



ofa Bulletin

an Association of Floriculture Professionals

Effective Use of Insecticides to Manage This Year's Most Voracious Insects

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Bulletin
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by Raymond A. Cloyd

Pest control materials, including conventional and biorational insecticides and miticides, are an integral component of any greenhouse pest management program. However, when pest control falters, resistance is often blamed. This may be the case in some circumstances, but there are also other factors that may lead to poor performance of pest control materials in control-

ling target pests such as plant-feeding insects or mites. These factors range from application techniques to water quality issues. For simplicity, any reference to a pest control material will pertain to insecticides and/or miticides.

There are a number of reasons why a specific pest control material does not perform to grower expectations, and this article addresses the ways greenhouse growers can make effective use of pest control materials to manage insect and mite pests.

1. Pest Identification

It is important to properly identify a pest prior to selecting any pest control material, whether it is an insect or mite, especially since many of the newer pest control materials are selective in the range of pests they control. For example, some

only control one group of pests (i.e. mites), whereas others may kill two to three different types of insects. To identify a given pest, growers should have several reference publications that contain adequate photos, so it is possible to identify the pest in question. Another option is to send samples to a state Extension entomologist or plant diagnostic clinic. Once a given pest has been correctly identified, then the appropriate pest control material can be applied.

2. Coverage

Thorough, uniform spray coverage is essential for controlling many greenhouse pests. Greenhouse growers should determine the location of pests, then direct

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What's Your Brand?

by Bob VanCura

Branding has been one of the hot button topics in our industry the last few years. It seems that everyone has jumped on the bandwagon recently. It wasn't all that long ago that we thought of a brand as a national product, such as Coca Cola or Tide Detergent. Now, we think in terms of most of the product we sell within our company, whether plants or hardgoods, being a brand. Even more so, we are thinking of our companies, wherever they fall in the production chain, as an individual brand our customer chooses.

The dictionary on my office shelf lists the definition "to make a mark" as the first

entry under brand. Some have suggested a more contemporary definition as "a promise to your customer." When we think of our brand as a promise to our customer, obviously some criteria come to mind. Image and perception are some of the first thoughts in the presentation of a brand. Certainly, consistency is one of the most important aspects. People want to know what they can expect each and every time they deal with your company or buy your product.

To Brand or Not to Brand?

Using the definitions suggested here, any company could be considered a brand.

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OFA Mission Statement

To support and promote floriculture professionals through lifelong learning, career enhancement, and public awareness.

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2004 - OFA's 75th Year

by Cheryl Cuthbert
OFA Staff

Thank you for being a member of OFA – an Association of Floriculture Professionals. And congratulations – you belong to a national organization that is member-driven, member-responsive, and industry-focused. We work on your behalf, and I wanted to be the first to thank you in 2004 for your support. This is a new year, full of new opportunities, and OFA is celebrating 75 years of making an impact on the floriculture industry.

We've updated several things in the last 12 months. Our new logo was released in spring 2003, and our new look is steadily being incorporated into our publications, our Web site, and all of our communications with members. This effort is based on the vote in July 2002 by the OFA Board of Directors to rebrand the Ohio Florists' Association to better reflect our membership. Our members are a truly diverse group of professionals located throughout the country, and you work in all areas of the floriculture industry.

One constant over the past 75 years has been the need for current information, for all parts of your business. In 2004, we will continue to improve the information we provide, as well as how we provide it. We want to make sure OFA is the first place you think of when you need more information to run your business better.

Improving Our Techniques

The OFA staff is excited about being able to better reach our members through improved fax, e-mail, and Web site communication. For example, we're now updating the OFA Web site (www.ofa.org). This is your place to find details about Association activities, links to the industry, and contacts with your peers. Stay tuned for a whole new look and feel to the home page, and general improvements that make the site much more user-friendly.

If you prefer hard copies of technical articles on paper, we've still got what you

need! The *OFA Bulletin* evolved in 2003 into a 24-page, bimonthly, three-color publication. We're now outsourcing the design/layout, so we can focus on providing in-depth articles for all segments of the industry and OFA News throughout the year. A new goal in 2004 is to refer readers back to the OFA Web site for additional photos and references to a variety of the *Bulletin* articles.

Look for two *OFA TIPS* publications this year. A new edition of *Tips on Managing Floriculture Crop Problems* will be published in mid-spring. When you attend the OFA Short Course this July, check out the OFA Bookstore for our new book featuring *Tips on Operating a Profitable Greenhouse Business*.

Providing What You Need

Our challenge at OFA is to make sure the OFA Short Course sessions and trade show, publications, Web site information, and other outreach activities provide current information. We understand what you want, because we ask you and your peers for input. Approximately 150 committee members help evaluate and plan the OFA Short Course and outreach sessions, plus experts throughout the industry write *Bulletin* articles and TIPS book chapters.

"Keeping up" with production issues is one area that growers always need to keep in focus. In this issue of the *Bulletin*, you'll find several articles that describe how to "keep up" with insecticides, plant height management, nutrition, and energy costs. We've also included articles on branding, plants at work, and taking a new step with your business.

Let us know what YOU need to learn more about – call us with your questions, write any time with your suggestions, tell us what you think of the Web site, and report on what you've learned at the OFA Short Course. OFA is your organization – and we want to help make floriculture work for you.

Which Flowering Shrubs Could Retailers Market as Indoor Flowering Potted Plants?

by Bridget K. Behe et. al

New or improved versions of a product in the mature or declining stage of the product's life cycle can profitably restart sales. However, launching new or redesigned products into a market creates challenges relative to existing product choices. Consumers may have preconceived notions that will affect the sale and acceptance of repositioned products. Their experiences with similar or related products may have created expectations and perceptions that need to be addressed along with product changes.

As a choice set, consumers perceive some products as similar; these products may be considered substitutes for each other. Products perceived with virtually no substitutes may occupy distinctly unique space in consumers' minds. Gaining a better understanding of customers' product perceptions and preferences can help marketers anticipate necessary changes, and may also give marketers pricing and promotional ideas.

What new products might be introduced to restart sales of flowering potted plants?

Commercial greenhouse growers now have the capability to program poinsettias, chrysanthemums, and other plants to flower on a specific date, within relatively concise limits. Growth in the wholesale value of flowering potted plants has been mediocre at best. Wholesale value increased from \$210 million in 1980, to \$684 million in 1996, and to \$832 million in 2001 or 3.6 percent (2.2 percent when adjusted for inflation) growth annually over the last 21 years, slowing to a mere 1.4 percent annual growth over the last five years (adjusted for inflation using Consumer Price Index, 2002) (National Ag. Statistics Service, 2003). The introduction of "new" flowering plants will help improve growth and profitability of this important floriculture segment. We wanted to see if several indoor flowering shrubs could be repositioned as indoor flowering potted plants that could possibly be installed in the garden at a later date.

We chose 15 flowering plants based on their differences in use (indoor or outdoor), plant habit or form, and flower color. Three plants were traditional flowering potted plants: azalea (*Rhododendron hybr.*), florist hibiscus (*Hibiscus syriacus*), and florist hydrangea (*Hydrangea paniculata*). Six plants were herbaceous perennials: campanula 'Cherry Bells' (*Campanula punctata*), delphinium (*Delphinium grandiflorum*), euphorbia (*Euphorbia milii*), geum (*Geum coccineum*), laurentia (*Laurentia axillaris*), and sisyrinchium (*Sisyrinchium tinctorium*). Six plants were flowering shrubs: hibiscus (*Hibiscus syriacus*), hydrangea (*Hydrangea paniculata*), itea (*Itea virginica*), weigela Wine and Roses® (*Weigela florida*), and two syringa (*Syringa x hyacinthiflora* and *Syringa meyeri*).

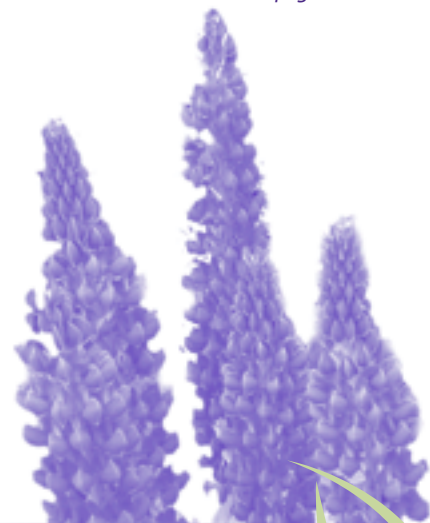
Plants were photographed in flower and "adjusted" with Adobe Photoshop. Adjusting the photographs gave us the ability to show plants in their ideal state. The photographs showed the plants in a green container against a black background. The pictures were shown in a frame on the Web page when a link was clicked to elicit a response by comparing two different plants.

We constructed an Internet survey, which was established on the Texas A&M University Horticulture Department Web server. The survey consisted of 36 plant comparison questions, four questions regarding plant preferences, and 15 demographic and gardening questions. Participants were asked to compare two different plants that were shown in a side frame on the Web page. We asked participants to choose which plants they would most likely use in an outdoor garden bed, which plants they would most likely use for decoration in the home, which flower colors they preferred, and which they would most likely purchase to give as a gift to a friend. The demographic questions included gender, age, education level, income category, number of adults and children in the household, and whether they rented or owned their home.

Survey Sampling, a professional sampling company, randomly selected 5,000 e-mail addresses from their ELITE database and invited those individuals to participate in the study. Their ELITE database was collected through a variety of permission-based marketing sources. As a screening question, each potential participant was asked: (a) were they over age 18 and (b) had they purchased a flowering plant to enjoy indoors or to give as a gift in the last year? If they answered yes to both questions, they were invited to participate in the survey. The survey was conducted in June 2002; 239 responses were obtained for Survey 1, and 282 responses were obtained for Survey 2.

Survey 1 participants were mainly women in their early forties, few of whom had some college education with a middle-income household. Survey 2 participants were composed of women in their mid-thirties who had a college education and middle-income household. The two samples were different in only one of five demographic characteristics (education level) and could be considered comparable. The samples also appear similar to the profile of Americans who participated in flower gardening in 2002, which was described as being 56 percent female, with 43 percent between the ages of 35 and 54; 43 percent were college educated; 24 percent earned \$50,000 to \$75,000; and 58 percent were married (Butterfield, 2003).

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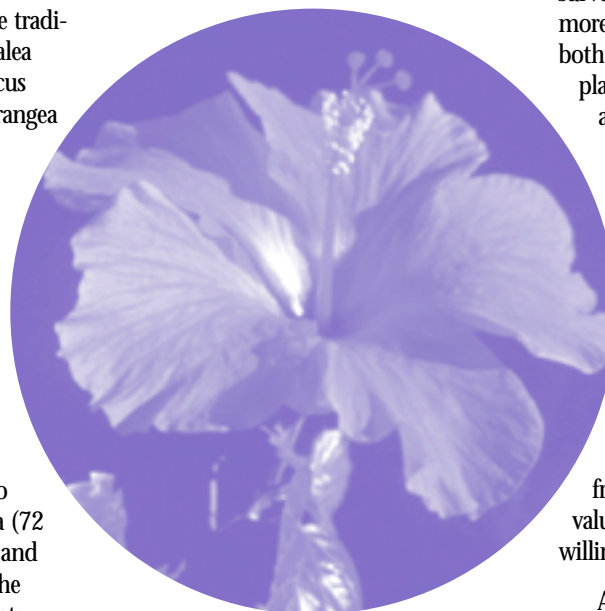
Which Flowering Shrubs Could Retailers Market as Indoor Flowering Potted Plants?

