.edu/flowers/ |
| Northwest Indiana (NWIFA) | Linda Ebert | Hank Maday | Cory Hannon | http://faculty.pnc.edu/emaynard/nwifa/about_nwifa.html |
| Northeast Indiana (NIFGA) | Doug Hackbarth | Bill Davis | Bernie Ferringer | bernie.greenhouse@gmail.com |
| Cincinnati (CFGA) | Don Furterer | Ralph Ostendorf | Lisa Wittataster/ Scot McCabe | http://www.cincinnatiflowergrowers.org/ |
| Maumee Valley Growers (MVG) | Dean Krauskopf | | Joe Perlaky | http://www.maumeevalleygrowers.com/about.htm |
| Toledo Flower & Vegetable (TAFGA) | Tom Creque | Andy Keil | Sandy Fall/ Sue Wolf | http://abe.osu.edu/green/floriculture/associations |

Indiana Greenhouse Grower Spotlight

By Roberto Lopez, Assistant Professor and Floriculture Extension Specialist,
Purdue University

As part of the Indiana Flower Grower Newsletter, I will spotlight the achievements and news of Indiana greenhouses and garden centers. Congratulations to Steve and Maria DeWald from [DeWald Gardens](#) in Fort Wayne for receiving the "Up and Coming Businesses" designation from GrowerTalks (January, 2008). They were one of four greenhouses from across the nation to be selected this year and the first from Indiana. This award is given each year to businesses that they feel "lead the industry, by example". According to the article they were selected for two main



Beautiful hanging baskets and planters designed by Maria DeWald

reasons. First, Maria's combination container designs were cited as "capturing the attention of growers around the country" (they have been the focus of previous GrowerTalks articles). Second and more importantly they were highlighted as a "seasonal retail growing business that has harnessed the ideals of their niche in the market place". Steve credits much of their success to being very focused on their customer base, primarily educated women with significant discretionary budgets that seek quality information and service. In addition they are very careful in their product selection and keeping costs down by growing most of their plants ready to go combo planters of every size and description as well as custom designs for their more discriminating clientele. In the past they have been open to the public just

12 weeks during spring, but this year they have expanded their perennial and shrub offerings and will stay open through the fall. To help accomplish this they have hired their first full-time employee Rhea Gratz, a graduate of Purdue's Horticulture and Landscape Architecture Program (B.S. 2002). Rhea will serve as their perennial specialist. If you have any note worthy news concerning your operation that you would like to share with other growers please send it to me.



Both Steve and Maria have PhDs in Horticulture from the U. of Florida

Greenhouse Production and Diagnostic Workshop in English and Spanish at Heartland Growers

When: Monday, March 17, 2008 from 10 AM to 3:30 PM

Purdue University Ornamentals Extension Specialists Roberto Lopez (Floriculture), Mike Mickelbart (Nursery Management) and Janna Beckerman (Plant Pathology) will be on hand to answer your greenhouse and nursery questions.

Program:

10 AM to 12 PM - *English*

Environmental Management and Plant Growth Regulators (Roberto Lopez)

12 PM to 12:30 PM Lunch

12:30 PM to 2:00 PM - *English*

Diagnosing Problems in the Greenhouse - Walking Tour (Roberto Lopez and Janna Beckerman)
(Question and answer/environmental problems, disorders, and diseases)

2:00 to 3:30PM - *Spanish*

Diagnosing Problems in the Greenhouse - Walking Tour (Roberto Lopez and Janna Beckerman)

Please e-mail (tgoodale@purdue.edu) or call Tammy Goodale at 765 494-1296 by **March 10, 2008** and indicate which session(s) you and/or your growers will be attending. If you are a paid IFGA member and will be staying for the entire workshop, you can sign up for a boxed lunch. All others please send \$10 for a boxed lunch to Tammy Goodale.

Directions to Heartland Growers can be found at: <http://www.heartlandgrowers.com/>

If you need a reasonable accommodation to participate in this program, prior to the meeting, contact Tammy Goodale.

Determining PGR Liner Dip Rates for Vigorous Bedding Plants

By Roberto Lopez¹, Matthew Blanchard² and Erik Runkle³

¹Assistant Professor and Floriculture Extension Specialist, Purdue University

²Graduate Student; ³Associate Professor and Floriculture Extension Specialist, Michigan State University

Objectives

- **Experiment 1** - To evaluate multiple rates of Piccolo (paclobutrazol, Fine Americas, Inc.) as a pre-transplant liner dip on growth and development of six vegetative annual species.
- **Experiment 2** - To evaluate how moisture content of the growing medium influences the response of a Piccolo liner dip.

