

BULLETIN

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Energy and the Greenhouse – How to Plug the Energy Cash Leak in Your Operation

by Donald Campbell

Energy issues have moved to the fore, of late, as oil prices approach \$100 a barrel and move well beyond the \$3 mark at the pump. The question before us now is how to stay profitable and in business as we move into this challenging territory.

Three spheres of action concerning energy can be helpful: inputs, operations, and marketing. Each has its own vulnerability to energy and to hydrocarbon production generally, but each also has areas that are amenable to significant improvement. The future will belong to those who can hone in on those areas and act.

Agriculture is a big user of hydrocarbons like energy, fertilizer, pesticides, and packaging. The trick is to find those places most amenable to change by the producer. Oh, now, that's easy! Right!

My goal is to help you, the producer, learn how to think about the hydrocarbon flows through your operation with a focus on energy. Conservation, efficiency, and energy sources – in that order – are places where improvements can be made. Renewable energy options will be discussed as part of energy sources.

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Using Light and Temperature to Manipulate Plant Height

by Peg McMahon

Plants have evolved to alter how they grow and develop in response to changes in light and temperature. Although these responses are survival mechanisms for the plant, greenhouse growers can take advantage of them to manipulate plant height. Before I go any further, it is very important to remember that no matter what methods you use to control stem elongation, they must be employed before the elongation occurs. There is no way to shorten a stem once it has elongated (other than physically removing part of it). I will be discussing prevention, not shrinking.

One of the oldest techniques for controlling plant height or stem elongation is to change the air temperature around the plant to slow or speed growth. This works primarily by affecting the rate of growth and development, including stem elongation. Most temperature recommendations for crops are based on what over 100 years of observations have shown to be the optimum day and night temperature regimes to bring a crop in on schedule and meeting desired quality standards, including acceptable height and proper flower development.

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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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Sustainability ... The Process

by Stan Pohmer

Editors note: This article was originally published in the December 2007 issue of *GPN*.

As a preface, let me make a few points very clear. I believe that ...

- As good stewards of the earth, growers need to be caretakers of our resources (water, soil, air) and other ecosystems.
- As good human beings, we need to ensure that our workers are respected, have the tools, training, and an environment to keep them safe and productive, and are paid a fair wage for the work they perform.
- It is essential that we simultaneously be profitable and sensitive to the ecological needs and social responsibility goals of sustainability.
- We first have a moral responsibility to implement sustainable production practices and continuously improve in these areas, and secondarily an opportunity to communicate our successes to the consumer to get credit for our efforts.
- Consumers may or may not be aware of what sustainable products or processes are or should be, but we should undertake these efforts because they are the right thing to do.
- We need a voluntary industry standard that is specific to our industry against

which we can benchmark, so everyone is measured and compared on the same practices and conditions, and that can be used as a path toward continuous improvement.

- Organic production and practices are a level of sustainability, not an independent standard. And that, from both a production and economic standpoint, organic isn't always desirable or achievable.

I share my beliefs because they shape the way I view sustainability and the efforts and direction our industry takes to become involved in sustainable practices. I recognize that my perspective may be different from yours and others within and outside our industry.

Many growers in the United States and other countries that supply the U.S. market have already been practicing good agricultural practices as a normal course of business. In some cases, we've had the additional guidance (wanted or unwanted) from federal, state, and local government agencies that restricted the use or application of pesticides and chemicals; mandated water run off collection; indicated the minimum wages we could pay our workers; regulated how they could be treated and protected; and other edicts. We also had a profit incentive for embracing these practices. Yes, there was a cost to implement, but in most cases, we found that there were cost savings and increases in worker productivity.

I believe that many growers were investing in and implementing sustainable business practices, though until recently, no one commonly used the term "sustainable" or even knew what it was. Is there room for improvement and moving our efforts to a higher level, and are some growers not being sensitive to these practices? Clearly, the answer is yes, and these producers need to get up to speed in these areas.





Why You Should be Concerned...

by Stan Pohmer

Sustainability can and should be a good thing for you, your customer, the environment, and the people who labor to produce the products you sell.

Some growers may take the position that they'll just take incremental steps and phase into sustainable business practices gradually over time. Others may take the position that they'll just wait and see how all of these standards develop and then pick and choose the one that is the easiest to implement.

And, yes, all of these standards and certification programs are being positioned as "voluntary" programs rather than "regulatory," but is this really the case?

The SCS-sponsored draft standard submitted to ANSI for agriculture is just one of many different certification programs that are either already established or in the process of development; others include Fair Trade, MPS, Global GAP, Rainforest Alliance, and more, and these are just some of the certification programs that currently deal with our product categories. Each of these certification program's standards focus on and emphasize different elements and areas of "sustainability," and their interpretation of sustainable practices vary greatly. Many of these standards apply to more than just floriculture and horticulture product categories, so we'd be required to comply with sustainable standards of a much broader range of categories like edible food products such as produce and aquaculture.

The consumer is starting to become confused. They hear claims about products being organic (with Organic spelled with a big "O" meaning it's supposed to meet USDA organic standards, and organic with a little "o," meaning that someone other than the government has established their own standard), and they hear about carbon footprint, air miles, and the benefits of locally grown products. But they don't really understand the vocabulary and terms being thrown around and are starting to question what this all really means to them.

As mass market retailers see the PR benefits of being able to promote that they are "green," eco-friendly, and sourcing from suppliers who use sustainable production and labor practices, they will need to be able to substantiate their claims. The best way to accomplish this is through third-party certification to an established and recognized standard.

But this leads to a few areas of concern ...

1. The retailers will want to embrace a certification that has the broadest product reach and covers the greatest number of items within their stores.
2. Each retailer will individually dictate to their suppliers which certification standard they must comply with; if you don't comply and get certified, you don't ship them product, plain and simple (this won't happen overnight, but the suppliers will most likely be given a tight timeline to get into compliance).
3. For both competitive and self-interest reasons, it's highly likely that the retailers will each want their own certification label, meaning that growers who sell to multiple retailers will have to obtain multiple certifications.

So should you be concerned about where these various standards and certification programs are heading? I think the answer is obvious. But what should you be doing about it?

First, become involved in the discussions as these standards are being developed to make sure they are realistic and reasonable, either by becoming part of the review process yourself or by providing input to the trade associations, like OFA, who will be representing your interests in the development and review processes.

Secondly, become involved with your retail customers and be part of the discussions before they make a decision on what direction they are taking with corporate or departmental sustainability initiatives, and act as a resource to them to add your perspective to the process. Rest assured that the certification companies are knocking at the retailers' doors promoting their programs (remember these certification organizations are for-profit companies!), so you need to weigh in to become part of the sustainability decision process.

So, should you be concerned? A resounding YES! The sooner you learn about the programs out there, get involved with the development, review, and decision processes, and think about how you're going to end up dealing with them, the better.

If you're not part of the process up front, you have no right to complain about the outcomes of the decisions made by others that will affect you and your business.

And growers who are achieving sustainability should get both recognition and preferences in the marketplace for their efforts.

It's been difficult in the past to measure one's level of compliance to sustainability practices because there was no standard against which to benchmark. As we've seen, especially in the European market, in the absence of a recognized and industry-accepted standard, it's fair game for anyone to

develop their own standards, whether to fit the standards creator's personal goals and agenda or for economic gain. Nature abhors a vacuum, and without an industry-accepted standard, any retail chain or organization can make up their own rules and impose them upon their trading partners.

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Sustainability... The Process

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A few years ago here in the U.S., a retailer approached a for-profit certification company, Scientific Certification Systems (SCS), to develop a standard for cut flowers, and later for potted plants. One of the major goals for this effort was to develop a certified “label” that could be used as a marketing tool to their customers; this label was Veriflora. SCS then approached a core group of both domestic and off-shore cut flower and potted plant growers to get their input as the standard was being developed. Once it was finalized, SCS certified these growers.

As I mentioned earlier, without a voluntary industry-accepted national standard in place, anyone can develop and certify against their own standards, creating confusion in the marketplace, especially at the consumer level. SCS recognized this and submitted a draft of their standards to the non-profit American National Standards Institute (ANSI). Once ANSI accepts a standard, it becomes the benchmarking criteria against which any certification company or label can compare itself.

But the draft standard that was submitted to ANSI went far beyond floriculture in its scope, and therein lies the challenge and my concern.