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All of the participants had purchased indoor flowering potted plants in the past year, since this was a screening question to make them eligible to participate in the study. Participants were asked about their plant preferences for indoors and outdoors. Participants were able to make multiple choices per question. Survey 1 contained three traditional flowering potted plants: Azalea (*Rhododendron hybr.*), florist hibiscus (*Hibiscus syriacus*), and florist hydrangea (*Hydrangea paniculata*); three flowering shrubs: hibiscus (*Hibiscus syriacus*), weigela 'Wine and Roses'® (*Weigela florida*), and syringa (*Syringa meyeri*), and three perennials: delphinium (*Delphinium grandiflorum*), euphorbia (*Euphorbia milii*), and laurentia (*Laurentia axillaries*). Of the participants who expressed a favorite plant(s), the top choices to place solely outdoors were: syringa (72 percent), hydrangea (66 percent), and florist's hydrangea (59 percent). The highest rated plants that participants would use only in their home were euphorbia (62 percent), weigela 'Wine and Roses'® (37 percent), and azalea (33 percent). Azaleas are typically used both indoors and out, but the weigela Wine and Roses® has been exclusively a landscape plant. This study identifies weigela as one flowering shrub to potentially be repositioned as an indoor flowering potted plant. Some of the participants selected plants to be used indoors and outdoors (Table 1). The top four plants that were perceived as dual-use products were: azalea (28 percent), weigela (27 percent), and laurentia, and hibiscus (26 percent each). The participants' favorite two colors were pink (azalea, 28 percent) and blue

(delphinium, 28 percent and laurentia, 25 percent). The top three plants that the participant would give as a gift were azalea, florist hibiscus, and weigela 'Wine and Roses'®.

The same three florist plants were used in Survey 2 (azalea, florist hibiscus, and florist hydrangea), to which were added three flowering shrubs (hibiscus, itea, and syringa) and three herbaceous perennials (campanula, geum, and sisyrinchium). Of the participants' favorite plants, the top choices for outdoor use only were hibiscus (65 percent), syringa (64 percent), and



sisyrinchium (60 percent). Of their preferred plants for indoor decoration, geum (49 percent), itea (38 percent), and florist hibiscus (35 percent) were most often chosen. Of those who said they would use it for both indoors and outdoors, azalea was among the most preferred – with 33 percent of the total participants indicating their preference for its dual use, followed by florist hydrangea at 28 percent. Florist hibiscus was third with 26 percent of the participants (Table 2). Another campanula which is blue, *Campanula carpitaca*, was highly preferred in both indoor and outdoor use in a previous study (Kelly *et al.*, 2003). A previous study also showed two blue flowering plants as most

favorite, followed by a pink flowered azalea (Moore, 1999). The blue flowering plant that was highly favored in this study was syringa (23 percent). Pink flowering plants that were highly favored were the campanula (21 percent) and the azalea (20 percent). The top three plants that participants would give as a gift were florist azalea (43 percent) and florist hibiscus (39 percent). Campanula (32 percent) was the third favorite choice.

Survey participants were predominantly females who had purchased a flowering plant in the year prior to the survey. Consumers may be willing to pay more for the ability to use a plant from both inside and outside over using a plant once indoors. Euphorbia, azalea, and weigela Wine and Roses® were the highest rated plants that participants would use in their home. Azaleas are typically used both indoors and out, but the weigela Wine and Roses® is not. This identifies weigela as one flowering shrub to potentially be repositioned as an indoor flowering potted plant. Another plant which may be repositioned is the lilac. The addition of fragrance from the lilac might be an added value for which some consumers are willing to pay.

Although some plants in the survey like sisyrinchium, do not appear to have near substitutes, this could be a marketing advantage (if consumers are willing to pay for the distinction) or it may be a disadvantage (if consumers have no idea how to place the plant in their garden). Results of this research identify some flowering shrubs as better candidates for repositioning than others.

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Plant	Use Location		
	outdoors	indoors	both places
<i>Rhododendron hybrid</i>	39%	33%	28%
<i>Weigela florida</i> Wine and Roses™	36%	37%	27%
<i>Laurentia axillaries</i>	52%	22%	26%
<i>Hibiscus Rosa-sinensis</i>	44%	31%	26%
<i>Delphinium grandiflorum</i>	49%	28%	23%
<i>Hydrangea macrophylla</i>	59%	24%	18%
<i>Euphorbia milii</i>	21%	62%	18%
<i>Syringa meyeri</i>	72%	13%	15%
<i>Hydrangea paniculata</i>	66%	25%	9%

Table 1. Of those who responded to the question, the percentage of Survey 1 respondents who expressed a preference for use location for each plant.

Plant	Use Location		
	outdoors	indoors	both places
<i>Rhododendron hybrid</i>	35%	32%	33%
<i>Hydrangea paniculata</i>	41%	31%	28%
<i>Hibiscus Rosa-sinensis</i>	39%	35%	26%
<i>Campanula carpitaca</i>	46%	30%	25%
<i>Geum coccineum</i>	33%	49%	18%
<i>Itea virginica</i>	44%	38%	18%
<i>Syringa x hyacinthiflora</i>	64%	18%	18%
<i>Hibiscus syriacus</i>	65%	20%	15%
<i>Sisyrinchium tinctorium</i>	60%	26%	14%

Table 2. Of those who responded to the question, the percentage of Survey 2 respondents who expressed a preference for use location for each plant.

Plants at Work Needs Ongoing Support

by MJ Gilhooley and Chris Rice

Plants at Work (PAW) is a national educational campaign created to inform professionals and the public about the important benefits of interior plants in the workplace. In less than three months, PAW may be forced to cease spreading its critical industry message. By April 2004, PAW's funds (collected during its first three-year phase) will be depleted, bringing its efforts to an unfortunate halt. Campaign spokespeople, such as Gary Mangum of Premier Plantscapes (plant1@aol.com), are now rallying industry members to contribute funds to the campaign (or renew their pledges if they haven't done so already). This is the only way that the PAW Initiative, which directly benefits interiorscapers, growers and suppliers, can continue to promote the interior landscaping industry.

PAW raised nearly \$875,000 for its first three years, all of which has been used for an extensive advertising, marketing, and public relations campaign. It has been determined that, even if just a small percentage of those who benefit from the Initiative's message make a three-year pledge, the funds needed to continue the campaign can be raised. The program would at least require the same amount to promote the interior landscaping industry for three more years. Considering the number of industry suppliers, growers, and interiorscapers who have yet to pledge their support, this goal is entirely reachable.

During PAW's first two years, public relations efforts placed more than 170 stories in publications and media outlets such as *Facility Management Journal*, *Buildings*, *Office Solutions*, *Facilities Design & Management*, *Journal of Property Management*, *Your Office*, *Health Facilities Management*, *CBS MarketWatch*, *National Public Radio*, *Reader's Digest*, and many more. This resulted in more than 80 million targeted

Take Action Today!

It has never been easier to make a difference "in your own backyard," the live plant industry! PAW has been humming along in the background for more than two years, consistently reminding your commercial clients of the value of interior plants every time they open one of their favorite trades or log on to their favorite news Web site. Did the PAW message reach one of your clients on the very day they were considering canceling their flower or plant program, and instead, they decided to stick with it?

By becoming a supporter (or renewing your pledge), you'll get invaluable hands-on sales/message training. And by training you on how

to use the PAW message, we can help you translate our rich collection of research and data into bottom-line growth for your business.

Today is the day! Now is the time! Log onto www.plantsatwork.org and click on the Pledge Form link on the home page. Just a few minutes of your time today is all it takes to pledge your support for three years. Help us continue to grow the size and profitability of **your** industry. And please, challenge your colleagues to get on board. Your pledge will help to ensure that your service is perceived as an absolute necessity...not a dispensable frill.



exposures to the Initiative's message. PAW's publicity efforts, in combination with ongoing ad placements, a comprehensive Web site, and various marketing materials, have yielded interiorscaping contracts for supporting investors. Along with a steady increase in actual sales leads, the Initiative's Web site enjoyed a

campaign high for both sessions and hits in June 2003, indicating growing interest in the benefits of interior plants.

PAW has done a great deal to grow the size and profitability of the interior landscaping industry. **And with ongoing support, the Initiative can do much more.** To become a supporter (or to renew your pledge), please visit www.plantsatwork.org and click on the Pledge Form link.

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What's Your Brand?

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However, the decision on how to communicate your brand and to whom becomes a key decision. Even more importantly, consider what value your "brand" offers to your customer. Is it the promise of better service? A unique product that they cannot find elsewhere? An easier way to use your product or service than the competitor?

Sometimes, branding can become a misguided effort to get your name on product. The brand should convey a message that will make the product more highly desirable to the customer. For example, before a grower labels all plants with the grower's name, ask the question "will this help my customers sell more of my product?" If the answer is no, then you are not developing a brand; you are just putting your name on a product.

How about the influx of brands?

As retailers, we need to make decisions on how to handle the plethora of brands now showing up on our shelves. Certainly, these brands have changed the face of retailing. For instance, consider some of the most popular annuals today. Ten years ago, how many of your customers knew the name Scaevola? Many of the hard goods vendors have come up with a brand as part of a campaign that makes it easier for the customer to select and use their product. Still, if not handled carefully, an individual store's image can become overshadowed by excess vendor branding.

At *A Proper Garden*, we have developed a few simple tests to determine how we will handle outside brands: ***Does it enhance or detract from our own promise to our customers (our brand)? Does the brand communicate the desired message to our own core customers?*** We have been known to receive products with misguided branding attempts and repot, retag, and repackage them, because the grower's brand communicated the wrong message.

Take for example two stores who sell the same "brand" of annual. One store makes it a point to recommend the line as having superior genetic qualities that are beneficial to the homeowner's garden, giving her the promise that her beds will be more beautiful than ever. The store makes sure she has the proper instructions for

planting and maintenance. She also leaves the store with the appropriate fertilizers and tools that these particular robust plants need to perform. Then the store is there to answer her questions, provide design tips at the point of purchase, and diagnose pests in the middle of the summer. The other retailer puts the same plants in the same pretty pots with the same pretty tags in their greenhouse, and has "Suzy" water them every once in a while. The plants quickly decline. What have we communicated to the customer who happens to shop at both stores? Consider how vendor brands work with your own store brand; maybe you will want to use the national or regional brand to enhance your own brand's image.

Above all else – defend your brand!

The point to my story is that a brand communicates a promise – whether good or bad. Each grower, retailer, or manufacturer needs to be aware of who their customer is, and what promise they want to make to them. Each company within the supply chain needs to consider who it is selling to and why. In the example just given, I would argue that the brand of the first retailer is being tarnished by the fact that a close competitor is selling the same product, but at a lower quality level. The consumer does not necessarily understand that the care is the issue, but may have a perception of the diminished quality as being a poor product.

Another example is that she can buy Clinique skin care products at anchor stores on opposite ends of the mall, but she won't find them at the discount store next to the Noxzema. This is a decision that each store will need to make for themselves. After all, there is nothing wrong with Noxzema; it's just positioned differently as a brand than the Clinique. You can be successful competing in many different markets, with many different kinds of products; but if you are serious about your brand, it is imperative to consistently examine the promise that you are making to your customers.

Communicate Your Brand

Volumes could be written on communicating your brand, and that is certainly not the objective here. Please be

concerned with how you are communicating your brand to your customers. Your communications are certainly your marketing pieces (consistency and recognition are key) and corporate image. This extends throughout the entire store – from the front entrance through to the restrooms. It incorporates the signage in front of the product and the bag you put it in when the customer leaves. Don't forget your staff – after all your brand isn't "the Gap," is it? Have them in uniform, looking clean and professional to convey the right communication of your brand to the customer.