Table 1. Vegetative annual species and Piccolo application rates used for each experiment.

| Species | Piccolo liner dip rates (ppm) | |
|--|-------------------------------|--------------|
| | Experiment 1 | Experiment 2 |
| Bacopa (<i>Sutera cordata</i> ‘Falls Big Pearl’) | 0, 4, 8, or 12 | 0 or 12 |
| Coleus (<i>Solenostemon scutellarioides</i> ‘Stained Glassworks Copper’) | 0, 4, 8, or 12 | 0 or 12 |
| Sweet potato vine (<i>Ipomoea batatas</i> ‘Blackie’) | 0, 4, 8, or 12 | 0 or 12 |
| Cape daisy (<i>Osteospermum hybridum</i> ‘Side Show Bicolor Pink’) | 0, 4, 8, or 12 | 0 or 12 |
| Petunia (<i>Petunia</i> × <i>hybrida</i> ‘Multiflora Prostrate Wave Purple’) | 0, 4, 8, or 12 | 0 or 12 |
| Verbena (<i>Verbena</i> × <i>hybrida</i> ‘Semi Trailing Escapade Bright Eye’) | 0, 4, 8, or 12 | 0 or 12 |

Greenhouse Environment

- Plants were grown in a glass-glazed greenhouse at Michigan State University with an actual average daily temperature of 70.9 ± 3.2 °F
- A 16-hour photoperiod was provided by high-pressure sodium lamps
- The average daily light integral was 13.9 mol·m⁻²·d⁻¹

Chemical Application

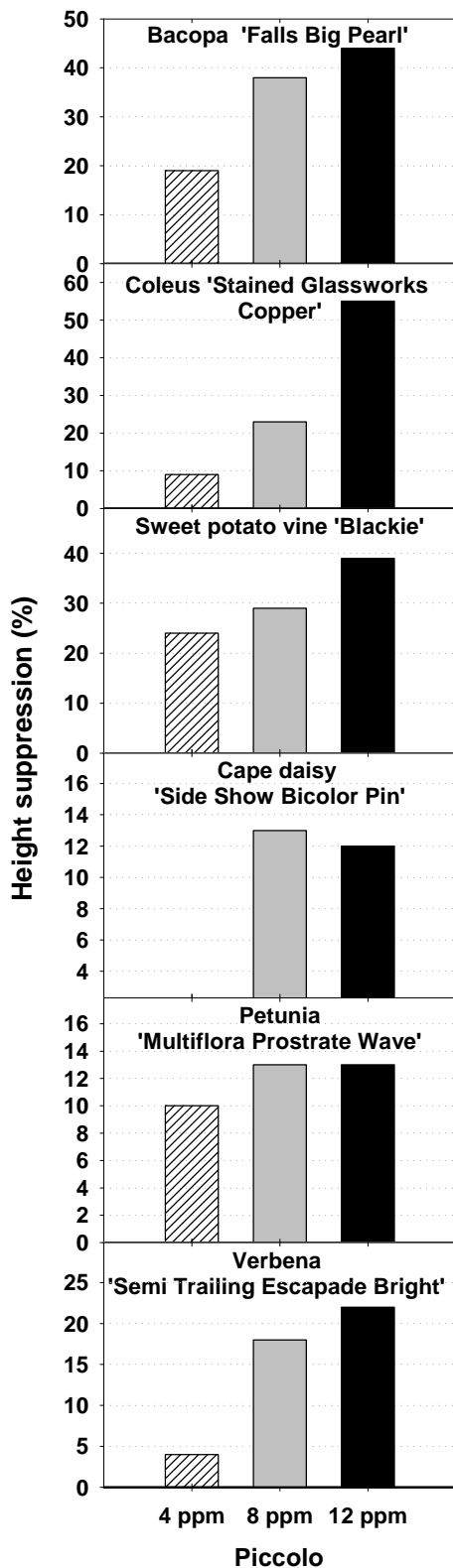
- Ten plants of each species, each in 50-cell plugs, were used for each treatment
- For Expt. 1, the media was moderately dry at the time of application
- For Expt. 2, plants were irrigated 1) in the morning of the day preceding the PGR dip so that the media was dry at the time of application, or 2) one hour prior to the PGR dip
- 10-cell plug tray sections were dipped into each PGR solution for 30 sec. (Table 1)
- Three hours following the applications, plants were transplanted into 4.5-inch round pots

Results

- **Bacopa ‘Falls Big Pearl’** The height of treated plants 6 weeks after the application was 19%, 38%, and 44% shorter than the control (Figure 1). At 4 or 6 weeks after treatment, rates of 8 and 12 ppm continued to be highly effective at suppressing growth.



- **Coleus ‘Stained Glassworks Copper’** Piccolo significantly suppressed average plant height at all rates tested when measured 6 weeks after the liner dip; plants were 9% to 55% shorter than the control (Figure 1). At 2 and 4 weeks after the liner dip, height increase was similar among all Piccolo rates but significantly less than control plants.