The submitted draft was the *Standard for Food, Fiber and Biofuel Crop Producers and Agricultural Product Handlers and Processors*, of which floriculture crops are a very small part. The products covered included produce (i.e. fruits and vegetables), row crops (i.e. corn, wheat, soybeans), fiber (i.e. cotton and wool), biofuel crops (i.e. corn used to produce ethanol), and more; and there’s been discussion to include cattle, dairy, and aquaculture as part of the scope of this standard. The way the draft was written, there are a core set of standards that apply to all agriculture crops, with annexes that address crop-specific guidelines and practices.

I believe in voluntary standards. But I have some initial concerns and reservations about the draft that was submitted to ANSI:

1. It’s too broad in scope. Many of the core guidelines and measurements have applicability to edible food crops, and these standards for food crops would necessarily be more stringent (especially regarding food safety and traceability standards) than what we would consider necessary for non-edible floriculture crops, but there’s no distinction, and, as submitted, we’d have to comply with the stricter edible standards.

2. The standards expressed in the draft were developed by SCS without the benefit of input from the major trade associations that represent the various covered crop segments (i.e. OFA for bedding plants, Produce Marketing Association for produce and floral, FNGLA for foliage crops, etc.), nor from major producers in these segments who would need to comply with these standards.

3. While I believe that special interest NGOs (non-government organizations) should have input into the standard, their representation in this review process is proportional to that of the producers that would sit on the Standards Committee.

SCS has contracted with the Leonardo Academy, an ANSI-certified Standards Development Organization, to shepherd and facilitate the three year draft review process (please see www.ofa.org/standards to view the proposed draft and presentations made at the kick-off meeting in October, and for more information on the review process). This process is just now beginning, and our industry has the opportunity to provide input and critique into the proposed draft to a “to be appointed”

Standards Committee that has the power to make changes to it. The major floral/horticulture trade associations, namely OFA, Produce Marketing Association (for both floral and produce), SAF, ANLA, and FNGLA are taking the lead in monitoring and representing their constituencies at these meetings, and I’d

recommend that you contact them with your comments and concerns after you read the draft.

As I stated at the outset of this diatribe, I firmly support sustainability as a concept and in practice, and I believe that a voluntary industry-wide national standard is essential to bring our industry into compliance with realistic and measurable benchmarking goals and guidelines. That said, we need a standard that makes sense for our industry and is specific enough to address our products and production/logistics methods. Perhaps the ANSI draft is the framework we can use to develop these floriculture standards, but it’s going to need input and involvement from our industry to ensure that the review and change process allows the standards and guidelines to be representative of our industry’s specific needs and opportunities, and not impacted by other agriculture crop standards that don’t apply to us.

The sustainability train is leaving the station. You can choose to be on the train and be proactive in the development of standards and certification programs that embrace sustainability, or stand on the platform and wave at the train as it pulls out. It’s your choice, but don’t complain if you aren’t involved and you don’t like the outcome at the end.

... a voluntary industry-wide national standard is essential to bring our industry into compliance with realistic and measurable benchmarking goals and guidelines.

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Energy and the Greenhouse – How to Plug the Energy Cash Leak in Your Operation

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Here we are at your greenhouse, farm, canning center, or garden center. Where do we start? The best place to start is with your utility bills. A good look at your utility bills can reveal where your greatest need is and perhaps where a small investment might yield a big savings. There is good information to be gleaned from your bills.

Look for seasonality and time of day by kilowatt-hour, not cost. Most bills will have a summary, by month, of your usage. If demand charges apply to your account, make note of any variability in this area as well. Look for the overall seasonal fluctuations in usage. Write down what you think causes those variations and the months the high loads occur. Also write down the time of day that the peak loads will likely occur.

For gas, the principle use will probably be for heating. Again make note of seasonal fluctuations and the reasons for them, as well as the 24-hour load cycle, if possible.

The next step is a walk around your operation. Remember the three steps – conservation, efficiency, and energy sources – as you do. What you are looking for in this first pass are areas that are either leaking money or need big infusions of cash to function. Look for places where heat is leaking out either through openings or through unnecessary glazing. Maybe the new glazing for your greenhouse that was way too expensive last year is a lot closer this year. Where do you think prices are going? Think about how you heat your facility and where the heat plant is. What fuel do you use?

Look at your lighting and electric motors. There is often low hanging fruit in these areas. Some utilities will help pay for improved efficiency in motors and pumps.

Now think about linking things that might not have crossed your mind before. Do you have a source of waste heat somewhere, perhaps a cooler? Are you blowing the heat into the atmosphere? If you have a need for heat, let that compressor help you out.

When you walk around look at places that can host a photovoltaic array, perhaps a shed roof, office area, or maybe an open area that is unused. You might also think about roofed parking or picnic areas.

Wind is a little more problematic because that “microclimate” can really alter the local windscape. And just because you feel wind doesn’t mean you have the correct wind regime for a sensible installation. Still there are different sizes and types of wind machines that are now available, and one of them may work where you are.

A growing area of interest is biodiesel. It can be a very affordable fuel to make and used on site. Things to consider



Figure 1. Photovoltaic modules were added to an existing structure to power a produce cooler within the building.

in this regard have as much to do with proximity to areas with enough restaurants or processed food plants that you can find a supply of the vegetable oil. The production of a significant quantity of biodiesel would require 1 or 1.5 employee days a week and a vehicle. The hardware can have paybacks within a year before you count labor and any cost for the oil.

As you can see, there are a number of ways to curb your energy diet. This article has been a primer to help you think about possibilities for your operation. When you get started, you might consider finding a consultant to help you through all the options, including federal and state tax benefits and incentive money often available from state government or other sources.

I want to leave you with a small project I worked on in Sunderland, Massachusetts. The farmer grew organic vegetables and strawberries. He had a sizeable cooler in his farmstand that also served as a distribution point for his community supported agriculture farm. We installed approximately 3 kilowatts of photovoltaic modules (PV) (Figure 1). The total cost was about \$10 per watt or about \$30,000. Because of tax breaks and very important incentives from the state and the USDA, his cost, as of the coming tax time, was less than \$6,000.

Before you think conservation and renewable energy are not cost effective, get a seasoned professional to help you with your thinking. You might have been right, or you might have eliminated a real long-term opportunity.

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Using Light and Temperature to Manipulate Plant Height

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Therein lies the problem with overall cooling or heating to control stem elongation. Raising and lowering the temperature of the plant affects other processes beside stem growth, e.g. flowering. Delayed flowering may not be wanted at the same time retarding stem elongation is needed. That does not mean you should never use overall cooling as it works very well for some situations, such as cooling to hold back plants that are ready or nearly ready to sell. Likewise, raising temperatures works well for plants that are too short and behind in development. However, a grower whose crop is behind schedule in flowering but getting too tall faces a dilemma if she or he wants to use temperature to slow the rate of stem elongation but at the same time force flowering.

With the discovery and development of DIF and DROP by Dr. Royal Heins and other researchers at Michigan State University (MSU), another means of controlling stem elongation by temperature is now available to growers. DIF/DROP work on the natural ability of plants to respond to the difference in night and day temperatures. In general, the greater the average day temperature is compared to average night temperature (within the normal growing temperature range), the more stems will elongate. When the difference of the averages becomes negative, stem elongation is noticeably restricted. When first presented to growers as DIF (difference of day minus night temperatures), achieving a negative difference (negative (-) DIF) was difficult during late spring and summer. Then the MSU folks found that it was really the early day temps that were most important. They developed the concept of DROP which is lowering temperatures before dawn to below night temperatures, then letting them gradually come up to normal daytime levels. DROP effects similar to -DIF were seen on stems, and without some of the unwanted -DIF side effects such as lower leaf yellowing, high energy use, and only seasonal effectiveness. One of the advantages of DIF and DROP is that desired average 24-hour temperatures can be maintained to keep developmental phenomenon such as flowering on track, while independently

controlling stem elongation. An example, using Easter lilies, to illustrate the principle is given in Table 1.

The same would be true for other plants such as bedding plants. If they are getting too tall in their plugs or flats but you do not want to slow down the flowering, decide what average 24-hour temperature you want to keep development continuing. Then schedule a -DIF or DROP sequence that would inhibit stem elongation while maintaining the desired average.