The concept of branding has caught on in retail today. It may be one of the most significant ways to differentiate your product from the competition's product. When attempts are misguided, it can also be one of the most significant ways to confuse your customer as well. Think about your favorite stores, look at their corporate image, and think about how it is incorporated throughout the store and marketplace. Consider the impact of possibly tarnishing your brand with the wrong product or message before being swayed into the latest and greatest.

Think about the brand that you offer customers. Get a clear idea of what that "promise" is, and be sure it is specific, true, and unique. Then implement a strategy to convey that message consistently throughout all that you do. That will take discipline to accomplish. Seek the help of an expert – it's hard to do all this alone; this industry has many amazingly talented people to work with. But above all else – do it! After all, in the words of Henry Ford, "you can't build a reputation on what you're going to do." Good luck!

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Effective Use of Insecticides to Manage This Year's Most Voracious Insects

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spray applications to those plant parts to obtain maximum coverage and increase the effectiveness of pest control materials. Because most pest control materials have contact activity, it is important that sprays get to leaf undersides where the life stages (eggs, young, and adults) of a majority of pests including spider mites and whiteflies are normally located. However, some pest control materials have what is called translaminar or local systemic activity. These materials penetrate leaf tissues and form a reservoir of active ingredient within the leaf. This provides residual activity against piercing-sucking insects and mites. Examples of pest control materials having translaminar properties include abamectin (Avid), acephate (Orthene), acetamiprid (TriStar), chlorfenapyr (Pylon), etoxazole (TetraSan), pyriproxyfen (Distance), and spinosad (Conserve).

It is more appropriate to make spray applications when applicators are not tired, which avoids poor coverage problems. Applications should never be performed during the heat of the day when discomfort can lead to reduced spray coverage. In addition, this may lead to plant injury (phytotoxicity) and possible heat exhaustion of the applicator due to the protective clothing and equipment required. It is important to understand the biology of insect and mite pests so greenhouse growers will know where certain life stages are located.

3. Timing of Application

If applications of pest control materials are made when insect or mite populations are high, then it takes longer to lower the number, and more frequent applications will be needed, especially when dealing with overlapping generations. In addition, pests may have already developed into resistant stages, may already be causing plant injury, or may be in locations that are difficult to reach with sprays (i.e. unopened flower buds). It is more appropriate to make applications when pest numbers are low.

Pest control materials should be applied in the early morning or late afternoon, because this is when whiteflies, thrips, and other insects are active. If applied when insect or mite pests are less active, pest control material efficacy may be reduced, particularly contact materials. Pest control materials applied during hot, dry, sunny days may result in rapid drying and less residual activity, reducing their effectiveness.

Applying horticultural oils during cloudy weather may result in phytotoxicity, because the material doesn't dry up. Evening applications of pest control materials may promote disease development. Assisting drying through heating, venting, and using horizontal airflow fans may alleviate this potential problem.

4. Water Quality

Water quality, including pH, can influence the effectiveness of pest control materials. High pH levels can cause certain pest control materials to breakdown (alkaline hydrolysis). Carbamate and organophosphate insecticides are most sensitive to alkaline hydrolysis, with carbamates degrading faster than organophosphates. A pH above 8.0 can reduce the effectiveness of the soil-bacterium *Bacillus thuringiensis* (Gnatrol). Also, a high pH solution may influence the dissolving process (i.e. length of time) of pest control materials formulated as water-soluble packets.

Several pest control materials recommend a particular pH range on their labels. For example, the Ornazin (azadirachtin) label states the pest control material "will break down in spray tank mixtures that have pH values exceeding 7.0. Recommend pH range between 5.5 and 6.5." The Floramite (bifenazate) label states that "Floramite has been shown to degrade rapidly when mixed and stored with alkaline water of high temperature (122°F). To prevent degradation under alkaline conditions, solutions of Floramite must be used promptly. Alternatively, a commercially available buffering adjuvant can be added to the solution to reduce the pH to a neutral/acidic range."

To minimize alkaline hydrolysis, the pH spray solution should be between 5

and 7. Degradation normally occurs above a pH of 7.5 for many pest control materials. To counteract pH problems, a buffering agent may be added to the spray solution. In addition, pest control materials should be applied as soon as possible after mixing. Some additional ways to avoid pH problems include 1) check the product label for precautions when using high pH water, 2) regularly check water pH, and 3) avoid leaving solutions in spray tanks for extended time periods.

5. Mode of Action and Rotation

To prolong the longevity of pest control materials, it is important to rotate modes of action to avoid insect and mite populations becoming resistant. Failure to rotate pest control materials with different modes of activity may result in resistance and reduced pest control. The key is to rotate modes of activity, not chemical classes, because some chemical classes have very similar modes of activity.

For example, both the organophosphates and carbamates, despite being different chemical classes, have identical modes of activity (acetylcholinesterase inhibitors). So using acephate (Orthene), an organophosphate, for several sprays and then switching to methiocarb (Mesuro), a carbamate, is not a proper rotation scheme. Similarly, chlorinated hydrocarbons and pyrethroids have the same mode of activity (affect nerve cell transmission). In this case, using dicofol (Kelthane), a chlorinated hydrocarbon, then switching to bifenthrin (Talstar), a pyrethroid, would not be a proper rotation scheme. Additionally, although pyridaben (Sanmite) and fenpyroximate (Akari) are in different chemical classes, they both work on the mitochondria electron transport system (responsible for energy production), so these two pest control materials should not be used in succession.

Rotating different modes of activity reduces the selection pressure placed on an insect or mite population and avoids exposing several generations of the pest population to the same mode of activity. This prolongs the usefulness of available pest control materials. Most conventional pest control materials have a site-specific mode of activity, while so-called

biorational pest control materials including insect growth regulators, insecticidal soap, horticultural oil, neem oil, and beneficial fungi and bacteria have broad-site or multiple-site activity (Table 1). Insects and mites are more

likely to develop resistance faster to pest control materials with a site-specific mode of activity than those

pest control materials with a broad or multiple-site mode of activity.

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Table 1. Chemical class and mode of action of insecticides/miticides registered for use in greenhouses.

Insecticide/Miticide Active Ingredient (Trade Name)	Chemical Class	Mode of Action
Acephate (Orthene)	Organophosphate	Specific
Chlorpyrifos (Duraguard)	Organophosphate	Specific
Dichlorvos (Vapona)	Organophosphate	Specific
Naled (Dibrom)	Organophosphate	Specific
Sulfotepp (Dithio/Plantfume)	Organophosphate	Specific
Methiocarb (Mesuro)	Carbamate	Specific
Bifenthrin (Talstar/Attain)	Pyrethroid	Specific
Cyfluthrin (Decathlon)	Pyrethroid	Specific
Fenpropathrin (Tame)	Pyrethroid	Specific
Fluvalinate (Mavrik)	Pyrethroid	Specific
Lambda-cyhalothrin (Scimitar)	Pyrethroid	Specific
Permethrin (Astro)	Pyrethroid	Specific
Chlorpyrifos + Cyfluthrin (Duraplex)	Organophosphate + Pyrethroid	Specific
Dicofol (Kelthane)	Organochlorine	Specific
Endosulfan (Endosulfan/Thiodan)	Organochlorine	Specific
Abamectin (Avid)	Macrocytic Lactone	Specific
Imidacloprid (Marathon)	Chloronicotinyl	Specific
Azadirachtin (Azatin/Ornazin)	Insect Growth Regulator	Broad
Cyromazine (Citation)	Insect Growth Regulator	Broad
Diflubenzuron (Adept)	Insect Growth Regulator	Broad
Kinoprene (Enstar II)	Insect Growth Regulator	Broad
Pyriproxyfen (Distance)	Insect Growth Regulator	Broad
Tebufenozide (Confirm)	Insect Growth Regulator	Broad
Novaluron (Pedestal)	Insect Growth Regulator	Broad
Potassium salts of fatty acids (M-Pede/Insecticidal Soap)	Soap	Broad
Cinnamaldehyde (Cinnamite)	Oil	Broad
Neem oil	Oil	Broad
Paraffinic oil (UltraFine Oil)	Oil	Broad
<i>Beauveria bassiana</i> (Botanigard/Naturalis)	Microbial	Broad
Spinosad (Conserve)	Microbial	Broad
<i>Bacillus thuringiensis kurstaki</i> (Dipel)	Microbial	Broad
<i>Bacillus thuringiensis israelensis</i> (Gnatrol)	Microbial	Broad
Nicotine (Fulex/Plant Products)	Botanical	Specific
Pyrethrin (Pyrenone/Pyrethrum)	Botanical	Specific
Fenpyroximate (Akari)	Phenyl Pyrazole	Specific
Pymetrozine (Endeavor)	Pyridine Azomethine	Broad
Etoxazole (TetraSan)	Diphenyloxazoline	Broad
Bifenazate (Floramite)	Carbazate	Specific
Hexythiazox (Hexygon)	Carboxamide	Specific
Clofentezine (Ovation)	Tetrazine	Specific
Chlorfenapyr (Pylon)	Pyrrole	Specific
Pyridaben (Sanmite)	Pyridazinone	Specific
Fenbutatin-oxide (Vendex)	Organo-Tin Compound	Specific

Effective Use of Insecticides to Manage This Year's Most Voracious Insects

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6. Application Technique and Formulation

Aerosols and fine sprays are effective in controlling flying adults, while high-volume sprays are preferred for controlling sedentary or immobile stages and pests inhabiting the growing medium. If an aerosol is used to control pests that are located in the growing medium, underneath leaves, or deep within the crop canopy, this may result in inadequate control, because the droplet size is too fine. Aerosols and fumigants should be used for adults, and drenches or "sprenches" should be used for the larval stages of insects located in the growing medium such as fungus gnats and shoreflies. Low-volume applications work well when plants are small, but may not provide sufficient coverage when the crop canopy closes. These conditions may warrant the use of a high-volume application.

7. Target Pest Stage

Pest control material failure will most likely occur if the vulnerable stage or stages of the target insect or mite pest are not present. Generally, the immature or young stages are more susceptible than older life stages to conventional or biorational pest control materials. Most contact or systemic pest control materials do not affect the egg and pupal stage of many pests. For example, adequate control will probably not occur if Western flower thrips eggs and pupae are the predominant stages present during an application. Young that emerge from eggs and adults that emerge from pupae will not be exposed to a pest control material for several days following an application. This is especially critical with short residual pest control materials, resulting in additional sprays likely being necessary. Targeting the early development stages may reduce the number of applications of pest control materials required and as a result, reduce the amount of selection pressure placed on an insect or mite population.

Proper scouting using colored sticky cards and/or visual inspections can help detect the vulnerable pest stages present, then a pest control material can be applied accordingly. Proper knowledge of pest biology will help growers understand what pest stages are susceptible to pest control materials.

8. Label Rate

Always follow the recommended label rates. Exceeding the label rate may cause phytotoxicity to a crop and result in economic losses. Applying less than

"Always follow the recommended label rates. Exceeding the label rate may cause phytotoxicity to a crop and result in economic losses."

the recommended label rate may result in inadequate pest control. Following the label rate will ensure success in managing pests. When a range of rates are provided on a label (i.e. 6 to 12 fl oz/100 gallons of water), it is best to use the low (6 fl oz) or middle (10 fl oz) rates initially. Constantly using the highest label rate of a pest control material may result in limited options when this rate fails. Using higher label rates may increase the selection pressure on the pest population, possibly resulting in resistance developing quicker. In fact, the lower label rate may be just as effective as the highest label rate. In the long-term, this extends the longevity of any pest control material.