- **‘Blackie’ sweet potato vine** Plant height 6 weeks after treatment was 24% to 39% shorter than the control plants (Figure 1).

- **Cape daisy ‘Side Show Bicolor Pink’** Plants dipped in 8 or 12 ppm of Piccolo were about 12% shorter than the untreated control (Figure 1).

- **Petunia ‘Multiflora Prostrate Wave Purple’** In general, at six weeks after application, all rates of Piccolo were effective, as height of the treated plants was 10 to 13% shorter than the control (Figure 1).

- **Verbena ‘Semi Trailing Escapade Bright Eye’** As time from the PGR application progressed, effectiveness diminished, especially at the lowest rates. At 6 weeks after treatments, a liner dip of 12 ppm was the only treatment that continued to significantly retard stem elongation of verbena (Figure 2).

- **Experiment 2** In general, stem elongation was extremely retarded if the plug media was dry prior a 12 ppm liner dip (Figure 3).

Conclusions

Table 2. Suggested Piccolo liner dip rates for six plant species studied based on our growing conditions in Michigan in late spring.

| Species | Suggested Piccolo Rates |
|---|-------------------------|
| Bacopa ‘Falls Big Pearl’ | 4 to 8 ppm |
| Coleus ‘Stained Glassworks Copper’ | 6 to 10 ppm |
| ‘Blackie’ sweet potato vine | 1 to 3 ppm |
| Cape daisy ‘Side Show Bicolor Pink’ | 4 to 8 ppm |
| Petunia ‘Multiflora Prostrate Wave Purple’ | 12 ppm |
| Verbena ‘Semi Trailing Escapade Bright Eye’ | 8 to 12 ppm |

- Pre-transplant Piccolo liner dips of 4 to 12 ppm can be a very effective strategy to control stem elongation and not significantly delay or reduce flowering in many aggressive vegetatively propagated bedding plant species.

- At six weeks after application or at first flower, Piccolo at the highest rates tested (8 or 12 ppm) continued to inhibit stem elongation in the trailing bacopa and sweet potato and the prostrate coleus and cape daisy. The inhibitory effects had diminished on petunia and verbena at this point.

Figure 1. The effects of Piccolo liner dip rates measured six weeks after application compared to the control in six species of vegetative bedding plants. Liners were dipped in Piccolo for 30 seconds and subsequently transplanted into 4.5-inch round pots.

- If the media is extremely dry prior to the dip, Piccolo can be even more effective at controlling stem elongation. Therefore, lower rates should be used because a greater volume of solution is absorbed.
- Flowering was hastened by an average of 2 weeks in cape daisy (*Osteospermum*) treated with Piccolo at all rates.

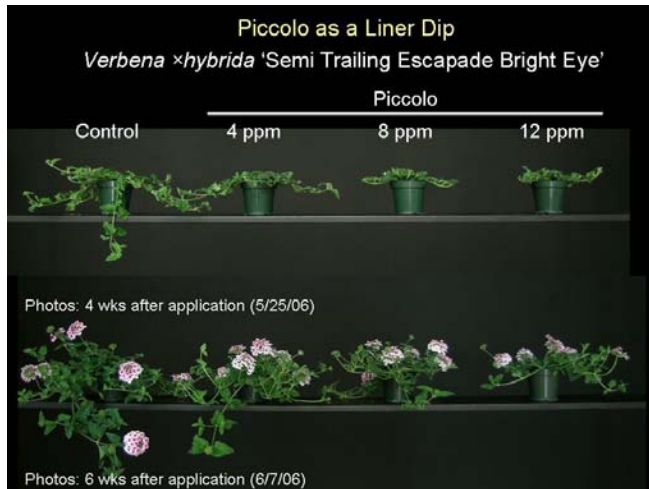


Figure 2. Expt. 1. The effects of Piccolo liner dip rates on height suppression in *Verbena* compared to the control. Liners were dipped in Piccolo (4, 8, or 12 ppm) for 30 seconds and transplanted into 11.5-cm round pots. Photos were taken four and six weeks after application.