Since most growing recommendations are based on day and night temperatures, you may have to calculate from those what the recommended average 24-hour temperature would be. In most cases that would be multiplying the day temperature by the number of hours you maintain that temperature, multiplying the night temperature by the number of hours you maintain that temperature, then adding the two numbers and dividing by 24.

$$\frac{(\text{day temp} \times \text{hrs. day temp.}) + (\text{night temp.} \times \text{hrs. night temp.})}{24}$$

Example: Recommended temperatures are 75°F day and 64°F night. Day temperatures start at 8 a.m. and are maintained until 7 p.m. resulting in 11 hours of day temperature and 13 hours of night temperature. Inserting the recommended temperature numbers in the above equation results in 69°F as the average 24-hour temperature you would want to achieve.

$$\frac{(75 \times 11.) + (64 \times 13)}{24}$$

Generally, the most efficient use of DROP is done when the greenhouse temperatures are controlled by a computer. The grower programs the desired temperature regime into the computer and temperatures automatically change, which is very nice since a major change is usually required around 4 a.m.! Another advantage of most greenhouse computers is that you can get a daily 24-hour temperature average which tells you how close the programmed regime is to achieving the desired temperature.

Table 1. An example using Easter lilies whose flowering is temperature dependent: Effects of DIF on Height and Flower Development:

Avg. day temp.	Avg. night temp.	Avg. 24 hr. temp.	DIF	Height	Flower Development
75	65	70	+ 10	Tall	All
70	70	70	0	Medium	Flower
65	75	70	- 10	Short	Simultaneously



Using light as a height control tool can be done in many different ways, but you have to understand what other processes in the plant you are manipulating, because, as with temperature, many different processes are being affected. Photosynthesis, photomorphogenesis (e.g. stem elongation), and photoperiodism (long day, short day flowering responses) are all light responses. Photosynthesis requires high intensity (400 $\mu\text{mol}/\text{m}^2/\text{s}$ or greater is usually suggested) from the region of light that is photosynthetically active. That region corresponds to the visual range of light (blue, green, yellow, and red), with blue and red being the most efficient at driving photosynthesis. Photomorphogenesis and photoperiodism (a type of photomorphogenesis) are influenced mostly by blue, red, and far-red light and at low intensities (2-3 $\mu\text{mol}/\text{m}^2/\text{s}$ is usually sufficient). Far-red is the culprit when it comes to stimulating stem elongation. It would be a great help if we could see far-red, but we are blind to it. Instead we have to rely on our ability to observe the light that reaches the plant and assess such things as the light's source(s), leaf overlap, and other factors to determine the influence of far-red.

As a rule of thumb, the more light a plant gets, the less unwanted stem elongation occurs. That occurs in part because it is the amount of far-red (FR) compared to red (R) that the plant receives that influences stem elongation. When there is more R than FR (R:FR greater than 1, as occurs in sunlight), stem elongation is inhibited. When far-red is greater, as occurs in leaf canopies when the upper leaves absorb red for photosynthesis but not far-red, stem elongation is promoted. Spacing plants far enough apart during production to let them intercept as much light as possible for photosynthesis and have enough "leftover" red light reaching lower leaves to maintain a R:FR greater than 1 is very desirable – but not always practical. During low light periods, you would have to have enough space between plants that their leaves did not overlap.

Even during higher light periods there could only be very little overlap. That would require an enormous amount of production space, so we generally compromise. When the plants are small they are spaced closely together, then spaced out as they get larger. To be cost effective, however, large plants usually have to be spaced close enough together to interfere with light interception in order to be able to produce enough plants. However, if the plants are spaced such that leaf overlapping does not occur until the plants are fairly mature, then excessive stem elongation is less likely to occur. That is why it is important to space plants before leaf overlap occurs. In addition, judiciously removing some leaves to allow better light penetration can be helpful.

Making more light available to the plant can be done in other ways too. Keeping the glazing material clean and removing shade compound early enough in the fall allows more light to enter the greenhouse. Making surfaces in the greenhouse as reflective as possible also provides more light to plants. This includes using white or reflective paint on the superstructure, cleaning cement floors, and cleaning or replacing gravel floors

when the gravel becomes embedded in dirt or covered with algae. Speaking of algae, because it is a plant it absorbs the same light your plants need, and can be a serious competitor (not to mention a haven for shore flies). Keep it off all surfaces!

During times when natural light intensity is low, as it is during the winter at higher latitudes and during prolonged overcast periods any time during the year, supplemental light may be beneficial. You want to use a light source that provides enough intensity to drive photosynthesis and does not stimulate stem elongation. High intensity discharge (HID) lamps (using high pressure sodium or metal halide, not low pressure sodium bulbs) are the only artificial light source currently readily available for this use. The HID bulbs suggested provide a relatively high amount of photosynthetic light but little or no far-red. Incandescent bulbs provide some energy in the photosynthetic range but they emit large amounts of far-red compared to red. Fluorescent bulbs have good photosynthetic light, but at low intensity. They do not emit far-red, however. Fluorescents can be used in germination areas and bulb coolers to reduce stem elongation. There are light sources such as LEDs under development that show promise of being suitable for promoting photosynthesis but not promoting stem elongation.

At times reducing light is necessary to maintain quality. The use of shade compounds applied to the roof or shade cloth installed inside or outside the greenhouse is usually the way intensity is reduced. It stands to reason that if the light intensity is too high, then reducing it some would not necessarily cause stem elongation as there should be sufficient red to maintain a high enough R:FR. However, if the material blocks too much light or is photoselective to the wrong colors, stem elongation can be promoted. Shade cloth that can be opened or closed to maintain light levels above a certain minimum amount of light can help to control stem elongation. If an automated system is not available it may be helpful to apply a light coating of shade compound on the roof and use a shade material that has a higher rate of transmission. The roof provides some protection constantly, and the shade cloth can be used during prolonged periods of high light intensities. That way plants are not constantly under deep shade.

Shade color is important too. Avoid green. Green pigments absorb red and very rarely absorb far-red. Even before the light gets to the plant, the R:FR may be well below 1. It is best to use a neutral density shade material that absorbs all colors equally. These would be black, white, or gray.

In summary, manipulating temperature and light properly can control stem elongation effectively at a reasonable cost with low environmental impact.

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ofa Interior Plantscape

New and Not So New in the Interiorscape

by Rich Batcho

Times are changing again in the interiorscape industry. This time is for the good. More and more buildings are going through lobby renovations. Their new “looks” are very contemporary as they no longer want to blend in but to stand out. So, how does this affect us as interiorscapers? Plenty! New “looks” equals new containers and new foliage plants. The building and facility managers are looking for new plant varieties instead of the standard bread and butter plants that have been used for so many years. Interiorscapers are excited and should look forward to these opportunities allowing for creative design and use of new and exciting plants.

Many growers, such as Kraft Gardens in Florida, have the exclusive rights to protected and patented plants. There are a limited number of exclusive growers so that these plants do not become “commodities,” being devalued by low quality, substandard growers. So, with that said, buy from quality growers to keep interiorscape standards high.

My Favorite New and Not So New Plants

Ficus binnendijkii ‘Amstel King.’ ‘Amstel King’ is the “Ficus of the Future” (Figure 1). Its foliage is wide and elongated, and it is fast growing. This ficus holds up much better than all the others. It requires anywhere from 200 to 2,000 foot candles and is available in both 14-inch and 17-inch grow pots.

King Maya Palm. This palm is multi-trunked with bamboo like foliage (Figure 2). It’s very tolerant of dry conditions and outlasts the Kentia palm in the interiorscape. Great alternative to the Kentia at a lesser price. Lighting is low to high and available to 7-feet tall.

Aglaonema. Oh, the old standby. Some really great varieties have come out on the market. Aglaonema ‘Millie’ maintains its compact shape even in low light and recovers appearance after wilting. ‘Millie’ is disease resistant and nematode free.

The Aglaonema Bay Collection were bred and patented at The University of Florida. The collection includes ‘Diamond’ (Figure 3), ‘Emerald’, ‘Golden’ (Figure 4), and ‘Moonlight’ (Figure 5) Bay. These are the most trouble free Aglaonemas on the market. They can tolerate temperatures as low as 45°F and prefer 100 to 250 foot candles of light.

Pothos. Pothos, pothos! Where would we be without pothos? Two of the newest pothos are ‘Silver Satin’ and ‘Silver Splash’. Both have unique coloration and texture, but ‘Splash’ has more green area than ‘Satin’. A great new plant if you are tired of the standard golden pothos. They come in 8-inch hanging baskets and in a 10-inch upright pyramid shape. I have found that ‘Silver Splash’ holds up better. It is exclusive to Kraft Gardens.



Figure 1. Braided Ficus ‘Amstel’.

Bromeliads. While there are many types of bromeliads used in the interiorscape, the Neoregelia varieties seem to be under used. This could be because the older varieties only had color near the center of the plant. There are three varieties whose color extends beyond the center to the outer edges of the plant. They are Neoregelia ‘Deb’ in deep red, ‘Lila’ in hot pink



Figure 2. King Maya palm.