9. Shelf Life

Pest control materials don't carry a lifetime warranty. They must be used within a specified time period (approximately three to five years depending on the formulation). Many pest control materials break down when exposed to continuous cycles of heat (over 100°F) and cold (below freezing – 32°F) over a period of time. This then reduces their effectiveness. Liquid formulations, if not used for an extended period of time (more than four years), may eventually separate into layers or settle out and form precipitates in the bottom of containers. This makes it difficult to get the active ingredient or carrier back into a suspension that is suitable for use.

Proper storage of pest control materials will help preserve shelf life.

Insulated pesticide storage chambers are ideal for protecting pest control materials from environmental conditions. In general, the proper storage conditions for many pest control materials are temperatures between 55 and 70°F and a relative humidity between 40 percent and 60 percent.

10. Frequency of Application

As previously mentioned, most pest control materials only kill the young (larvae, nymph, or immature) and adult stages of insects or mites, having no direct effect on the eggs and pupae. As a result, repeat applications are necessary to kill stages that were missed with previous applications, such as larvae, nymphs, or immatures that were in the egg stage and adults that were in the pupae stage. This is especially important when there are many overlapping generations. In some cases, two to three spray applications may be needed when populations are high and there are overlapping generations.

Frequency of application may depend on the season. During cooler temperatures, the insect or mite life cycle (egg to adult) is extended in contrast to warmer temperatures. This may influence the number of applications needed to treat susceptible stages.

A common problem is that spray intervals are too long, which often leads to inadequate pest control. However, when insecticidal soaps and/or horticultural oils are applied at frequent intervals, this may result in phytotoxicity to a given crop.

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Methods of Controlling Plant Growth

by Brian E. Whipker and Brian Krug

Undesirable stretching due to high temperatures, lush growth, or low light can be a production reality. Therefore, plant growth regulation is an integral part of the production program of many greenhouse crops. Growers must be prepared to prevent excessive stem elongation. A number of non-chemical and chemical control options are available to manipulate plant growth so well-proportioned, compact plants can be produced.

There are three primary control options for controlling plant growth: biological, physical, and chemical. For most greenhouse operations, a combination of factors are used to manipulate plant growth. We will cover each of these below.

Biological Control

The genetic variation (cultivars) available for most plants can be used as a control option. Selecting shorter growing cultivars is often the first step available to growers. While this may work in theory, it may not be commercially practical. Many customers demand specific color or growth form characteristics, and shorter growing cultivars with these attributes may not be available. Therefore, physical or chemical control strategies must also be incorporated into a production plan.

Physical Control

Knowing how the growing environment and cultural practices can affect plant growth will help in managing a crop's growth. There are a number of physical control options available: container size, timing, water stress, nutrient stress, mechanical conditioning, light quality and quantity, pinching, and temperature.

Container Size. Root restriction can be used to control plant growth. This is done by utilizing a small container or by increasing the number of plants per pot. This method works especially well when other production parameters such as ample light and proper nutrition are provided.

Timing. One of the most effective methods of controlling excessive plant growth is by crop timing. The simple method of staggering the finish time of a crop at two- to three-week intervals is very effective with many crops like bedding plants. This ensures that a new supply of plants will always be available, thus avoiding the need to hold a crop which can become leggy.

Water Stress. A traditional method of controlling plant growth is to withhold water. Water stress can be used on a number of crops, including impatiens and tomatoes. Allow the plants to wilt slightly between waterings, but do not allow them to reach the permanent wilting point. This will lead to shorter plants, but may have the undesirable effect of reduced plant quality, delayed flowering, or premature bolting (as with cole crops).

Nutrient Stress. Reducing or withholding fertilizer tends to slow overall plant growth. Limiting the amount of nitrogen to 50 ppm to 100 ppm N will help control growth of many crops like bedding plants. The type of nitrogen supplied can also impact plant growth. Relying on nitrate-nitrogen instead of ammoniacal-nitrogen or urea-nitrogen forms (which encourage lush growth) will help.

Phosphorus also promotes plant growth. Plug producers commonly use low phosphorus fertilizers like 13-2-13 Cal-Mag® or 15-0-15, which does not contain phosphorus, to help limit stem elongation.

Mechanical Conditioning. Brushing plants has been found to be a very effective way of controlling plant height (30 percent to 50 percent) of many vegetable transplants or herbs. This is especially important for these crops, since no chemical control measures are available. Brushing involves the movement of a PVC pipe or wooden dowel rod over the top third of the plant. Research by Joyce Latimer of Virginia Tech recommends that the plants should be brushed daily for about 40 strokes to obtain the greatest effect. The foliage should be dry to avoid

damage to the leaves. This method is not effective on plants such as cabbage or broccoli and should not be used if foliar diseases are present.

Light Quality and Quantity. Higher light quality tends to limit plant elongation, thus resulting in shorter plants. Low-light conditions caused by late spacing of the crop, crowding, or too many hanging baskets overhead can lead to leggy plants and should be avoided. Photoperiod also can be used to control plant growth. This practice is widely used with pot chrysanthemums by providing taller cultivars with only one week of long days (LD) to limit vegetative growth, when compared to shorter cultivars which receive three weeks of LD to promote growth.

Temperatures. Temperature manipulation can be used very effectively in controlling plant growth. Higher day temperatures than night temperatures (positive DIF) promotes stem elongation, while lower day temperatures than nights limits growth (negative DIF). Negative DIF is very effective in controlling plant growth.

Chemical Control

To control excessive plant growth, many crops require the use of chemical plant growth regulators (PGRs). Most of the commercially available PGRs are anti-gibberellins and work by inhibiting gibberellin (GA) synthesis within the plant. GAs promote cellular elongation; so without them, cells do not elongate as much and plants do not grow as tall.

PGR Types. A number of PGRs are available for height control. Table 1 (page 12) lists some of the important attributes of each one.

A-Rest is a PGR that has been around for a number of years. Its activity is greater than B-Nine or Cycocel, but less than Bonzi or Sumagic. It is actively transported within the plant and can be applied as either a spray or a drench. It can be used on a number of crops, and growers use it on many bedding plants, bulbs, fall pansies, plugs, and poinsettias.

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Methods of Controlling Plant Growth

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Phytotoxicity is possible, but usually only when excessive rates are applied.

B-Nine is probably the most widely used PGR in the U.S. market. It is actively transported within the plant and only used as a foliar spray. It has a low degree of activity, so multiple applications are required. Its efficacy is lower in warm climates. Because it has a lower residual effect, phytotoxicity rarely occurs; but late applications can delay flowering.

Cycocel also is actively transported within the plant. It can be applied as a foliar spray or drench. Cycocel is used extensively on geraniums and poinsettias, and multiple spray applications are usually applied. Phytotoxicity can occur with rates greater than 1,500 ppm on geranium or poinsettias.

Bonzi is a paclobutrazol and is one of the more active PGRs. It is not actively transported within the plant (phloem), so applications to the leaves do not readily move to other parts of the plant. Bonzi is readily absorbed by the stems or roots and transported by the water flow (xylem) to the growing point. Bonzi is used as either a foliar spray or drench. Typically only a single application is made, although some growers do experiment with multiple applications at lower rates. Late applications or excessive rates can cause stunting or delayed flowering. Piccolo was introduced into the U.S. market in 2003, and it is also a paclobutrazol. In our trials at North Carolina State University over the past two years, both paclobutrazols had similar efficacies as sprays and drenches.

Sumagic's degree of activity, uptake, and use is similar to that of Bonzi. It has the advantage of having a greater degree of efficacy than Bonzi on many crops, and only about half as much chemical is needed to obtain control. The high degree of activity requires that growers accurately mix and apply Sumagic. Overdose applications can lead to stunted growth.

Topflor is a new PGR that is being registered for use in the United States. Registration is expected in 2005. Topflor has been used in Europe since the mid-1990s. Its degree of activity is between Bonzi and Sumagic, and it also has excellent activity on a wide assortment of crops.

Florex is not actively transported within the plant, but is readily absorbed by the leaves and stems. So uniform coverage is required to obtain optimal results. It is applied as a foliar spray. Florex is not an anti-gibberellin, but it prevents flowering and promotes branching of stock and finished plants. Residual effects can last six to eight weeks, so timing of application is important.

Efficient Use of PGRs

There are a number of factors that influence the efficacy of PGRs. Each one needs to be considered in order to obtain suitable and consistent results.

Timing. PGRs work by controlling cell elongation before it occurs. They are not plant shrinkers. Therefore, the timing is important to match the application with the desired stage of growth to prevent stretch. Recommendations vary by the type of PGR used. For many crops, the less active PGRs like A-Rest, B-Nine, and Cycocel require the first application be made within a few weeks of potting the plant. This is generally when there is 1 inch to 2 inches of new growth. Growth is controlled in stages by the use of multiple PGR applications. This allows for the greatest flexibility in deciding when and how much chemical to apply so factors such as weather conditions and plant vigor can be taken into consideration.

PGRs like Bonzi and Sumagic have a greater efficacy, and applications are made when the plant has developed sufficient canopy growth. For example, with fall pansies, the Bonzi label recommends an application when the plant is 2 inches in diameter; while the Sumagic label recommends applying it when the plant is near final height (3 inches tall). In general, only a single application is

Table 1. A comparison of plant growth regulator attributes used for height control¹.

Factor		A-Rest	B-Nine	B-Nine Cycocel
		Chemical	Ancymidol	Daminozide
Formulation (active ingredient)		0.0264%	85%	
Level of Activity		++	+	+
Difficulty of Use		++	+	+
Multiple Applications		++	+++	+
Application Types	Foliar Sprays	yes	yes	y
	Drenches	yes	no	r
	Dips	cuttings	cuttings	
Chemical Absorption	Relative ease of absorption	+++	+	
	Time required (Hours)	0.5 to 1	18 to 24	18 to 24
	Factors that improve absorption of foliar sprays	normal greenhouse conditions	high humidity and limited air movement	high humidity and limited air movement
	Translocation in the plant (once absorbed)	+++	+++	+
Absorption Sites	Leaves	+++	+++	+
	Stems	+-		
	Roots (substrate)	++	-	
Typical Concentrations (for actively growing plants, excluding plugs)	Foliar sprays (ppm or mg/L)	15 to 50	1,250 to 5,000	B-Nine 2,500 Cycocel 1,500
	Drench (mg active ingredient per pot)	0.125 to 0.5	--	
Other Factors	Does pine bark affect a drench?	++	-	
	Phytotoxicity potential	++		+
	Overdose potential	++		+
	Influence of irrigation water pH	-	----	
Shelf Life	In the bottle (years)	at least 3	at least 2	
	Mixed spray solution	within 24 hours	within 24 hours	within 24 hours

Symbols: (-) not applicable; Degree of activity: (+) less to (+++) greater.
¹ Check the label for legal uses.

made. Labels for all of the PGRs have recommendations for how late an application can be made in order to avoid a delay in flowering or smaller flowers.

Target. The target tissue or plant part to treat when applying a PGR depends on the chemical type and the plant species. Most PGRs are applied as a foliar

spray. Sprays are a very cost-effective and time-efficient way to apply PGRs.

Substrate drenches also work effectively for a number of plants. In general, the time that it takes to apply a drench makes it suitable for plants where foliar sprays are not as effective. Examples include many of the spike-flower producing perennials, dahlias, and many of the bulb crops.

Environmental Conditions. Environmental conditions can have a significant impact on the efficacy of a PGR. Applying PGRs early in the morning (when the evaporation rate is lower) will allow for greater chemical uptake. Plants should not be water stressed when PGRs are applied. The risk of phytotoxicity increases with stress. After application, the PGR should be

allowed to dry, and wetting the leaves should be avoided. B-Nine should be applied at least four hours before wetting the foliage, while most of the other PGRs only require one hour.

Check Plants.