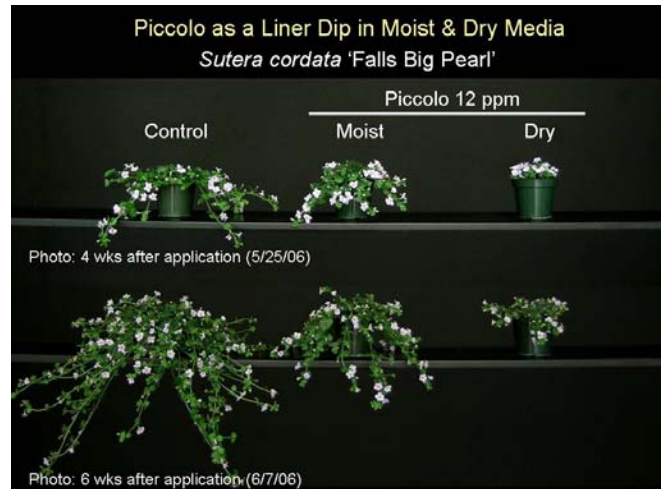


Figure 3. Expt. 2. The effects of a Piccolo liner dip with moist and dry media on *Bacopa* compared to the control. Liners were dipped in Piccolo (12 ppm) for 30 seconds and subsequently transplanted into 11.5-cm round pots. Photos were taken four and six weeks after application.

Acknowledgements: We would like to thank Fine Americas Ltd., the Western Michigan Greenhouse Association, the Metropolitan Detroit Flower Growers Association, and Raker's Acres for their financial support of this project. Research was conducted at Michigan State University.

Temperature Variation within a Greenhouse

By Matthew Blanchard and Erik Runkle, Department of Horticulture, Michigan State University

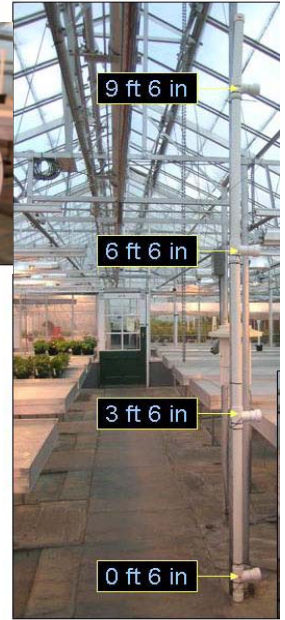
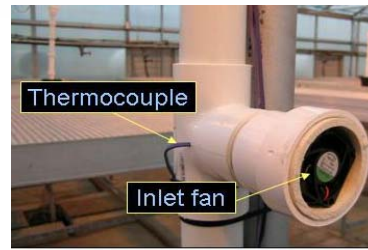


Figure 1. The effect of a cold exterior side wall on flowering delay.

In the production of greenhouse crops, plants are grown on the floor, on benches, or overhead in hanging containers. In each of these locations, the temperature and light environment can be considerably different. Growers are most familiar with the temperature variation that can exist horizontally within a greenhouse. For example, flowering can be delayed in crops grown adjacent to a cold sidewall compared to crops grown in the center of the greenhouse (Figure 1).

Temperature variation can also occur vertically within a greenhouse, from floor to ceiling. With the increased need for energy-efficient production, growers have asked us how much temperature varies between the floor, the bench, and overhead. We didn't have any data, so we conducted an experiment to help answer this question by measuring the air temperature at different vertical positions above the floor in one of our research greenhouses at MSU. In the center of a greenhouse section, we placed a thermocouple at four different heights above the concrete floor: 0 ft 6 in, 3 ft 6 in (bench level), 6 ft 6 in, and 9 ft 6 in. Each of the thermocouples was inserted into a 2-inch diameter white rigid PVC pipe that was positioned vertically in the greenhouse (Figure 2).

Figure 2. (Upper right) Experimental setup used to measure air temperature at four different heights above the greenhouse floor.



At each thermocouple location, small holes were drilled into the sidewall of the PVC pipe and a 2-inch diameter fan forced air across the thermocouple. The thermocouples were connected to a data logger that measured the temperature every 10 seconds and recorded hourly averages. We collected data with horizontal air flow (HAF) fans off or on for 8 days each.

As expected, the data collected indicate that the average air temperature within the greenhouse increased as the distance above the floor increased. However, the magnitude of temperature variation depended on the time of day and on the operation of HAF fans (Figure 3). The greatest temperature variation occurred during the day and there was generally little difference with and without HAF fans operating during this period. For example, during the 8-day period with HAF fans on, the air temperature near the floor during the day was on average 1.2 °F (0.7 °C) cooler than at bench height, and 3.0 °F (1.7 °C) cooler than 9 ft 6 in above the floor.

The use of HAF fans was most important during the night. For example, during the 8-day period, the average air temperature at night near the floor without HAF fans was 1.2 (0.7 °C) cooler than the temperature at bench height, and 3.3 °F (1.9 °C) cooler than 9 ft 6 in above the floor. When the HAF fans were operating during the night, the air temperature near the floor was similar to bench height and only 1.9 °F (1.0 °C) cooler than overhead.