Figure 3. Aglaonema 'Diamond Bay'.



Figure 4. Aglaonema 'Golden Bay'.



Figure 5. Aglaonema 'Moonlight Bay'.

and 'Tangerine' a vibrant orange. And remember, never water bromeliads in their cup.

ZZ Plant. Introduced many years ago, but still somewhat new to some, the ZZ plant lends itself to having a very contemporary look. *Zamioculcas zamifolia* (I love saying this) has a unique appearance all to itself. With its shiny leaves it can tolerate light levels as low as 25 foot candles and can go without water for many weeks in low light situations. This plant is host to very few diseases and pests. The ZZ plant grows to approximately

3-feet tall and is available in 6-inch, 8-inch and 10-inch pots, growth to 36" tall.

Liriope. Bringing the outdoors inside is what makes this plant so special. Liriope (pronounced "lah-RYE-oh-pee") is a grass-like exterior plant (Figure 6 page 10) that produces a purple spike flower in the fall. I have even had them bloom for me in not the brightest of locations. Liriope "Super Green Giant" is another

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New and Not So New in the Interiorscape

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Figure 6. *Liriope 'Super Green Giant'.*

plant grown exclusively by Kraft Gardens and is a stand out performer in the interiorscape.

I've been told that we will be seeing yet more new plants coming out later this year or early next year. So, keep an eye out for them. Exciting times are here. Try something new and stand out from your competition. You'll be glad you did. Attend the OFA Short Course Interior Plantscape program on July 12, 2008 in Columbus, Ohio to expand your knowledge of interior plantscaping. A fantastic workshop is planned.

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Photos courtesy of Kraft Gardens Inc, Fort Pierce, FL

ofa Management

Analyzing Financial Statements for Better Management in Horticultural Businesses

by Alan W. Hodges

As the green industry in the United States has grown and matured in recent years, business conditions have become increasingly competitive, with many companies experiencing depressed prices, reduced profitability, and increasing rates of bankruptcy. In this environment it is imperative that business owners and managers make the effort to regularly evaluate the company's performance. Without such measurement it is impossible to know whether the business is succeeding and where it is going. Analysis of company financial statements and other business records is a proven approach to achieving greater efficiency, productivity, profitability, and financial security. Managers can use this information to guide financing of business expansions, developing marketing strategies, selecting an appropriate mix of products, controlling costs, and planning operations. Financial analysis can help identify common problems, like low output, poor pricing, excessive costs,

waste, poor cash flow, undercapitalization, and imbalanced debt structure. When done correctly, this exercise will often yield benefits in terms of increased profitability, reduced risk of business failure, better customer service, and increased job satisfaction of employees.

Comprehensive Review

A comprehensive review of your company's financial situation should be done at least twice a year, quarterly, or ideally every month. It is not enough to do once a year at tax time, because that is too late to spot problems and take corrective action. Often, the changes in financial indicators from one period to the next are as important as their absolute level. It is good practice to arrange a formal meeting among the business owners, its financial advisors, and management team to do this evaluation thoroughly and systematically. When reviewing your company's





financial statements, there are a number of simple but important questions that should be asked routinely:

- What are the total income, total expenses, net income, and profitability (net margin, rate of return on equity) of the firm in the most recent period?
- Are these values growing, stabilizing, or declining since the previous period and over time? If so, is there a reason for the change? Is income growing in inflation-adjusted terms?
- What is the firm's cost structure? Are any cost items excessively high or rapidly increasing over time? What is the relationship between direct costs (COGS) and indirect, overhead, or general operating expenses?
- What is the general financial solvency of the firm? Is the company's net worth or equity growing over time?
- What is the structure of capital managed in the firm? What is the condition of the company's long-term assets such as machinery, equipment, and buildings with respect to accumulated depreciation? Are any assets depleted and in need of replacement?
- What is the liquidity situation of the firm? Can current liabilities be met with expected cash flow? Is there a seasonal pattern or trend in sales or total income? What is the firm's accounts receivables in relation to sales, and is the company maintaining timely cash collections on accounts?
- What is the firm's labor situation with respect to costs for employee wages and benefits?
- Are there any changes observed in productivity/efficiency indicators such as output per worker, output per square foot, or inventory turnover?
- How does the company's performance compare to industry standards or financial benchmarks?

Where to Begin

The starting point for financial analysis of any business is to gather the most accurate and recent information available from financial statements. Using these together with other company records, one can readily calculate the standard financial ratios and other meaningful metrics. The financial statements that are provided by most in-house accounting systems or professional accountants are the income statement, the balance sheet, the cash flow statement, and sometimes the statement of change in financial position.

The income statement, also known as the "profit and loss," is probably the single most important one, as it summarizes the company's revenues, expenses, and net income for the year or the accounting period of interest. The balance sheet or statement of financial position is a snapshot in time at the end of the accounting period that shows the company's assets, liabilities (debts), and equity or net worth. Assets and liabilities are typically classified as current, intermediate, and long-term, because these different types are managed differently. The cash flow statement indicates the sources of cash from operations, financial lenders, and savings, and the uses of cash for operations, investments, debt service, and payments to business owners. The statement of change in financial position shows how the balance sheet items change from one accounting period

to the next. For a thorough analysis, it is necessary to look at all of these financial statements together because each provides a different type of information, and many of the financial measures are calculated from items on different statements.

The financial statements are supposed to conform to Generally Accepted Accounting Principles (GAAP) developed by the accounting profession and governed by the Financial Accounting Standards Board (FASB). These standards assure that the financial information has a consistent meaning so valid comparisons can be made over time or across different businesses, and for publicly-held companies that there is full disclosure of information that may be important to stockholders and potential investors. Within the standards, however, there is considerable latitude to customize the financial statements to meet your company's particular needs. For example, in a wholesale nursery it may be important to have a very detailed itemization of production expenses, whereas a retailer would have a listing of major groups of merchandise purchased for resale and the gross margin on sales. It may be necessary to work with your accountant or accounting software vendor to find the right form for your financial statements. Businesses may elect to use either a cash basis or accrual basis for accounting. The cash basis is more commonly used for small businesses because of its simplicity in tracking of cash transactions and may avoid some tax liability for gains on unsold product; however, the accrual system is usually more accurate since it accounts for changes in inventories, receivables, and payables.

Net Income

The "bottom line" for financial performance of a company is usually net income, simply the difference between total income and total costs. Net margin is the ratio of net income to total income, or in other words the share of income that is profit. Sometimes, the income statement may show net income before taxes, management expenses, and interest expenses, in which case it is termed return to capital. Rate of return on investment is the net income or return to capital divided by the total capital investment (assets owned). Rate of return on net worth or equity is an even more refined measure of profitability, calculated by dividing net income into the net worth (total assets less liabilities). This measure expresses profitability in relation to the equity of owned assets, and is comparable to annualized yields on stocks, bonds, or savings deposits.

Cost Analysis

Analysis of costs is a key role for firm management because costs are typically more controllable than income. For effective analysis of costs, it is important that the expenses be identified in meaningful categories. As a general rule, any cost that represents 5 percent or more of total costs should be itemized. In many nursery businesses, there may be perhaps 20 to 50 individual expense categories, which could generally be grouped into a reasonable number of major categories such as management, employee labor and benefits, materials/supplies, facility/equipment, administrative overhead, depreciation, and interest. The costs should be expressed as a percentage of total costs or income

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Analyzing Financial Statements for Better Management in Horticultural Businesses

Continued from page 11

in order to evaluate. The cost per unit of growing space is also a useful measure for estimating individual plant growing costs or comparing cost efficiencies of different production systems.

Inventory

Green industry firms have special challenges in accounting for inventories of growing plants because they are difficult to value since they are constantly changing. Changes in plant inventory may be an especially significant factor in a nursery that is rapidly growing. A recommended approach is to use the degree of completion method of valuation, based on average market prices and average production times. So, for example, if a particular crop normally requires 20 weeks to produce, and at the end of the accounting period it has been in production for 10 weeks, then we would say that this product is 50 percent finished, and would be assigned an inventory value equal to half of its ultimate sales value. If the firm is rapidly growing and expanding its inventory, a representative measure of financial position can be taken as an average of values at the beginning and end of the accounting period.