How well does the PGR treatment really work? The only way to confirm the efficacy of a PGR is to leave a few representative plants untreated. These “check plants” offer a valuable insight into ways to adjust future PGR applications.

Dosage. The dose to apply to a crop is based on two factors: 1) the solution concentration and 2) volume of solution applied per area.

Foliar sprays require an even application to obtain consistent results. To accomplish this, a dose is based on:

- a. measuring out a known amount of chemical;
- b. adding it to a known volume of water; and
- c. applying a spray to a known bench area. Most foliar sprays are applied at the rate of 1 gallon per 200 square feet of bench area.

Drench applications are based on:

- a. measuring out a known amount of chemical;
- b. adding it to a known volume of water; and
- c. applying a known volume of the drench to each pot or plant.

The volume of drench applied increases with the pot size (specifics are listed on each product label). For instance, 2 ounces of drench solution should be applied to a 4-inch pot, 3 ounces to a 5-inch pot, 4 ounces to a 6-inch pot, and 10 ounces to an 8-inch pot.

When mixing PGRs, great care must be given to accurately measure and apply the chemical. As always, the label contains the legal mixing information. The North Carolina State University website (www.pgrinfo.com) contains a free downloadable Excel® spreadsheet which enables you to calculate PGR rates. A CD version can also be purchased from the North Carolina Commercial Flower Growers’ Association (919-334-0093).

PGR Rates. Recommended rates for the commonly grown floricultural crops are listed on the chemical label. These should be used as guidelines, and adjustments should be made for your particular location. Keeping complete records about how well a PGR application worked will assist you in customizing future PGR rates to your own operation. The records should include stage of development, fertilization program, and weather conditions.

Plant Growth Regulator Types					
Line + Cocel	Bonzi / Piccolo	Cyocel	Florel	Sumagic	Topflor
-	Paclobutrazol	Chlormequat chloride	Ethephon	Uniconazole	Flurprimidol
-	0.4%	11.8%	3.9%	0.055%	0.38%
+	+++	+	+	+++	+++
+	+++	+	+	+++	+++
+	+	+++	++	+	+
es	yes	yes	yes	yes	yes
no	yes	yes	No	yes	yes
-	bulbs, cuttings	cuttings	cuttings	bulbs, cuttings	bulbs, cuttings
+	+++	+	++	+++	+++
to 24	0.5 to 1	4	12 to 16	0.5 to 1	0.5 to 1
humidity limited air movement	normal greenhouse conditions	high humidity and limited air movement	avoid sunny, hot conditions	normal greenhouse conditions	normal greenhouse conditions
++	+	+++	-	+	+
++	+	+++	+++	+	+
+	++	+	+-	+	+++
+	+++	+	-	+++	+++
1: 750 to 1000 + 1: 750 to 500	2 to 60	1,000 to 3,000	250 to 1,000	1 to 50	2 to 60
	0.1 to 3	300 to 500	-	0.125 to 3	0.1 to 3
-	++	-	-	++	++
+	+	+++	++ avoid plant stress	++	
+	+++	+	++	+++	+++
			works best at water pH of 4	--	
-	at least 4	at least 2	indefinite	at least 2	at least 2
24 hours	within 1 week	within 24 hours	within 24 hours	within 24 hours	within 24 hours

Research has also been conducted on dipping. This procedure is most commonly conducted with rooted cuttings prior to transplanting or with bulbs. For many crops, a specific PGR concentration and dipping time should be followed. Dips are an excellent method of applying PGRs, but disposal of the leftover dip solution is a concern.

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Academic Update: Virginia Tech



by Joyce G. Latimer

When Bob Lyons left Virginia Tech for the J.C. Ralston Arboretum at North Carolina State University (NCSU), he took the existing floriculture program with him. But within a short year, a new floriculture program was formed. With Holly Scoggins from NCSU and Joyce Latimer from the University of Georgia arriving within days of one another, the new Virginia Tech floriculture program was born. A few months later, Velva Groover was hired as the floriculture research specialist to manage the research activities and to assist with the budding floriculture teaching and Extension programs.

Joyce Latimer is the Extension specialist for greenhouse crops and maintains the research program on growth regulation of perennials that she initiated in Georgia more than 12 years ago. She is actively involved in grower education programs and serves as the educational advisor to the Virginia Flower Growers Association (VFGA) and the Southeast Greenhouse Conference. Joyce, along with Holly, is putting the finishing touches on the completely revised "Greenhouse Operator's Training Manual" published by the VFGA, which made its debut at the Southeast Greenhouse Conference in June.

"Dr. Holly" teaches floriculture crop production, herbaceous landscape plants (I & II), public gardens maintenance and management (I & II), and is currently developing an online greenhouse management course with Joyce.



and Holly L. Scoggins

Holly is the faculty advisor for the Virginia Tech Kappa Chapter of Pi Alpha Xi, works with the Horticulture Club, and will give talks on anything and everything from growing media to woodland wildflowers. She is also the director of the Virginia Tech Horticulture Garden – 2 acres with ambitious expansion plans for an additional 5 acres. Holly's research emphasis has followed her pedigree in floriculture nutrition gained from the University of Georgia and NCSU. But her interest in new crops has also led down some intriguing research paths.

Velva Groover holds a Master of Science in horticulture and, as floriculture research specialist, is responsible for managing the floriculture research program. As an integral part of the program, she helps with several graduate projects along with the faculty research projects. She also participates in and presents at local and regional workshops and conferences.

Although Holly, Joyce, and Velva make up the base of the floriculture team, they have developed cooperative programs with other Virginia Tech faculty including Tom Banko in horticulture at the Hampton Roads Ag Research and Extension Center (HRAREC), Chuan Hong in plant pathology (HRAREC), and Ed Lewis in entomology. In particular, they are working on an integrated plant health management plan for production of herbaceous perennials. This ongoing research project has received funding

from the Fred C. Gloeckner Foundation and the Virginia Agricultural Council.

Other, more specific, projects are described below:

Nutrient Monitoring Guidelines for Container Production of Herbaceous Perennials (H. Scoggins)

An ongoing effort as part of the collaborative effort "Production of Herbaceous Perennials: Development of an Integrated Plant Health Management Program" described above. This study defines pH and soluble salts levels obtained with the pour-through method of media solution extraction for many widely grown perennial species. The effect of varying fertilizer rates on growth and quality will also add to the cultural information for greenhouse- or nursery-grown perennial crops.

Media Selection and Fertilizer Type and Rate: Effects on Container-Grown Herbaceous Perennials (H. Scoggins)

Potting media is a production input that impacts total cost of production, and may influence time to finish and product quality. Is the added expense of a commercial mix justified by higher quality and/or quicker crops? This ongoing project compares the growth of several species of herbaceous perennials in both a traditional nursery media of pine bark and sand, and the commercially available pre-mixed growing media containing sphagnum peat moss, vermiculite and/or perlite, and other amendments in addition to the pine bark. Various rates of slow-release fertilizer were added, and the nutrient holding capacity of the media is being compared.

Propagation and Cultural Requirements of *Strobilanthes dyerianus* – Persian Shield (H. Scoggins and E. Gamrod)

Discussions with University of Georgia's Allan Armitage revealed a problem in the production of Persian Shield – one of the Athens Select™ plants. Growers were reporting difficulty

ofa Academic Update

maintaining a vegetative state in stock plants held over the winter under greenhouse conditions. The objectives of this research were to explore various techniques to inhibit flowering and promote branching of stock plants, including photoperiod manipulation and application of ethephon. The project evaluated the plant's performance at different levels of fertilizer.

Plants were treated with photoperiods of 8, 10, and 12 hours and a 4-hour night interruption. An additional photoperiod study subjected plants to 8-, 12-, and 16-hour photoperiods at two temperature regimes: 17°C day/14°C night and 24°C day/21°C night. The data did not give a clear indication of the critical photoperiod or of the effect of temperature in inhibiting flowering. Flowering occurred sporadically under all photoperiods and temperature regimes. Further studies will be necessary to unravel this mystery.

Another study examined potential for ethephon sprays to keep plants vegetative. The rates of 0, 150, 300, 450, 600 and 750 mg/L were applied weekly, biweekly, or monthly, and plants were grown under short-day conditions. None of the tested rates or application frequencies were sufficient to maintain vegetative plants.

Nutritional requirements were also examined. Plants were irrigated with 15-5-15 Cal Mag fertilizer as a constant liquid feed at 0, 100, 200, 300, or 400 mg/L nitrogen (N). High quality plants were obtained with 100, 200, 300, and 400 mg/L N, with these plants showing no difference in quality. Largest plants based on shoot dry weight and leaf area were found at the 200 mg/L N treatment. Foliar macro and micronutrient sufficiency standards were also developed for tissue testing. This work was the master's project for Erin Gamrod, graduate research assistant, and was funded in part by a research grant from the Ohio Floriculture Foundation (now merged into FIRST).

Greenhouse Production of *Rosmarinus officianalis* – Rosemary (H. Scoggins and P. Westervelt)

Rosemary has a reputation as a difficult crop to grow under greenhouse conditions. Over-watering and poor media drainage lead to crown rot and aerial blight by *Rhizoctonia* spp. This project tested a wide variety of soilless mediums under differing irrigation regimes to find the best combination of drainage and nutrient retention. It also evaluated fertilizer regimens to produce high quality, marketable plants by monitoring media pH and EC ranges. This work was the master's project for Paul Westervelt, graduate research assistant.

A total of four experiments were conducted examining the effects of irrigation, fertilization, and growing media in various combinations on rosemary shoot and root growth in the greenhouse.

Plants were grown at 50, 100, 150, 200, and 300 mg/L N constant liquid feed from a complete fertilizer. The largest shoot and root dry weights resulted from 50-200 mg/L N, and all plants were of marketable quality. This indicates rosemary can be grown effectively at low fertility rates.

Another study included growing rosemary in five different commercially available mixes with varying components and water-holding capacities. Plants were irrigated to a 20 percent, 30 percent, or 40 percent volumetric moisture content (VMC) as determined by a Theta Probe moisture meter. Plants grown at the 30 percent VMC had the highest root and shoot dry weight, but plants across all irrigation regimes (including those watered almost every day) were equally marketable. While plants experienced the tip dieback reported by many growers, it could not be consistently linked to any treatment. The plant disease clinic determined it was not pathogenic and it did not affect root or shoot dry weight. The experiment was repeated, and after 12 weeks, there were no concrete differences among treatments.



Propagation and Evaluation of *Astilbe biternata* (H. Scoggins and B. Trader)

The only *Astilbe* native to North America, *A. biternata* (False Goat's Beard) is relatively rare with very few nurseries offering it. Not the usual ephemeral wildflower, *A. biternata* is quite distinctive. Bold, biternate foliage is topped by creamy white, gracefully drooping flower panicles. Reaching 2 to 3 feet in height, it provides summer flowering and stature in the shade garden. Found infrequently in moist shaded areas of mountain forests of the Appalachians, *A. biternata* is hardy from USDA Zones 4 to 8. Micropropagation as a potential technique for rapid multiplication of *A. biternata* is being investigated, with the assistance of Richard Veillieux (Virginia Tech Department of Horticulture) and his lab. Standard tissue culture techniques will be employed for shoot apex culture, axillary shoot proliferation, and somatic embryogenesis. These three methods will be evaluated based on the number of plantlets produced, time to transplant, and transplant success in the greenhouse. However, there is another unusual aspect of *A. biternata*: it is sub-dioecious, and the size of the inflorescence is a function of sexual genotype. Selection of female non-fruiting plants will result in maximum flower panicle size and be used for future vegetative propagation. This work has been funded in part by the Virginia Nursery and Landscape Association and is part of Brian Trader's doctoral work.