This study provides an example of how much temperature variation can exist vertically in a greenhouse during the day and night with and without HAF-fans. The magnitude of temperature variation will vary from one greenhouse to another and is dependent on the size and structure of the greenhouse, HAF fan characteristics, humidity, etc. These results also demonstrate the importance of using HAF fans especially during the night to mix warm air overhead with cool air on the floor. Are HAF fans installed and working properly in your greenhouse? For more information on the benefits and installation of HAF fans, read John Bartok's article available as a pdf file through the MSU Greenhouse Energy Resource website at: <http://www.hrt.msu.edu/Energy/Notebook.htm>

Remember that plant temperature, not air temperature, controls how fast or slow plants develop. Plants can be several degrees warmer than the air under high-intensity lighting and when it is sunny. In contrast, plants can be several degrees cooler than the air during the night, especially when humidity is low.

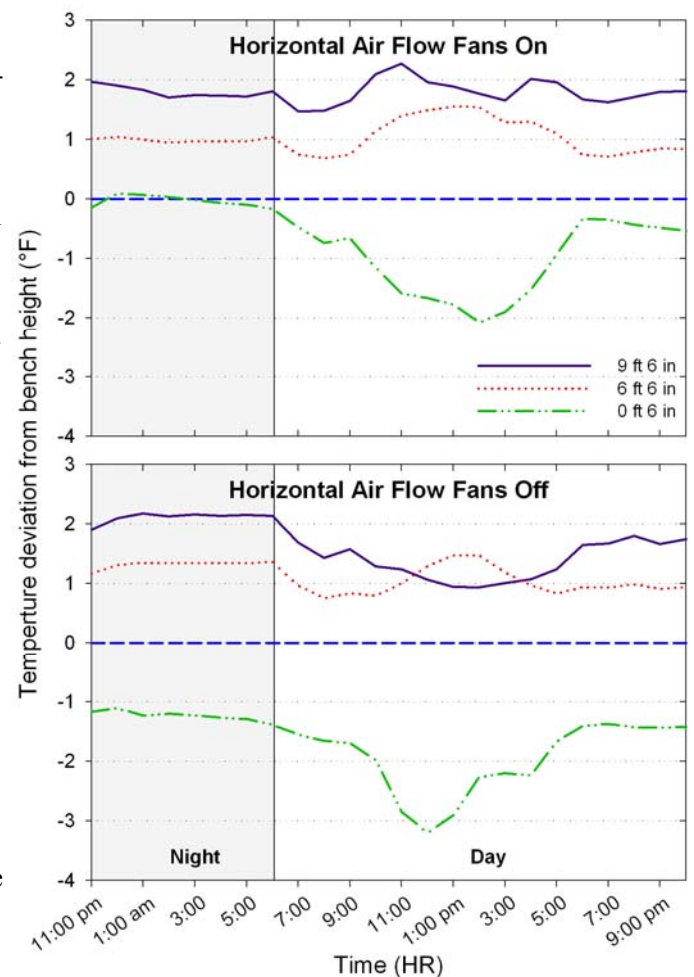


Figure 3. (lower right) Measured air temperature at bench height (3 ft 6 in) and at 3 different heights above the greenhouse floor with or without the operation of horizontal air flow (HAF) fans. Data was averaged for 8 days with HAF fans on and 8 days with them off. The daylength was extended with high-pressure sodium lamps to provide a 16-hour photoperiod (from 6:00am to 10:00pm).

Plant temperature can be easily measured with a hand-held infrared thermometer. This practice can give you an idea of how plant temperature varies from the air.

In conclusion, we encourage all growers to position their covered, aspirated temperature sensors at crop height. As our data shows, temperature measured just 3 feet above a crop can be a little warmer than at crop level. Thus, a temperature sensor mounted above a crop can lead you to believe that crops are growing at a warmer temperature than they actually are.

This article was originally published in the Michigan State University Greenhouse CAT alert, Issue 2, 2008
<http://www.ipm.msu.edu/grnhouse08/G01-02-08.htm>

Trouble-Shooting Greenhouse Problems with the Help of the Purdue Plant and Pest Diagnostic Laboratory (P&PDL)

By Gail Ruhl; P&PDL Senior Plant Disease Diagnostician; Department of Botany and Plant Pathology <http://www.ppdل.purdue.edu>

Root rots, wilts, leaf spots, and blights are everyday realities in the 'world' of the greenhouse flower grower. Even the best growers will have plants that do not perform well. The ability to make an accurate diagnosis on-site is often dependent on whether a disease produces unique, 'signature' symptoms. Look-alike symptoms throw a wrench into the diagnostic process and create confusion with regard to management. The Purdue Plant and Pest Diagnostic Lab can assist you in the diagnoses of specific diseases, insects and cultural factors that wreak havoc on your plants and help you tailor your management decisions to target the specific problem.