In order to have an accurate calculation of profitability, the rate of return on investment, or rate of return on equity, there should be a realistic valuation of the company's assets. If you are evaluating financial statements over an extended time period, say three or more years, changes in values should be stated in inflation-adjusted terms, using a price index such as the Consumer Price Index (CPI) or the GDP Implicit Price Deflator (US Commerce Dept.). Owned capital in buildings, improvements, and equipment are usually assessed at original purchase cost less depreciation, known as book value. Some-times when these assets are rapidly depreciated under IRS rules for accelerated cost recovery (ACR) over three, five, or seven years, the useful life and true value of the asset may be understated. Also, the value of land owned by the company is typically stated at original purchase price, which may be far below its real market value, especially during times of rapid growth in real estate prices as we have experienced over the past few years.

Financial Ratios

Financial ratios among the values on a company's balance sheet express measures of financial solvency and liquidity. Leverage is the ratio of total assets to net worth and is an indicator of long-term solvency, which takes into account the financial risk of the venture. Higher values indicate greater risk, with potential for both greater returns and greater losses. The impact of financial leverage on profitability can be understood as a multiplier (leverage multiplied by the rate of return to capital assets equals the rate of return on net worth). Leverage factors below 2.0 are generally considered to represent a very safe financial position. The quick ratio is a measure of liquidity, or a firm's ability to meet short-term debts, calculated by

dividing cash and accounts receivable by current liabilities. Cash and accounts receivable are the most liquid of current assets, which are usually available on short notice, but inventories are not included in this measure because they may not be immediately salable. A value for this ratio below 1.0 would indicate an illiquid position.

Beyond strictly financial information, other kinds of information on the physical and labor resources of your company may enter into an evaluation of productivity and efficiency. For nursery operations, the plant production area should be measured as the net usable growing space within growing beds and fields, excluding non-productive space in aisles, driveways, and other service areas. This can be used to evaluate costs and sales per square foot, or the level of capital investment per acre of growing area. Labor is often the most important resource in a horticultural business, and it is important to track it in terms of physical quantity (hours) as well as monetary cost, in order to measure its productivity or efficiency. The total payroll hours of labor employed should include production, administrative, sales, and management personnel. Labor is often expressed in terms of fulltime equivalent (FTE) persons, representing the number of employees working for a year at 40 hours per week, or 2,080 hours per year.

Benchmarks

Financial benchmark analysis is the use of key indicators to evaluate a company's operational and financial performance in comparison to industry standards or benchmark values. Benchmark data are available for most major industries, for different types and sizes of businesses, and regions of the country. Ideally, comparisons should be made with the leading or most profitable firms in an industry. Some sources of information for agricultural sector industries include the Farm Credit Bank, the Risk Management Association's Annual Financial Statement Studies (www.rmahq.org), as well as land grant university research and extension programs. The University of Florida's Horticultural Business Analysis System is an Internet-based system (<http://hortbusiness.ifas.ufl.edu/hortmba/>) for financial analysis of wholesale nursery firms, with benchmark data available for Florida growers (1990-2004), including large and highly profitable firms, and for several types of plants, such as woody ornamentals, flowering plants, and tropical foliage.

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ofa Garden Center

Retailing 2008 – A Tough Year for Some

by John Stanley



“Job Slump Latest Omen of Recession.” Pick up the January 5, 2008 edition of the *Los Angeles Times* and this would be the heading that greeted you. A news headline to welcome you to 2008, with an effect that could affect retailers around the world.

We are being warned that 2008 could be one of the toughest years for retailers around the world. The negative news seems to be coming out of the United States and worrying the global banks, but at the same time Asia keeps powering along, and that should continue until at least August when Beijing hosts the Olympic Games.

These are global issues that a small retailer has no influence over, even though the ripple effects are felt. What you can do is make sure you have defenses in your business that are stronger than your competitors to ensure you weather the storm and remain strong. I was recently asked what five strategies I would introduce into my retail business in 2008. Here they are:

1. Improve My Customer Service

Every business provides customer service – ask any retailer and they will tell you. But in reality most retailers process customers rather than provide a memorable experiences. Ask customers, and they will tell you they would support small business if they believed the business cared. They want a memorable, positive, consistent relationship within the store.

Alas, they do not find this as often as they should, which is why many pundits are predicting that 60 percent of sales will be via the Internet within five years. Over Christmas my wife and I visited one of our local stores (planning a BIG purchase). Their average sale is \$23, but we spent \$400. It disappointed us to find their service to be almost non-existent. A fellow customer commented that the service at the local box store was better, and we should try there in the future. It is very sad when local business fails to meet the needs of local customers and then blames the competition for taking market share.

Therefore I would invest time in my team to ensure they are providing a memorable experience. The basics are important. Everyone should wear a name badge as not every customer can remember a team member's name, and new customers will rarely ask. Encourage them to get to know customer names to build relationships. It is easy to build relationships with customers who have already become friends, the challenge is to do it with a stranger.

Start with ensuring your team verbally welcomes every customer and follows this up with a social comment or question before the inevitable “How can I help you?” This simple approach is the starting point to show you care and want some empathy with the customer. It makes a difference to the bottom line.

2. Get Wired

As I have already mentioned customers will increasingly buy from the Internet; that means that they could be buying from you via the Internet. I would ensure I had a web presence and that I was promoting to my consumers and advising them to buy products from the web. I would ensure my web page was blog friendly and active. It may start off slowly, but in the future a large percentage of sales will be via the web, so why not keep that business or even grow your business via the web?

3. Start A Loyalty Club

I realize a number of retailers have loyalty clubs, but many have resisted because they feel it is expensive. I disagree; it can be cheap and easy to implement and it works. It can be as simple as a card that a team member stamps every time the customer comes in. Our local health shop has a cardboard loyalty card that easily slips into my wife's purse. It is stamped every time she visits the store and is used as a conversation tool by the retailer. The customer gets rewarded based on the number of visits and the amount spent. It is a very low cost system, but it has kept our family loyal to their business.

4. Network with Other Local Retailers

Neighbor-to-neighbor marketing is a big marketing drive at present. The aim is not to keep people coming back to your store, but to keep the local cash flow within the community. The more people shop locally the more win-win relationships can be developed. Work with retailers within your community to build the community. My own town of Kalamunda is situated on the outskirts of Perth, Western Australia and has started networking at a local level to stop consumers from getting in their cars and visiting the air conditioned shopping mall in the next suburb.

The networking is being driven via the Chamber of Commerce, Rotary, and other local groups. As a result, we have a vibrant retail community that has a thriving monthly craft market and at least four different festivals a year. One indicator of the success of this approach is the number of coffee shops that have opened in the town in the last few years.

I am not saying every retailer is behind this campaign, we have retailers who complain we have too many customers in town and you cannot park a car, but once you get 60 percent of retailers supporting your campaign, you are on the way.

5. Dare to be Different

In addition to good customer service and strong marketing concepts, one must also develop the internal displays in your

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Retailing 2008 – A Tough Year for Some

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store. When economies are motoring along, you can play safe and still win, but as the song says, “Once the going gets tough, the tough get going.” In retailing this means building displays that are daring and therefore noticed. Great displays stop consumers in their tracks, make them smile, say WOW, or just want to buy the product on display. You have to achieve this in a five-second glance from the customer. Most displays are missed by the consumer because they don’t yell at them. Go out and make your displays yell. Dare to be different as long as you do not offend your target customer base.

Plus, remember you have to keep changing them; customers soon get bored. It was Bob Dylan in the 1960s who made the

phase, “The times are a changing” famous in one of his folk songs. Those times are back, so enjoy them.

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Exporting Plants to the European Union: Problems and Solutions

by Chris Schlegel and Doug Cole

The Problem

In years past, exporting plants to European Union (EU) countries was fairly simple. Growers in the United States would have the plants inspected, and if clean, the cuttings or potted plants would receive a phytosanitary certificate from the local U.S. inspection official. The plants were shipped to the EU and life went on. In recent years, however, the EU has put restrictions on this process with the intent of keeping *Bemisia* biotype Q and viruses from entering Europe. The guidelines set up by the EU have been difficult to interpret by USDA, so much so that in most states exports of plants have come to a standstill.

Involvement with European Growers

D.S. Cole Growers in Loudon, New Hampshire, established in 1987, has nearly four acres of primarily Dutch glass houses as well as several acres of outdoor production. The company built its foundation on the propagation of double Impatiens, having patents on the Summer Ice and Rosebud series.

We specialize in the production of vegetatively propagated annuals, and have diversified to offer more than 500 varieties of young plants. We root approximately 10 million cuttings annually and ship throughout the country. In addition, we finish over 400,000 potted plants each year for independent garden centers in New England.