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Growth Regulation of Herbaceous Perennials (J. Latimer and V. Groover)

Joyce has continued her long-term research focus on identifying effective plant growth regulator rates for perennials with research management help from Velva Groover. With an emphasis on testing PGRs on new crops and evaluating methods of application, they expanded the list of crops evaluated and now work in both greenhouse and nursery production conditions. Additional work in the use of labeled and experimental branching compounds on perennials was conducted with former graduate student, Sadie Puglisi, using on-campus facilities and on-site at Riverbend Nursery in Riner, Virginia. The overall goal of the project is to develop effective PGR rates for growth management during production and shipping without excessive persistence of growth reduction in the landscape.

Nutrition and PGR Rates for Container-Grown Spiderwort (J. Latimer, H. Scoggins, S. White)

Sarah White, graduate research assistant, has a passion for spiderwort, but production problems limit its availability in the trade. The objective of this project was to determine fertilizer and PGR rates for high quality growth of spiderwort (*Tradescantia virginiana*) in a greenhouse production setting. Three PGRs at ascending rates were foliarly applied to three spiderwort cultivars during the spring growing season. The most effective rates for height suppression were Bonzi at 120 ppm, Sumagic at 45 ppm, and Topflor at 45 ppm. Three spiderwort cultivars were screened for their growth response to several nitrogen rates. Plants fertilized with 100 or 200 ppm N (15-16-17) were similar in quality and marketability.

The researchers examined how fertilization rate affects the persistence of PGR growth control during the summer growing season, but the PGRs did not suppress plant growth. Plants fertilized with 200 ppm N were larger than those fertilized with 100 ppm N, regardless of

PGR treatment. Plant quality was similar, and plants were marketable. The results of these studies indicate that PGR effectiveness in suppressing plant height may be dependent upon season, with PGR application to spiderwort only being necessary during the spring growing season.



Developing Optimum Chemical and Cultural Practices for the Production of Rudbeckia and Phlox (J. Latimer and S. Hill)

This research, conducted by Latimer and graduate student Shannon Hill, will determine optimum rates of irrigation, fertilizers, and plant growth regulators, as well as the best type of media to use for growing *Rudbeckia hirta* and *Phlox paniculata*. In the fall, optimum rates of these cultural factors (irrigation, fertilizers, and media type) will be integrated with a range of PGR treatments to evaluate disease resistance following inoculation with powdery mildew. This information will contribute to the plant health management plan for perennials production.

Extension Programs

As with all good floriculture programs, Virginia Tech also has an active Extension program. An annual perennials production program has been well-received by Virginia growers. After the initial program in Louisa, Virginia, the program is now held in September each year on the Blacksburg campus to showcase the Virginia Tech Horticulture Gardens and the extensive array of perennials that Holly has added to these gardens and to showcase ongoing research.

Joyce has presented a number of seminars about getting started in the greenhouse business, while Holly offers cut flower production seminars. A basic greenhouse production seminar was held in January 2002 in 10 locations around the state and in Tennessee that utilized many of the graduate students in the department. It was an excellent experience for them, and the attendees gave it excellent reviews. This program was followed with a more advanced training program in 2003 in five locations in the state. In addition, specialized production programs in geraniums and vegetative annuals have been conducted cooperatively with Brian Whipker at NCSU to maximize resources in both states. The Virginia Flower Growers Association has been an active co-sponsor of greenhouse Extension programs along with the major horticultural distributors in our area, Maryland Plants and Supplies, Griffin Greenhouse and Nursery Supplies, and Wetsel.

Summary

In summary, Virginia Tech's floriculture program is young in years but is very organized, active, and responsive to student and grower needs and input. Holly has already expanded the undergraduate course offerings in floriculture, and the development of the online class will make floriculture training available to a wider range of students. Our research program focuses on issues related to perennial plant production and landscape use. Our Extension program is broad-based to address the entire cadre of floriculture production issues.

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Keeping Up With Nutrition

by Dean Krauskopf

Nutrient balance, intensity and availability are the keys to a successful fertility program; but everything is based upon a healthy, active root system. Fertilizer ions don't move into or out of the roots and nutrient deficiencies begin if roots are too cold or too hot or starved for carbohydrates because of reduced photosynthesis. Roots damaged by pathogens or low oxygen are not able to take up nutrients or prevent ions such as aluminum from moving into the plant. High levels of aluminum and sodium in the foliage can be the first indications of a root problem.

Intensity

Intensity, the total number of ions surrounding the roots (measured as electrical conductivity [EC] or soluble salts), can be difficult to manipulate because of irrigation water quality, changing optima as the plant grows, cultivar differences, and regulatory limits on the amount of ions allowed in drainage water. Optimum intensity levels vary depending upon the stage of development (plugs versus mature plants) and crop. Too low intensity (less than 0.75 mS/cm saturated media extract [SME] method for pot plants) will slow or stop plant growth, and can be increased by adding additional nutrients or decreasing the leaching fraction. If you are applying liquid fertilizers, a problem can occur during periods of slow growth (low light, young plants), because you are not irrigating frequently and nutrient intensity is dependent upon nutrients held in the media. Options are to increase the exchange capacity of the media so more nutrients are held or use controlled-release fertilizers.

Media solution ion concentrations greater than 3.5 mS/cm (SME method) cause water to move out of the root even when the media is moist (physiological drought), and lead to reduced total growth, slowed growth rates, and damage to leaves and flowers (salt burn). These symptoms may occur at much lower intensities for sensitive crops. Many growers find it difficult to reduce

intensity (EC) because of high soluble salts in their irrigation water. This may become more common as high quality water is reserved for drinking and manufacturing. Increasing the leaching fraction, reducing the nutrient holding capacity of the media, reducing the amount of fertilizer applied, changing fertilizer formulations, or switching water sources are options for managing salt problems.

High quality plants can be grown at low fertilizer rates using systems such as ebb and flow where little or no leaching occurs, with controlled-release fertilizers (CRF), or in combination (Morvant et al. 2001). High fertilizer rates in the irrigation water cannot overcome excessive leaching. The media EC remains below optimum while most of the fertilizer is lost in run-off (Yelanich and Biernbaum. 1993).

Optimum levels of soluble salts differ for specific cultivars; however there is little data in the literature (Whipker et al. 1999), and most industry information is observational rather than research-based. This is an area that needs systematic attention not only to most efficiently produce high quality crops, but also to reduce the amount of nutrients leaving the pots – since I feel most growers err on the high side and are applying more nutrients than necessary.

Availability

Availability is controlled by the frequency of fertilization, amount of ions held by the media (cation exchange capacity [CEC]), and pH. Frequent fertilization at low rates is desirable to maintain nutrient availability, since the CEC of most media is quite low. Fertigation (fertilizer in the irrigation water) has proven quite useful, since water use increases in tandem with plant growth and nutrient demand. Excess fertilization when growth slows can rapidly cause excessive EC. Continuous liquid feed and increasing media CEC by adding components such as calcined clays can maintain availability while reducing the amount of liquid fertilizer

applied. Precharged alumina (Williams et al. 2000) and zeolites (Carlino et al. 1998) used as media components can release enough nutrients to grow quality plants with very low nutrient concentrations in the media solution compared to conventional fertigation. More research is needed to understand how best to overcome physical and pH problems. Researchers are also looking at composts and other organic materials as both structural media components and as nutrient sources with the goal of minimizing nutrient leaching.

Nutrient solubility is controlled by the pH of the media solution. Control of pH has become a greater problem since new crops and cultivars (Albano and Miller. 1998) vary widely in how efficiently they take up iron and manganese. Inefficient crops such as petunia and calibrachoa cannot take up sufficient iron and manganese at media pH above 5.8; while at that pH, efficient crops such as New Guinea impatiens, marigold, and geranium take up so much iron and manganese that tissue levels become toxic. Most crops fit between these extremes. The latest work on controlling pH has been summarized in *Understanding pH Management for Container-Grown Crops*, Meister Publishing. Unfortunately, some of the most valued plants in mixed containers (such as geranium and calibrachoa) have opposite pH optima; only breeding and selection for varieties that are not as extreme in their requirements will totally solve the problem.

The plant controls the pH of the media solution immediately around the root and can influence the pH of the entire medium. This perhaps precipitates the sudden pH drop that has bedeviled geranium growers (Nelson and Huang. 2003). As nutrient intensity is reduced to minimize leaching losses, the plant's influence on media pH will become more of a factor. The specific mechanisms of ion uptake, including pH control, are not completely understood; so breeding or utilizing genetic

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Keeping Up With Nutrition

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engineering to change uptake patterns is difficult, slow, and expensive.

Nutrient Balance

Nutrient balance is the optimum relationship between ions in the plant. Balancing nutrients and other ions available to the plant is necessary to avoid nutrient deficiencies, competition between nutrients during uptake, and toxicities. Quality crops can be grown at suboptimal or high intensities as long as the media nutrient solution is balanced. A ratio, expressed in ppm, of 13 Nitrogen: 1 Phosphorus: 13 Potassium: 7 Calcium: 2 Magnesium: 2 Sulfur (John Biernbaum, Michigan State University, personal communication) seems to be useful for most crops.

Manipulating the amount and form of nitrogen has been used for years to control plant growth, especially in bedding plants. Recent recommendations are to hold all other nutrients steady and use only nitrogen rate to control growth to maximize plant quality. Generally, a ratio of ammonium to nitrate greater than 1:4 will increase growth rate as well as cause media pH to decrease, while the opposite is true for ratios favoring nitrate.

A balanced fertilization program must take into account not only the nutrients found in significant amounts in irrigation water, primarily calcium (Argo and Fisher. 2003), but also sodium and chloride which can interfere with uptake of other ions or accumulate to increase EC to unacceptable levels. Boron levels above 0.5 ppm can lead to boron toxicity.

Floricultural media and foliar nutrient standards are based upon individual nutrient levels (critical value approach [CVA]) rather than nutrient balance, except for the percentage total salts approach in media analysis (Warnke and Krauskopf. 1983). There is no system in floriculture such as DRIS (diagnosis and recommendations integrated systems) in fruit and other crops, where the degree of deficiency or

excess can be mathematically determined and appropriate recommendations made (Paparozzi. 2003). DRIS values for floriculture crops would provide much greater precision in fertilization recommendations, which is increasingly important as the industry deals with strict water quality regulations.

Testing

Both pH and EC provide most of the information needed to monitor a nutritional program; so every grower should invest less than \$400 in quality testing instruments, make sure they are calibrated each time they are used, and test regularly. Weekly tests are standard, but media chemistry can change rapidly in plugs because of their small volume – so some growers test daily or every other day.

There are a number of testing procedures that can be used. The oldest test procedure is 1 part distilled water to 1 part media for pH and either 1 part media to 2 or 5 parts water for EC. Media should be air-dried for accurate results. SME is easy to master and is much quicker, since the media doesn't need to be dry for reproducible results. The pour-through (Wright, R.D. 1986) and squeeze tests (Scoggins et al. 2001) have been validated, and there are tables available showing comparable values for each test. The squeeze test for plugs is destructive, so consider planting extra flats of pH-sensitive crops and cultivars just for testing.

Testing should begin before the crop is planted. Irrigation water should be tested before every crop cycle, since water chemistry is greatly influenced by the amount of rain in the previous months. Media should be placed in pots, placed on the bench, and watered as it would be if a crop were present. Test for pH and EC daily until test values stabilize. The faster the media pH reaches 5.8, the less opportunity for geraniums and other efficient crops to take up enough iron and manganese to cause toxicity symptoms. It's very common for media pH to be in the ideal range by the time symptoms are apparent. Media samples should be moist for least three days before being sent to a laboratory for analysis; this gives the nutrient charge in

the media enough time to dissolve and come into equilibrium. Samples sent dry to the lab aren't moist long enough during the SME procedure for this to occur, and the data isn't representative of the root environment early in the crop. A gallon-size plastic bag of dry media should be collected from each batch or load, marked with any identifying batch numbers, and stored until the crop is gone from the greenhouses. Media chemistry can change greatly before symptoms occur, so it's very difficult to diagnose the cause of a problem unless the initial chemistry can be determined from the stored sample.