Root Rots

Root problems of greenhouse crops can be caused by a number of factors, including fertilizer toxicity such as excessive soluble salts, lack of oxygen due to water-logged soils, and feeding damage from fungus gnat larvae and/or plant pathogenic fungi. In many cases, excessive soluble salts and excessive moisture predispose (weaken) plants to infection by pathogenic fungi, such as *Pythium* spp, that thrive under saturated conditions. Although extensive root decay eventually results in wilt, initial symptoms of root rot often include stunting and/or nutrient deficiency symptoms, such as leaf yellowing (chlorosis). Examination of the roots on wilting plants is critical for an accurate diagnosis of potential root rot. Remove the plant from the pot and examine the roots. Healthy roots are generally white and firm while decayed roots are usually water-soaked in appearance and/or darkened and easily macerated between the fingers. Sometimes root colonizing fungi may also move into the stem and cause canker or "black leg".

Phytophthora spp., a fungal-like microorganism can also cause root, crown and stem rots. *Pythium* spp and *Phytophthora* spp are most destructive when soil moisture is abundant. *Rhizoctonia* is another common cause of root disease and stem canker. Unlike *Pythium* spp, saturated soil is not necessary for disease development. For this reason, *Rhizoctonia* spp often tends to be more active in the upper portion of the soil. There are a number of other plant pathogens occasionally encountered in rotted roots including *Thielaviopsis* spp (Figure 1), *Fusarium* spp, and *Cylindrocladium* spp.

An accurate laboratory identification of the cause of root rot is necessary to manage the problem effectively.

Cutting Rots:

When cuttings have a large wound on the base they can be very susceptible to bacterial soft rot. This is especially true when temperatures are in the 90s and there is plenty of water. When bacteria are the cause, the base of the cuttings becomes soft and slimy. If the cuttings appear diseased but remain firm, further investigation of the cause is necessary.

The P&PDL can help with the identification of what might be causing a cutting rot.

Bacterial Blight:

Bacterial blight of geranium is caused by *Xanthomonas campestris* pv. *pelargonii*. *Xanthomonas* does not cause root rot or stem canker on geranium. One or two leaves will initially become limp and droop. Wilt symptoms can also be caused by root rot or high soluble salts, but in those cases the whole plant usually wilts. Another symptom of *Xanthomonas* can be leaf spots or “V” shaped lesions originating from the leaf margin. *Ralstonia (Pseudomonas) solanacearum* can also cause a systemic wilt of geranium but does not cause leaf spots. *Ralstonia* is a bacterial disease associated with infected cuttings that usually originate from unclean stock. *Xanthomonas campestris* pv. *pelargonii* only infects geranium while *Ralstonia (Pseudomonas) solanacearum* infects a variety of ornamentals and vegetables. Reliable test kits that are easy to use are available for ‘on-site’ testing for the presence of geranium bacterial blight and *Ralstonia (Pseudomonas) solanacearum* (not for the specific race or biovar).

The P&PDL provides testing for the presence of bacterial pathogens in plant material.

Leaf Spots and Blights:

Leaf spots and blights can be caused by a number of different factors, including fungi and bacteria. There are many fungi that cause spotting of floriculture crops. Although some fungi are easily recognizable, like *Botrytis cinerea*, which produces an easily identifiable crop of gray spores, many cannot be identified ‘on-site’. Bacterial leaf spots can look very similar to fungal leaf spots. When you hold spotted leaves up to the light, spots caused by bacteria will often have a translucent, water-soaked, appearance and you may also see a halo around the spot. Bacteria usually flourish under excessive moisture and warm temperatures while fungi tend to prefer somewhat cooler conditions. Bacterial diseases are not controlled with fungicides and thus an accurate laboratory diagnosis is recommended for correct management decisions.

The P&PDL provides testing for bacterial and fungal pathogens that cause leaf spots and blights.

Powdery Mildew:

This disease is easy to identify because of the powdery crop of spores it produces on plant parts, including the surface of leaves, flowers, and stems. Powdery mildew rarely kills plants but can result in unattractive discoloration and lower leaf drop. African violet, begonia, coreopsis, dahlia, gerbera, hydrangea, and kalanchoe commonly develop powdery mildew. On kalanchoe, powdery mildew can be difficult to recognize because the primary symptom is not a white, powdery coating on the leaf, rather a scarring or cracking of the leaf surface that looks more like an edema.



Figure 1. Foliar symptoms (purpling) suggestive of a nutritional imbalance. *Thielaviopsis* root rot is the cause of the purpling and stunting of Petunias in this tray.



Figure 2. Normal petunia plugs (left) exhibit healthy, white roots. Infected Petunia plugs (right) exhibit rotted, dying roots. Root rot decreases the number of healthy roots available to supply top growth with needed nutrients and water—thus the purpling and stunting.