From its inception, D.S. Cole Growers has had an international focus. We prefer to work with numerous breeders



and select superior varieties from each one. Our involvement with European growers began through an association with Begonia JNP of Denmark. Denmark is a leader in flowering potted crop production in Europe, and the growers typically specialize in growing a single crop. During our young plant season we receive weekly shipments of unrooted cuttings from many European companies. Due to globalization, many of these growers have moved their production of cuttings to Asia, Africa, and Central and South America. We also have been working with a breeder in Europe on new product development and have plant material in tissue culture labs in Europe.

Trends Dictating the Need for Global Interaction

Currently about 30 percent of our liner production originates from in-house cuttings. The percentage of cuttings purchased from offshore sources increases each year. Often it is more cost effective to purchase cuttings instead of maintaining stock plants. Perhaps more importantly, the quality of cuttings from offshore suppliers is often superior to what we can produce in our northern climate.

With this increased dependence on foreign suppliers comes the need for exporting material to the EU. We need to provide our suppliers with plant material with which to build stock. In some cases, they are unable to maintain the stock year-round due to climate issues and rely on us to send fresh material for stock plants on an annual basis.



The increasing popularity of cordyline and tropical plants has also necessitated more exchanges with the EU. Most of these items are produced from tissue culture and some of the European labs can provide us with a good supply of quality material. Our desire to send plant material to tissue culture labs in the EU initially led to our investigation into how we might meet their importation criteria.

European Union Import Directive

The primary concerns of the EU appear to be the threat of importing *Bemisia tabaci* (whitefly) and viruses transmitted by this pest. The regulation refers to “pest free places of production,” and there needs to be clarification of that concept. There is no obvious way to determine if this “place of production” refers to an isolated area within a greenhouse, a single entire greenhouse, or a large greenhouse range.

A second point in question involves the means of establishing virus-free status. There is confusion about whether plants must be laboratory tested for specific viruses, or if a lack of visual symptoms suffices. The cost of tests is one issue, and the efficacy of testing for some of the listed viruses is another.

In speaking with regulatory personnel, the vagueness of the directive makes it difficult for them to certify plant material for export to the EU. Additionally, it seems that most growers simply find the process too complicated and costly. Therefore, significantly less plant material has been exported from the U.S. to the EU.

Impact of the Restrictions

The restrictions imposed by the EU have impacted our business in several ways. In past years, England was an excellent customer of our patented varieties of double *Impatiens*. We shipped unrooted cuttings to growers on a regular basis. The restrictions have virtually eliminated the European market for us. We have also been unable to send *impatiens* cuttings to tissue culture labs in Europe. In order to produce the highest quality liners, we prefer starting with clean stock each season. The quality of the material from specific labs in Europe has been impressive, and we would like them to provide us annually with clean *impatiens* stock.

There are several new varieties that we would like to add to our popular “Designer Series” of tropical plants. In order to produce these liners we need to have them in a lab that can provide us with high quality tissue culture material. Once again, the restrictions have kept us from pursuing this project with the European labs. In some cases the quantity of tissue culture material needed dictates using more than one lab. Multiple sources ensure having an adequate supply of material to meet demand.

Desire to Find Means of Compliance

We recently held a meeting at D.S. Cole Growers with state and federal regulatory personnel to address this export issue. Our goal is to create a practical plan that will allow us to meet the requirements for exporting to the EU. The compliance agreement that we jointly create will be specific for our business.

Our plans include the construction of a physically isolated zone within one of our clean stock houses. This will serve as the

final containment area for plant material that is designated for export. The isolated area would then be referred to as a “pest free place of production” relative to whitefly. By effectively eliminating whitefly in all its stages, treatment for this pest should not be necessary. There will be three inspections by a government official at three-week intervals prior to shipping plant material. Plant material from this area will be certified as long as it meets routine inspection guidelines as well as being free of whitefly and viral symptoms. The packaging of all plant material for export must take place in the isolated area to avoid contamination.

While meeting the criteria for establishment of the isolated area is important, there are additional procedures to follow. Our personnel must conduct regular scouting, and records must be maintained diligently. An effective weed control program is also a necessity. It is imperative that plant material exported to the EU can be traced back to its origin. Records including pesticide treatments, inspections, and locations must be maintained throughout the production of the plant material.

Our goal is to find the means of complying with regulations so that we may continue relationships with our European partners. We also hope to demonstrate a means of making it feasible for other U.S. growers to export plant material to the EU.

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How Wet is Wet? Watering Terminology

by Will Healy

Facts

- The profitability of your business is controlled by the person holding the hose.
- More plants are damaged by incorrect water application than any other thing you do.
- Pesticide and growth regulators compensate for incorrect water application.
- Slow growth, reduced quality, and poor post harvest survival are all signs of incorrect water application.

Watering plants is a core activity in greenhouse production. Most employees receive limited training which consists of “go water the plants.” Rarely does a new employee understand the intricacies of when to water, how much to apply, or the frequency of application based on plant development and weather conditions. Invariably growers either “figure it out” or become frustrated, quit your company, and start the process all over somewhere else. Unfortunately, while the growers are “figuring it out” they produce crops that are inconsistent in quality with increased production costs.

Part of the problem with training growers to water correctly and consistently is the use of very ambiguous terminology to describe the watering process. “Too wet, too dry, medium wet, medium dry, wetter, drier, spritz, flush, soak, and drench” are all terms used to inform growers what they should be doing. When the growers don’t achieve the desired results, the growers are reprimanded for failing to follow instructions.

How can growers correctly interpret standard watering terms when managers can’t define the terms? When you compound the ambiguity of the watering terminology with the requirement to modify the frequency and amount of water based on crop development it is easy to see why growers become confused. As a defensive position, most growers end up just keeping the plants on the wet side since they aren’t reprimanded for keeping the plants wet all the time. To compensate for excess watering the growers then apply fungicides and growth regulators to correct the root rot disease and excess stretch! A vicious cycle ensues where keeping the soil too wet requires watering with fungicides to correct the excess watering.

The dilemma for managers is “How do I train growers to water when I was never trained myself?” The key to training your staff is to break the process down into definable, teachable activities and then train the appropriate staff intensively. The watering process is broken down into four different levels of knowledge with each subsequent level of knowledge dependent on a thorough understanding of the previous knowledge (Figure 1).

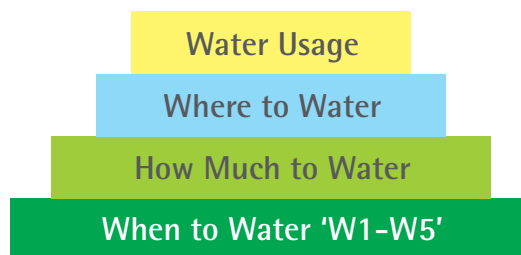


Figure 1. Watering Knowledge Pyramid

All employees need to understand “when to water.” This level of knowledge involves developing a common terminology so everyone in your organization can communicate the moisture status of the crop. From shipping to growing to pot filling – if the soil is a “level 2,” everyone knows what the soil moisture level is and what they need to do about this level based on production protocols.

“How much to water” is a knowledge level that growers need to complete. This level trains the staff on methods to apply water using different equipment to achieve the desired moisture level.

“Where to water” and “water usage” are more complex levels of knowledge that key growers and managers need to master. The highest quality products are produced by growers who understand where in the container to apply the water and how to anticipate water usage so that plants receive enough water to survive one to three days.

Watering Terminology

When to water W1-W5. The key to determining when to water is to define what is “dry” through “wet.” Since everyone learns and processes information differently, we need to provide different ways to determine when the plants reach different points in the continuum from dry to wet. There are five distinct levels of soil moisture for peat-based medium. At each level you should be able to see and feel different criteria to help understand what level the soil has reached.

Level W5

When the soil is fully saturated the soil moisture is a level W5 (Figure 2). Growers will water to a level W5 when fertilizing, leaching to reduce salts, or during periods of rapid drying or rapid growth. Plants do not grow well when the soil is maintained at a level W5. At this level there is not enough oxygen in the soil to promote good root growth.



- **Black Color**
- **Free Water**
- **Soil is Saturated**
- **Pudding or Tofu**

Figure 2. Level W5 – Wet

Level W5 Characteristics

The color of the soil is black and shiny due to the free water that has filled all the pore space. If you take a soil sample in your hand it feels like pudding or tofu and water freely drips out of your hand. A level W5 does not last long after watering since gravity will reduce the moisture level at the surface of the soil. Although the surface may appear dry, the bottom of the pot may remain a level W5 until roots reach the bottom of the pot.