Data from pH and EC tests during the crop should be plotted or entered into a program such as Dr. Paul Fisher's Florasoil, so trends can be determined and minor corrections made rather than having to react to problem situations. For normal crops, a media and foliar sample should be sent to a laboratory for a complete analysis long enough after planting for the crop to be actively growing, but not so late that corrections cannot be made before the crop is sold. Media analysis tells what the plant could take up, while foliar analysis indicates what the plant did take up; and any differences between the two are important. Foliar analysis is also the best way to determine micronutrient content – critical information for iron/manganese-sensitive crops.

Problem diagnosis requires both foliar and media analysis. Nutritional standards haven't been developed for many new crops, so send samples from problem plants and normally growing plants in the same area to the lab so you can compare the results. Accurate interpretation of foliar analysis data is very dependent upon the sample being taken from the correct location on the plant at the proper time during the crop and correct handling after sampling, so follow your laboratory's instructions exactly.

Web Sites

The holy grail of greenhouse plant nutrition information on the Web is found at the North Carolina State University (NCSSU) Plug Research and Information Development Center, <http://www.ces.ncsu.edu/depts/hort/>

floriculture/plugs/index.htm, and the NCSU Horticulture Substrates Laboratory, <http://www2.ncsu.edu/unity/lockers/project/hortsublab/pubs/index.html>. Pour-thru and squeeze test standards, water relations, media components, alkalinity control, and fertilizer calculation programs – it's all there.

Paul Fisher's site (ceinfo.unh.edu/agriculture/documents/flora.htm) has the Florasoil computer program for graphically tracking your test results and articles on iron and managing the pH of growing media (a Spanish version is also available).

Books All Growers Should Have on Their Bookshelf

A Growers Guide to Media and Nutrition for Greenhouse Crops, David Wm. Reed, editor, Ball Publishing. This book is a collection of articles on all phases of greenhouse plant nutrition. It's well written, an excellent reference, and available in Spanish.

Greenhouse Operation and Management, 6th Edition, P.V. Nelson, Prentice Hall. This is one of the best books available on greenhouse operation and includes outstanding sections on nutrition. It's easy to read and a great reference book. If I could have only one book on my shelf, this would be the one.

Understanding pH Management for Container-Grown Crops, William R. Argo and Paul R. Fisher, Meister Publishing. Drs. Argo and Fisher have done a tremendous amount of research on pH control and brought it all together in a book that covers all aspects of the topic. If you have a question about media pH, you'll find the answer here.

For the Hard Core

Greenhouses, Advanced Technology for Protected Horticulture, Joe J. Hanen, CRC Press. Along with information on greenhouse engineering and plant production, this book contains one of the most extensive summaries of the chemistry and physics of media and

plant nutrition available; but since it was published in 1998, it doesn't include some of the latest information. It's not easy reading, being targeted toward advanced growers and researchers; but a great attraction is Dr. Hanen's pithy and at times stinging comments and opinions.

Plant Analysis Handbook II, Harry A. Mills and J. Benton Jones, Jr., MicroMacro Publishing. This is especially useful for those routinely using foliar analysis for monitoring and problem diagnosis. It provides a good discussion of sampling and various analytical procedures and an extensive listing of foliar analysis values for many greenhouse crops, trees, shrubs, and herbaceous perennials.

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Energy Costs – A Reality Check

by Alan Zylstra

Dejá Vu? Gas prices spike for a few months, they fall back to previous levels, everything returns to “normal.” Just like before, right? Maybe the energy companies are up to no good, and we just need to take another truckload of executives off to the hoosegow. Maybe last year’s cold winter caused the increases... maybe the war... How about relying on oil instead of gas; it’s cheaper right now. Just figure out how to get through this season, and it’ll be OK.

Probably... No

Ignoring the upward ratcheting fuel prices is at your own peril. Assuming that petroleum prices will somehow magically remain well below gas prices and therefore provide an escape is equally perilous.

Some pretty reliable people with good “inside” intelligence have been warning us that things won’t be getting better anytime soon. “Everyone from (Federal Reserve Chairman) Alan Greenspan to U.S. Energy Secretary Spencer Abraham has been warning that natural gas prices are likely to go up by 20 percent to 30 percent this winter,” says Liz Robinson, director of the Energy Coordinating Agency. Quoted in a June Wall Street Journal article, Greenspan warned that “... consumers and businesses... won’t see any relief soon...” and “We are not apt to return to earlier periods of relative abundance and low prices anytime soon.”

The problem runs much deeper than just one frosty season. It’s really pretty simple. The forces driving up the costs are fundamental: demand for natural gas has been rising sharply since the 1980s, and gas production has not kept pace. Natural gas reserves were reported as of January 8, 2004, as 8 percent over our five-year average, “... but demand has increased substantially more than that.”

Furthermore, prices have not been high enough to support additional gas exploration (when and if allowed), transportation pipelines, or to accommodate construction of LNG (Liquefied Natural Gas) terminals. Something has to give... and I think it’s us.

Higher fuel prices are here to stay. In fact, since natural gas is predicted to replace oil as the main energy source in electrical

generation plants (and possibly vehicles) in coming decades, the demand for natural gas is expected by some experts to increase by 500 percent over the next 30 years.

It is time to take a horizon view of your heating costs and how to reduce them long term. Look beyond the short-term fixes and ways to quickly cut fuel consumption to just get through another winter. These short-term approaches nearly always sacrifice some other aspect of production such as quality, selection, crop time, chemical costs, etc. The only reason to be switching to a colder growing crop is if the market is demanding it, not just to cut fuel bills. As always, remember the main thing... why you’re in business – to grow and sell beautiful plants that consumers want to buy.

Make A Plan

So, stop, take a deep breath, and resolve to immediately undertake the development of a game plan of how you are going to make your operation energy efficient for the long term. Not just the next 12 to 24 months, but for the next 10 years and beyond. And, there is quite likely no time like the present. Interest rates are low, energy costs and potential dollars saved are high and promising to rise, and new tax incentives are quite appealing. Here are a few basic steps to follow to create a plan:

1. Resolve to look long: Base your investment decision on a realistic Return On Investment (ROI) calculation or Return on Capital calculation, rather than relying on a frequently misleading “years payback” method. Five years is the reasonable “payback” period for a hot water heating system. Your heating system needs to serve your facility for far more than one to three years, so look at your costs and returns for longer than one to three years. A properly designed heating system will deliver efficient service far past 10 years, so looking out to five years or even longer is logical. A system that would deliver a five-year average ROI of 14 percent or a 20 percent annual Return on Capital would be rejected for not meeting a one- to three-year payback test, without even considering the effect

of future fuel price increases!

2. Audit yourself: It’s the first thing Arnold did as the new governor of California, find out where the money was really going, and you should too. You’ll probably want to enlist the help of a professional to accomplish this. An energy audit will identify your current efficiency numbers and the source of your energy losses. You’ll need to pull together fuel bills for at least one year. Two or more years of data will factor out seasonal data and weather circumstances. This will establish the current operating fuel use efficiency of your facility. A follow-up inspection will then identify areas of excessive energy loss or consumption, including an inventory of all heating equipment. This will provide the information basis to formulate a list of possible equipment upgrades and/or conservation projects at your facility. Audits my company performs frequently reveal surprisingly low efficiencies, many in the 50 percent to 60 percent range and some well below 50 percent! You may go through the roof when you see how many of your profit dollars have already gone that way... or up the chimney. Be sure to check it out.

3. Relate your costs: What is the cost of fuel as it relates to other key factors? What is it as a percent of gross sales and gross profits; percent of net profits; cost per square foot; cost per unit of production (tough to come by but give it a shot)? This will help establish the appropriate level of importance and impact on overall business strategies. Perhaps see how you could compete a little better, improve your bottom line, or both.

4. Set targets: Set a realistic energy savings target for your facility. It may be expressed as a dollar savings goal, efficiency targets, or percentage improvement. Most facilities in the United States can accomplish an overall improvement of 15 percent to 20 percent, and many can accomplish substantially more than that. Remember, increasing your overall fuel efficiency from 50 percent to 70 percent is an increase of 40 percent. If you’re spending a dollar a foot now, what does that add up to? This number will help you establish a capital improvement budget.

5. Make a budget: Establish a special capital improvement budget for conservation retrofits based on a reasonable ROI target. Be realistic based on your existing system and facilities. Start with a simple calculation to establish a budget base to work from: take your past 12-month fuel bill, multiply by 15 percent, and multiply that by 3. That's \$33,750 on a 100,000-square-foot facility that spent \$75,000 in fuel last year. Your actual budget may need to be substantially higher than this, or maybe less.

Say, for example, your facility is relatively new, with good heating systems running and a 70 percent efficiency. You'd like to bump it 10 percent to 77 percent. Perhaps a relatively small investment will do the trick and pay back in three years or less – some pipe insulation, a new boiler, combustion air separators for your unit heaters, etc. Another example – your facility is old, and the person who designed the heating system died a number of years ago. You've taken to sleeping on the heating pipes on cold winter nights so you'll know when the system dies. You stopped growing warm crops years ago because of the cost of heating or inability to hold temperatures. You'll need to adjust your thinking and think in terms of dollars per square foot. But, the good news is that the current combination of high fuel costs and low cost of money makes the ROI or payback period quite attractive on most of these investments. Remember, you may need to set up the project in phases, implementing it over a period of two to five years.

6. Know your stuff: You will be focused on increasing fuel efficiency; it seems logical then to understand the terminology related to heating system efficiency. Unfortunately, for the uninitiated, 80 percent frequently (usually?) doesn't translate to an actual 80 percent. Knowing how to determine this and what to ask will help you avoid making a large investment based on misleading efficiency claims that won't meet your target. Do you know the difference between **Combustion Efficiency** (the highest possible efficiency number), **Thermal Efficiency**, and **Annual Fuel Utilization Efficiency (AFUE)** or **Seasonal Efficiency**? Not surprisingly, the least efficient equipment generally uses the most optimistic method of

stating efficiency. It is common for commonly used boilers and unit heaters to deliver actual Seasonal Efficiency of 6 percent to 15 percent lower than its stated Combustion Efficiency.

7. Determine your design priorities: In what order of priority do you place the following: system reliability/serviceability, fuel efficiency, uniformity of heat distribution, initial cost? This will be your guide for selecting system design(s) and components for your facility, and establishing it in advance will help you quickly sort through the various options available and select the most appropriate one. These priorities vary from grower to grower, often depending on the crop being grown. A plug producer or propagator may place heating uniformity at the top of the list, while this may be less important to a small bedding plant finisher. Efficiency may top the list for a grower in a high energy-cost area, but take second place to system reliability for a really large facility in a low energy-cost area. Pick your priority and remain a little flexible.

8. Make a list of possible projects... and rank them by lowest cost and then again by highest return. It will probably take a few years to work through the plan. This will help you sort through and prioritize the options based on the budget available in a given year and other variables that occur during the life of the plan.