The P&PDL can assist you with microscopic examination for the presence of powdery or downy mildew

Viruses:

Virus diseases can be either very distinctive or impossible to recognize. The most common virus in the greenhouse is Impatiens Necrotic Spot Virus (INSV). While not all plants are hosts, the host list is at least 500 species long. The symptoms vary considerably from plant to plant but once you can recognize INSV on a specific plant, you can usually identify it the next time it occurs on the same host. It is important to accurately identify viruses since they are carried by different insect vectors (i.e. thrips and aphids) and have different host ranges. Reliable test kits that are easy to use on-site are available for testing INSV, TSWV and several other virus diseases of ornamentals.

The P&PDL provides testing for selected virus pathogens in symptomatic plant material.

Diagnosing the Unknown

When unique, ‘signature’, symptoms are not present or you have exhausted your troubleshooting options and an accurate on-site diagnosis is not possible, the Purdue Plant and Pest Diagnostic Lab (P&PDL) can offer the diagnostic assistance that is paramount to your timely management decisions.

The diagnosticians associated with the P&PDL can help you identify the diseases, disorders, weeds or insect pests causing problems in your greenhouse and assist with providing information regarding the possible environmental and/or cultural conditions that may have predisposed your plants and encouraged problems to develop.

Collecting and Submitting Plant Specimens for Diagnosis

The accuracy of any diagnosis depends on the quality of the sample you submit and the background information you include with the sample. A good sample is one that is representative of the problem and shows varying degrees of the symptoms observed. If plants are small, it is best to submit entire trays or portions of trays that exhibit the full range of symptoms (dead, dying, healthy) on the plants. If plants are in pots it is best to submit several pots that contain plants exhibiting the symptoms in question. Individual pots should be placed into plastic bags (Figure 3a), using a twist tie to secure the bag around the base of the stem(s) to contain the potting media and keep it away from the foliage. Clear packing tape can also be placed over the top of the pots and around the plant stems (Figure 3) to contain the soil and preserve integrity of the foliage. If pots are excessively large, plants may be removed from the pots prior to shipping. Bundle the plants and adjacent soil together by placing a plastic bag around the roots and soil to keep the foliage separated from the soil. Plants can then be wrapped in newspaper or bubble wrap before placing in a sturdy container for shipment (Figure 4). Do not add water. If the sample cannot be mailed immediately, keep it refrigerated or out of direct sunlight. It is important that you try to collect the sample prior to any pesticide applications since once pesticides have been applied it may be difficult to obtain an accurate diagnosis of the disease pathogen present. If pesticides have been applied, be sure to note what has been applied and the dates of applications on the submission form. Fill out as much information as possible including names of cultivars affected, fertilizers and rates, PGRs used, pH and EC, pattern of injury, when first observed, etc. Submission forms can be downloaded from the P&PDL website at <http://www.ppd.purdue.edu>.



Figure 3a. Plastic bag placed around the base of plant stems with a twist tie (b) clear packing tape over the top of the pot and around the base of plant stems to prevent potting media from 'soiling' (no pun intended) foliage en-route. (photos courtesy of Jan Byrne and Gail Ruhl)



Figure 4. Bubble wrap helps to keep pots from shifting once placed inside a crush-proof box.

Send the sample by overnight, first class mail or ground delivery, early in the week to:

Plant and Pest Diagnostic Laboratory
Purdue University
915 West State Street
West Lafayette, IN 47907-2054

Please feel free to contact the P&PDL with any questions prior to your sample submission. The P&PDL diagnostic staff work hard to provide you with fast, accurate results. Providing answers to your important questions prior to sample submission may enable us to get you the answers you need more quickly. You can contact the P&PDL by telephone (765-494-7071) or fax (765-494-3958). You may also wish to visit our website at: <http://www.ppdل.purdue.edu> for additional information about our lab, our picture of the week and for other links of interest.

Remember--a proper diagnosis depends on you.

Our diagnoses and recommendations are based on the samples submitted and information that accompanies the samples. You can help us to provide you with the most accurate diagnosis by providing a high quality, representative sample accompanied by complete background information.

Virtual P&PDL Picture of the Week

The P&PDL has weekly contributions from extension educators and specialist on a wide range of topics (Figure 1).

<http://www.ppdل.purdue.edu/PPDL/>

Past pictures of the week can be found at:

http://www.ppdل.purdue.edu/PPDL/Weekly_Picture_index.html



Figure 1. Examples of past pictures of the week.