Level W4

When gravity reduces the free water from the soil matrix the soil moisture is a level W4 (Figure 3). At a level W4, the soil becomes dark brown and is holding the maximum water against gravity. Growers will maintain a level W4 when germinating certain genera, callusing cuttings, spot watering during periods of rapid drying, or when using very high EC levels during production. Many growers erroneously believe that a level W4 is the ideal moisture level to grow plants. At a level W4, it is easy to stretch plants and promote pythium development.

Level W4 Characteristics

The soil is a dark brown but not shiny since there is no free water present in the soil. If you take a soil sample in your hand and squeeze the soil slightly, water will drip. At a level W5 water will drip without squeezing, while a level W4 requires some force to extract water. After squeezing the soil, it retains the shape with some cracking since the water “glues” the soil together.

Level W3

As more water leaves the soil due to evaporation or uptake by the plant, the soil begins to become lighter in color and weight.



- **Soil is Dark Brown**
- **No Visible Water**
- **Soft Squeeze →**
Water Runs
- **Soil Glued Together**

Figure 3. Level W4 – Medium Wet

As the soil turns to brown, the soil has reached a good balance between available water and air in the soil. Growers use a level W3 to encourage strong root development, to reduce hypocotyl and stem elongation, and to reduce disease development (Figure 4). Although growers may want to water when the plants reach a level W3, plants will flourish when the soil is allowed to dry to level W3 or W2. The key is to determine what the moisture level is throughout the soil profile. If the surface is a level W3, the bottom of the pot (where the roots are) may be a level W4 or W5. As the soil moisture moves to a level W3 it becomes critical to evaluate the container moisture level from top to bottom before watering to prevent excess water in the container.



- **Soil is Brown**
- **Hard Squeeze →**
Water Drips
- **Soil Cracks Apart**

Figure 4. Level W3 – Medium

Level W3 Characteristics

As more water is lost from the soil, the soil continues to become lighter in color and is brown. If you take a soil sample in your hand and squeeze as hard as possible you can get one or two drops of water from the soil. If water freely drips as you squeeze then the soil is a level W4, if no water can be squeezed out the soil is a level W2. After squeezing the soil, the soil will crack apart but the chunks stay together.

Level W2

As the soil begins to dry further, the soil will take on a light brown to tan color. At a level W2 there is still water available to support plant growth although the plant has to “search out” the water that is available in the soil (Figure 5 page 18). When the soil is a level W2, root and shoot growth is restricted. Depending on growth rate and environmental conditions a plant can survive for a considerable period of time at a level W2. The challenge with maintaining a level W2 is the plants can begin wilting very rapidly if the entire root ball reaches a level W2. During high evapotranspiration periods plants have a difficult time extracting sufficient water from the soil at a level W2, while at cool, humid conditions evapotranspiration is low and plants can survive at a level W2.

Level W2 Characteristics

As the available water is lost from the soil, the soil continues to become light brown to tan. If you take a soil sample in your hand and squeeze as hard as possible you cannot squeeze any

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How Wet is Wet? Watering Terminology

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- Light Brown to Tan
- Hard Squeeze →
- No Drip
- Soil is "Squeaky"
- Crumbles Apart

Figure 5. Level W2 – Medium Dry

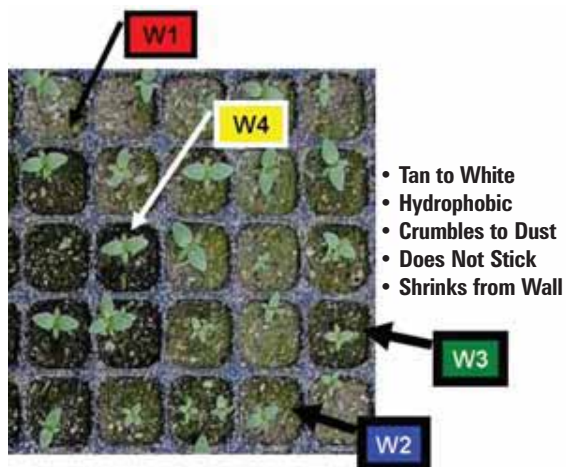
water out. If you squeeze the soil near your ear you can hear the soil "squeak" as the water moves through the pores of the soil. After squeezing the soil, it will fall apart in your hand, but if you blow on the soil it stays stuck together.

Level W1

As the available water is removed from the soil, the color turns to a light tan to white-gray, and the soil volume may shrink in the container. Once the soil reaches a level W1 the soil becomes hydrophobic and rewetting is difficult without a wetting agent (Figure 6). Plants become stressed when exposed to a level W1; therefore, unless the crop protocol calls for severe water stress conditions (succulents and cacti) growers should avoid a level W1. It is not uncommon for growers to overreact to the surface of the soil reaching a level W1 while the lower portions of the soil ball are still at a level W2 to W4.

Level W1 Characteristics

All available water is lost from the soil and the soil turns tan to white-gray. If you take a soil sample in your hand and squeeze as hard as possible you cannot squeeze any water out the soil. If you squeeze the soil near your ear you cannot hear the soil "squeak." After squeezing the soil it will fall apart in your hand, and if you blow on the soil it disperses since it cannot stick together.



- Tan to White
- Hydrophobic
- Crumbles to Dust
- Does Not Stick
- Shrinks from Wall

Figure 6. Level W1 – Dry

When to Water

For each stage of development there is a different point where the plants need to be watered. Based on a grower's production protocols, specific recommendations can be developed to help growers know "how dry is dry enough to water." Tables 1 and 2 suggest different water levels that will optimize growth for seedling or finished production. For seedling plug production (Table 1) growers need to maintain very different moisture levels for germination, while during Stage 3 the levels are the same. This is true since root development during Stage 3 is the same regardless of genus.

Table 1. Examples of moisture levels when plugs should be watered for optimum growth.

Crop	Stage 1	Stage 2	Stage 3	Stage 4
Pansy	W4	W3	W3	W3
Impatiens	W5	W3	W3	W2
Petunia	W4	W4	W3	W2
Verbena	W2	W3	W3	W3
Vinca	W4	W3	W3	W3

When finishing plugs or liners (Table 2), there are different moisture requirements depending on stage of development. For many crops root development is promoted in a level W4 while other crops prefer a drier moisture condition. When plants are growing rapidly during "biomass development" moisture levels should not be limiting if the plant is subject to rapid wilting, as with impatiens. With other crops maintaining a level W3 will keep the plant height in check. When preparing the plants for shipping it is always a good idea to subject the plants to moisture level W3 to harden the plant. Reducing the moisture level too severely (W2 or W1) can cause root death during shipping and merchandising periods.

Table 2. Examples of moisture levels for optimum growth when finishing plants.

Crop	Root Into Pot	Plant Establish	Biomass Development	Ship
Geranium	W3	W4	W3	W3
Imp NG	W4	W4	W4	W3
Imp Fiesta	W4	W4	W4	W3
Petunia	W3	W4	W3	W3
Verbena	W4	W3	W4	W3

In the next installment we will cover when to water and higher levels in the water knowledge pyramid.

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ofa Grower

OFA Fact Sheet: Botrytis

by Margery Daughtrey



Hosts

Botrytis cinerea is a widespread pathogen that causes a disease known as gray mold or Botrytis blight. The host preferences of this fungus include virtually every plant grown in the greenhouse. Growers can usually recognize *B. cinerea* by the coating of grayish brown mold that it forms on dead plant tissue when it sporulates. Wounded or senescent tissues and flower parts are very susceptible. Some of the crops especially prone to Botrytis blight include anemone, geranium, dahlia, fuchsia, cyclamen, primula, bacopa, exacum, snapdragon, zinnia, rose, lisianthus, poinsettia, and vinca. There are additional *Botrytis* species that are more host-specialized. The most familiar of these is *Botrytis elliptica*, which is a pathogen of lilies, and *Botrytis tulipae*, which can attack tulips.

Symptoms

Flowers suffer from Botrytis blight during production and post-harvest when tiny spots may form on petals or the flower head may rot. Roses and gerberas are two cut flower crops subject to such postharvest losses. Although they may look unblemished at harvest, flowers may develop Botrytis lesions during transport or storage. Botrytis epidemics can be generated when a hanging basket crop deposits petals on the crop below. Leaf lesions are brown to tan, irregularly shaped, and may expand to cause extensive blighting. They usually have a zonate pattern representing several cycles of wet and dry conditions. Stem infections often start from a leaf scar or a cutting wound, or from the petiole of a blighted leaf. Leaves wilt on cankered stems.