9. Find the money: Identify equipment rebates, conservation grants, and interest-abated loans that may be available. Substantial dollars are being found from a variety of sources by growers to apply to heating and water conservation projects. Contact the marketing department of your local utility and your state's Department of Energy; talk to industry heating and environment system experts; and check with your local growers association and the local agriculture association. Enlist their assistance to investigate and solicit these incentives and identify the equipment and/or systems that would satisfy the requirements and meet your needs. In some cases, these grants cover even the majority of the purchase cost. And, no...you can't save more than you spend.

Pre-arrange the financing. Talk to your bankers; tell them about your project, why you're doing it, how much you anticipate needing to spend, etc. Find out what they want to see, and

what they are and are not willing to consider. Bankers are often frustrated entrepreneurs; they love to feel that they are part of your management team and like to be asked for advice. An informed banker is a happy banker – and is much more likely to agree to what you need than if you broach the subject after the decisions have all been made. And don't overlook business leases as a great way to pay for the systems and equipment you need. These financial instruments are used everyday by healthy businesses large and small to finance needed equipment. They allow the equipment to be obtained with little or no initial capital outlay; the amount financed does not appear on your balance sheet; the payments are (generally) 100 percent expense-able; and there is no long-term obligation to keep the equipment past the term of the lease.

10. Bring in a pro. Developing a long-term plan requires a good understanding of greenhouse production requirements and the various heating tools and solutions that are available to be applied in the greenhouse. It's not a job for the local residential heating guy who would "love to have a crack" at your heating system or the industrial heating supplier that does an occasional greenhouse heating system. Save it for the new home you'll build with your added profit dollars! Call in a knowledgeable industry advisor to help out.

In a recent project, the greenhouse owner (a very orderly businessman) followed similar steps and proceeded with the retrofit of an entire steam heating system. The estimated payback period was approaching six years. Savings are now reported at 30 percent or more, and with the increased cost of fuel, the cost recovery period may be less than five years. And this was a complex replacement of the entire heating system in a large greenhouse facility with multiple heating systems. It was further complicated by the increased investment required because the facility was spread out in several separate greenhouse ranges over a large property and the fact that an LP Air Injection system (adding more

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Energy Costs – A Reality Check

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than 10 percent to the cost) was required to satisfy the requirements of interruptible gas service.

Other Conservation Tips

1. First, reduce heat loss. Check the greenhouse for air leaks around vent openings and doors, at gutters, and around the base perimeter. An inch here and an inch there adds up quickly in a large facility. Install a curtain system, especially in houses with single-layer coverings.
2. Resist the urge to close up ventilation openings near your gas-fired heating equipment. The shortage of air will only cause your gas-fired equipment to run less efficiently, possibly costing more than the savings from keeping the cold air out. Insufficient combustion air will not only reduce combustion efficiency by several percent, but it will likely shorten the life of the equipment.
3. Clean and adjust all of your heating equipment – every year. Your heating equipment is responsible for one of your largest operating costs, and as such deserves regular attention and preventative maintenance. Clean burners, heat exchangers, air intakes, and chimneys will allow the equipment to operate at maximum design efficiency. Just a 1/8-inch buildup of scale in your boiler's heat exchanger will reduce heat transfer efficiency by as much as 11 percent.
4. Insulate hot water transport pipes that run out of the greenhouse zone, paying careful attention to pipes running outside. Transport pipes should be elevated above the ground and any water. If they must run on or in the ground, make certain they are insulated with insulation designed for burial and exposure to water.
5. Replace old burners on high-mass boiler equipment with new high-efficiency burners. It will shave 4 percent to 9 percent off your fuel bill and may make you a cleaner citizen by lowering emissions to boot. Better yet, consider replacing high-mass boiler with low-

mass, high-efficiency designs.

6. Check out adding a "leader boiler" to your high-mass boiler system. A small high-efficiency, low-mass boiler can serve multiple purposes. By handling intermittent partial daytime loads, it could allow the larger high-mass boiler to operate on low fire or no fire through much of the day, coming on line only in the evening hours and colder days. This can reduce boiler standby losses significantly. Also, a "leader boiler" can provide shock cooling protection for the larger high-mass boiler by preheating the water before the high-mass boiler starts.
 7. When replacing or adding unit heaters, purchase only heaters with induced draft combustion and only with separated combustion air, taking all combustion air from outside the greenhouse.
 8. Check fuel supply (gas or oil) to confirm that all of your equipment is receiving specified pressure and volume. Greenhouse expansions often leave existing gas piping and meters overtaxed, resulting in insufficient supply pressure and/or volume.
 9. Be cautious in considering a change in fuel types, such as switching from natural gas to oil when natural gas prices rise faster than oil prices. First, there is no guarantee that the same price advantage will exist in a year or two from now, so be very cautious about making a large investment just to accommodate the alternate fuel. And remember, things are often not what they seem. For example, oil is often sold as a more efficient fuel than natural gas or LP, because the BTU content is higher and often the price per gallon is less.
- However, the efficiency of the heating equipment must be taken into consideration; and since gas-fired equipment is nearly always available in substantially higher efficiencies (up to 99.8 percent) the seeming advantage of oil often disappears or at best is significantly less appealing. There are always other "hidden" costs with fuels other than natural gas, such as fuel storage and handling, and excess equipment maintenance is often required. These costs can be enormous and surprising.

Sometimes it makes sense, but a full accounting of all potential costs will often reveal a truth far less appealing than originally promoted or considered. Do your homework thoroughly. Remember, you are a grower, not a fuel engineer. Even if its cheaper, if it diverts you from doing your main job well, it is still more expensive.

10. Look into alternatives in how you purchase your fuel. Purchasing transport gas direct from one of the energy companies can yield significant savings at even relatively low usage levels. Check with your local association to see if transport gas contracts or an interruptible gas supply is reasonable.
11. Dump your thermostats in the garbage and buy a good electronic controller or computerized control system. The cost recovery will probably be less than two years and will make your life easier. If you have more than a 30-foot x 96-foot Quonset, you can't afford to control it with a thermostat.

Final Thoughts

In closing, there are two important things to take away from this. First: there is no quick solution to controlling your energy costs if you haven't addressed it before. If you do nothing with the information provided here or in many other articles written on improving efficiency, it will be of no value. Second: remember, you are going to pay anyway. You will pay the fuel man or you will pay the heating system supplier – there remain only the questions of how much, for how long, and what will you have for it in five years? You need to make long-term investments in your facility to keep operating costs within reason as fuel prices go up.

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12 Resolutions To Make 2004 the Best, Easiest and Most Profitable Year Ever!

by Bob Negen

It's that time of year again. Time to make a commitment to making 2004 the best year ever, for both you and your business.

I know, I know this is just like the 10 resolutions I wrote about last year. But my question to you is "how many of these resolutions did you keep?"

I used to chain smoke cigarettes; and I used to quit often and start back just as often. For many years I probably only smoked eight months a year, but I sure sucked 'em down during those eight months.

My friends and I had a long running joke about the fact that I never quit quitting. This pattern of start/stop went on for more than a dozen years; but finally on New Year's Eve in 1998, I quit for good. Not a puff since.

Hopefully these important resolutions won't take more than a decade to become habit. It's important to visit them often, because these resolutions represent the traits we all need to keep our eyes on if we want to achieve long-term, big-time success.

New Year's Resolution 1

I will never, ever take my customers for granted.

New Year's Resolution 2

I will work exceptionally hard to establish and proactively develop relationships with all of my customers. I will ask every person if they would like to be on my mailing list. I will regularly communicate how shopping at my store will make their life better and save them money, and I will tell

them about the many other wonderful benefits of shopping with me.

New Year's Resolution 3

I will be proud of my successes and will use them to create momentum to build an even better, more successful, more profitable business.

New Year's Resolution 4

I will spend more time training and coaching my staff.

New Year's Resolution 5

I will make a habit of catching, praising and rewarding my staff for "doing things right."

New Year's Resolution 6

I will turn my staff into a sales machine. We will be out on the floor, talking to customers, making sure they are getting the service they deserve and helping them understand why we provide the best value in town.

New Year's Resolution 7

I will keep my windows washed, the snow shoveled, the cigarette butts picked up in the parking lot, the floors vacuumed, the fixtures neat and my counter clean. These little things make a BIG impression. I will always remember, "Retail is detail."

New Year's Resolution 8

I will manage my inventory like my business depends on it (which it does!). I will never run out of best-sellers, and my "dogs" will get marked down and sent down the road. I will spend time this year learning the "nuts and bolts" of how to buy properly.

New Year's Resolution 9

I will take responsibility for my part in the things that don't work. I will not

blame my staff, the economy, our government, my chamber of commerce, my trade association, or the competition. I will "pack my own parachute."

New Year's Resolution 9a

I WILL NOT WHINE. It won't change one doggone thing.

New Year's Resolution 10

I will constantly learn and improve. I will pay attention to what works and why. I will apply what I've learned to make everything I do better, easier, and more profitable.

New Year's Resolution 11

I will respond to stress with action. Every time I feel stressed out, I will immediately find a way to solve the problem and act. I will do something positive.

New Year's Resolution 12

I will have fun. I will make my professional life a wonderful adventure – not always easy, but always worthwhile. Hey, if I'm going to spend at least a third of my life someplace you can bet I'm going to enjoy it!

If you have any resolutions that will make your life or business better in 2004, I'd love to hear about them. Just e-mail me at: bob@whizbangtraining.com. Good luck!

Want more great tips? Get your FREE "WhizBang! Tip of the Week" via e-mail. The tips are short, practical, profitable and fun! Just go to: www.WhizBangTraining.com and sign up.

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OFA Event Calendar

February 20-22	OFA Board & Committee Meetings
July 10-14	OFA Short Course – Columbus, OH

Recent OFA Outreach Programs

Texas A&M University, in College Station, Texas, recently hosted an OFA seminar and showcase for growers on greenhouse profitability. Attendees learned how to maximize profits in their production facilities – taking an in-depth look at how to calculate production costs and compare crops for profitability. Seminar sponsors were: OFA, Texas A&M, and *GMPPro*/Branch-Smith Publishing. Promotional help from Ball Publishing and *GPN*.

An optional one-day tour organized by FIRST visited Kyle Field and the Bush Library on the Texas A&M campus, the Blue Bell creamery, and Ellison's Greenhouses in Brenham, Texas.

Two grower-focused seminars also were held in November 2003 – on Technology, Automation, and Greenhouse Efficiency – in Morgantown, North Carolina and Richmond, Virginia. Seminar and tour sponsors were: OFA, AgriNomix Inc, Argus Control Systems Ltd, North Carolina Commercial Flower Growers' Association, North Carolina Cooperative Extension, Priva Computers Inc, QCOM Corporation, Tagawa Greenhouses Inc., True Leaf Technologies, Virginia Cooperative Extension, and Virginia Flower Growers Association.

Utility Savings Program Available through OFA

OFA has introduced the *APPI Savings Solutions* program – a new member benefit that identifies and implements options that reduce the costs of each member's energy, utility, and telecommunications services. This is an optional program administered by APPI, an independent consulting firm. For more information on this program, refer to the introductory articles on APPI and utility expenses in the November/December 2003 *OFA Bulletin*; call 800-520-6685; e-mail info@appi-energy.com; or contact OFA.

Attention Ohio OFA Members – Workers' Compensation Update

The 74th Ohio Safety Congress and Expo will be held March 23-25 at the Cincinnati Convention Center. The Ohio Bureau of Workers' Compensation (BWC) and the BWC's Division of Safety and Hygiene will offer 100+ educational sessions, and the exhibit hall will feature 225 suppliers of safety-related equipment and services. Admission to the event is free. For more information, contact the BWC at 800-OHIO-BWC or visit the OFA Web site at www.ofa.org.

Future OFA Short Courses

July 9-13, 2005	Columbus, OH
July 8-12, 2006	Columbus, OH
2007-2010	Columbus, OH

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