Upcoming 2008 Industry and University Events

| Date | Event | Location | Speaker/ Topic | Web site/ Email |
|------------------|-----------------------------------|---------------------------------------|--|---|
| Mar. 12 | NIFGA Meeting | Hensch's Airport Greenhouse | Allen Hammer | Contact: bernie.greenhouse@gmail.com |
| Mar. 13 | NWIFA Meeting | Blooming Acres, Lake Village, IN | Roberto Lopez - GH Efficiency | http://faculty.pnc.edu/emaynard/nwifa/about_nwifa.html |
| Mar. 17 | IFGA Grower Clinic | Heartland Growers, Westfield, IN | English and Spanish programs | Contact: rglopez@purdue.edu |
| Mar 29 - Apr 5 | Calif. Pack Trials | Throughout Calif. | Trials | http://www.ngb.org/pack_trials/index.cfm |
| Apr. 2 | (CFGGA) Meeting | Knollwood, Beavercreek, OH | Roberto Lopez on GH Temperature and Lighting | http://www.cincinnatiflowergrowers.org/ |
| Apr. 9 | NIFGA Meeting | Broadview Greenhouse, Fort Wayne, IN | Roberto Lopez on GH Lighting | Contact: bernie.greenhouse@gmail.com |
| June 12 | NWIFA Meeting | A. Bernacchi Greenhouses, LaPorte, IN | TBA | http://faculty.pnc.edu/emaynard/nwifa/about_nwifa.html |
| June 19 - 21 | Southeast Greenhouse Conference | Greenville, SC | Education and Trade Show | http://www.sgcts.org/ |
| July 12 - 15 | OFA Short Course | Columbus, OH | Education and Trade Show | http://www.ofa.org/shortcourseinfo.aspx |
| Aug. 4-15 | Michigan Garden Plant Tour | Throughout MI | Display gardens | http://www.hrt.msu.edu/planttour/default.htm |
| Aug. 5 | MSU Garden Plant Showcase | East Lansing, MI | Educational and garden tour | http://www.hrt.msu.edu/planttour/MSU_showcase.htm |
| Sept. 29 - Oct 1 | Plug & Propagation Conference | Orlando, FL | Educational | http://www.ballpublishing.com/conferences/ |
| Oct 8 - 9 | IFGA Meeting | West Lafayette, IN | Golf, banquet, tour & educational sessions | http://hort2.agriculture.purdue.edu/flowers/ |
| Oct 8 - 9 | Canadian Greenhouse Conference | Toronto, Canada | Education and Trade Show | http://www.canadiangreenhouseconference.com/ |
| Nov. 5 - 7 | New England Greenhouse Conference | Worcester, MA | Education and Trade Show | http://www.negreenhouse.org/ |
| Nov. 7- 9 | Sustainability Conference | Fresco, TX | Educational | http://www.growertalks.com/ |
| Nov. 9-10 | Retail Experience | Fresco, TX | Educational | http://www.ballpublishing.com/conferences/retail/ |

Free Electronic e-Newsletters/ Resources:

Greenhouse and Nursery:

- **Greenhouse Grower BENCHRUNNER**
Subscription: <http://greenhousegrower.com/benchrunner/registration.html>
- **GMPRO GreEn-mail**
Subscription: http://www.greenbeam.com/email/email_form.html
- **GrowerTalks Acres Online**
Subscription: <http://www.growertalks.com/acresonline/>
- **GPN Weekly** Subscription:
<http://www.gpnmag.com/index.cfm?&fuseaction=showNewsletterSubscriptionForm>
- **Big Grower Bottom line** Subscription:
<http://www.biggrower.com/index.cfm?&fuseaction=showNewsletterSubscriptionForm>
- **Business Enhancement Newsletter**
Newsletter: <http://abe-cms.ag.ohio-state.edu/green/floriculture/floriculture-resource>
- **Weekly NMPRO**
Subscription: http://www.greenbeam.com/email/email_form.html
- **MSU Greenhouse CAT Alert**
Subscription: <http://www.ipm.msu.edu/email-greenhouse.htm>

Retailing:

- **Green Profit's BuZZ**
Subscription: <http://www.greenprofit.com/buZZ/>
- **Today's Garden Center**
Subscription: <http://www.todaysgardencenter.com/index.html>
- **The Weekly Dirt**
Subscription: http://www.greenbeam.com/email/email_form.html
- **EZONE:**
Subscription: http://www.greenbeam.com/email/email_form.html
- **America in Bloom:**
Subscription: <http://visitor.constantcontact.com/email.jsp?m=1101603741932&p=oi>

Floriculture Economics:

- **Making Cents**
Subscription: <http://ellisonchair.blogspot.com/>
- **Virtual Grower**
Download: <http://arsserv0.tamu.edu/services/software/download.htm?softwareid=108>

Sustainability:

- **GreenTalks** Subscription:
<http://www.ballpublishing.com/BPsubscriptions/newslettersignup.aspx?newsletter=greentalks>

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