Dispersal

Botrytis forms spores that allow the fungus to spread and sclerotia that help it to linger in the greenhouse. The spores (called conidia) are microscopic in size, formed in miniature grape-like clusters at the end of brownish conidiophores and dispersed on air currents or by splashing. Sclerotia are hard knots of fungus tissue that help the fungus to survive in soil or on dead plant parts until conditions are good for a new cycle of pathogenic activity. Sclerotia that form on bulbs or other transported plant parts can hitchhike around the world to cause disease far away from where they formed.

Management

Environmental Control

Botrytis blight prevention in greenhouses is achieved primarily by environmental manipulation. Because the conidia of *Botrytis* are spread easily by air currents or during irrigation,

inoculum is repeatedly distributed around the greenhouse under normal cultural conditions. One critical factor that is largely under the grower's control is the duration of moisture on plant surfaces – extended periods of leaf wetness are essential for spore germination. Just a few consecutive hours of moisture on a plant will initiate the infection process. Minimize the length of time plant surfaces are wet by spacing plants adequately, using wire mesh benches that allow air to pass upward between plants, and circulating air with fans. Irrigate early in the day, only when necessary, and avoid creating puddles that will contribute to the overall humidity. Irrigation by drip tubes is preferable.

Heating and ventilating the greenhouse at sunset to drive out the moisture-laden air before nightfall is also beneficial. Botrytis blight is a gray, rainy weather disease – low light favors the pathogen. It is hardest to control outside the heating season and during cloudy spring or fall weather. Reducing relative humidity is key – keep RH below 85 percent to avoid a Botrytis-favorable atmosphere. Short heating bursts to lower RH can be cost effective for disease control. Humidity control is more critical at certain times, such as just after cutting harvest.

Sanitation

The second key feature of Botrytis management is preventing the buildup of spore inoculum. This includes removing dead or dying plant parts promptly and keeping receptacles for plant debris in the greenhouse covered. Spent flower heads and senescent lower leaves starved for light are two places where Botrytis commonly sporulates. Spores of *B. cinerea* may land on petals of flowers in the greenhouse and remain alive for months, so that any postharvest condensation permits infections.

Cultural Factors

Nutrition impacts Botrytis diseases as well. The fungus needs a supply of nutrients to power its infection, so biocontrol may be effective if organisms applied outcompete *Botrytis* for nutrients. Pollen can stimulate *Botrytis* by serving as a food source. High levels of N can create dense plant canopies that hold high humidity around the crown and thus create a microclimate favorable to disease development. It is important for plants to have adequate calcium, as deficiency of this nutrient weakens cell walls that are an important physical barrier to Botrytis.

Chemical and biological control treatments for Botrytis blight supplement careful sanitation and environmental regulation. Botrytis fungicides work by contact action. Because this pathogen produces large numbers of spores very quickly, it is

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OFA Fact Sheet: Botrytis

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extremely adept at developing resistance to fungicides that are “at risk” for resistance development due to having a single-site mode of action. Highly resistant Botrytis populations have been documented for thiophanate-methyl, and partial resistance has been seen for iprodione. In university tests, chlorothalonil, fenhexamid, iprodione, and fludioxonil remain some of the most effective active ingredients for Botrytis control. Some benefit is seen with other chemical and biological products, and promising new materials are currently being trialed. To guard against resistance, materials with different modes of action should be applied in strategic rotational schemes. Treat before the crop canopy closes in to get good coverage on lower leaves.

Diagnosis

To confirm that spotted or cankered plant parts are diseased by Botrytis, you can place them into a plastic bag along with a moist paper towel. Seal the bag tightly and re-examine it in 24 to 48 hours. If the discolored areas are caused by Botrytis, the characteristic gray mold will form on the lesion.

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ofa Garden Center

Markdowns: The Good, The Bad, and The Ugly

by Bob & Susan Negan

Fact: You can minimize markdowns, but you won't eliminate them. Taking markdowns is just a fact of doing business. Learn how to take markdowns wisely and well to minimize their impact on your business. If you don't take markdowns on merchandise that's not selling, you're simply tying up cash that could otherwise be spent on saleable goods. Trust me, holding on to bad merchandise and hoping it will eventually sell at full price just doesn't work.

There are two kinds of markdowns to consider. The first kind is a *permanent* markdown. This is the markdown you take on merchandise you want to clear out of your store forever and aren't going to re-buy. You know, that talking flamingo with the bouncing head that the sales rep talked you into, or the “darling” little chartreuse bonnets your mom picked out. Mark the lower price in red (or another bright color) on the price tag. And keep lowering the price until it's gone! This is the stuff that should be in your clearance section.

The second type of markdown to consider is the *point-of-sale* markdown. Use this kind of markdown when you want to put items on sale that you intend to keep selling in your store. With this kind of markdown you don't permanently lower the price; the special price is only for a specific period of time – like a weekend sale or a month-long special event. The price tag stays the same, and the markdown is taken at the time the sale is rung up. When the sale is over, the merchandise goes back to

its original price. You might use this kind of markdown for a temporarily overstocked item (umbrellas during a drought or sleds in a mild winter), or if you are having a special promotion.

10 Tips to Make the Most of Your Markdowns

1. **Just do it!** Markdown the “dogs” in season. Don't wait to mark down something that you know isn't going to sell – especially if it's a seasonal item. Marking it down in season allows you to take a smaller percent off than if you wait too long, and it's also more likely that you'll end up actually selling the goods than if the season has passed.
2. **Pick a percentage that motivates buying.** If it's a bad buy, don't try to get away with a 5 percent markdown. Start at least 20 percent off, and go down from there if necessary.
3. **Don't overdo the “SALE” mode.** If you're always “on sale” your customers will hesitate to buy from you at regular price. Try to keep big, storewide sales to twice a year at most.
4. **Move permanent markdowns to a clearance area.** If you leave permanently marked down merchandise mixed in with regular price goods, it's hard to spot the great deals. Move all your clearance to one area so it's easy to shop.
5. **Sign, sign, sign.** Make sure you have signs highlighting all your markdowns. A big sign for the clearance area and signs to indicate your point of sale markdown (All Games 40% OFF) are the best ways to make sure your customers know what's on sale.





6. Try a price point table. If you have lots of items at around the same price point, try a price point table – for example, “All Items On This Table \$10.” That might mean a 22 percent markdown on some items but a 48 percent markdown on others. It makes the buying decision easy for your customers, and that moves merchandise.

7. Put your markdowns at the “back of the bus.” If you put your clearance section at the back of the store, you’ll minimize the clutter in your store (because, let’s face it, clearance isn’t very pretty!), and you’ll also make customers walk through all the wonderful regular priced merchandise to get to the bargains!

8. Train your sales staff. Take time to thoroughly train your sales staff on great selling behaviors. Encourage them to sell regular priced merchandise. This will mean fewer markdowns for you and higher overall margins.

9. Broken colors, sizes, or assortments = markdowns. The right time to mark something down is tricky. Here’s one rule of thumb: If you have a coordinated merchandise group that has few matching sizes, colors, or pieces left, mark it down.

10. Over a year old? Dump it or donate it. Your store is not a museum. If you have basic merchandise that’s over a year old, take a loss on it or donate it to a charity to get the write off on your taxes. There’s some stuff that just won’t sell no matter how low you mark it!

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ofa Grower

Why Is It Important to Know Mode of Action?

by Raymond Cloyd

Insect and mite pests such as aphids, whiteflies, thrips, fungus gnats, and spider mites, when present in abundant numbers, can make it difficult for greenhouse growers to produce a quality crop. As such, pest control materials, in this case insecticides and miticides, are still primarily used to prevent or reduce the buildup of plant-feeding insects and mites and minimize the damage they cause. However, over-zealous use of insecticides and/or miticides can result in resistance developing in insect and mite pest populations. This is why it is imperative to implement proper stewardship of currently available insecticides and miticides to preserve their longevity and extended use. In order to do this, it is important that greenhouse growers understand the mode of action of insecticides and miticides.

Mode of action refers to the summation of the anatomical, physiological, and biochemical interactions or responses that result in the toxic action of an insecticide or miticide. In other words, mode of action is how an insecticide or miticide negatively affects the metabolic and/or physiological processes in an insect or mite pest. However, the mode of action may not always be known or understood, or there may be more than one mode of action involved. The major modes of action of insecticides and miticides may be classified into distinct groups including physical toxicants (desiccants or membrane disruptors); nerve toxins; metabolic inhibitors; cytolytic toxins (cause cells to rupture or disintegrate); and disruptors of molting, metamorphosis, and cuticle formation.



Most insecticides, in general, interfere with the central nervous system of the target insect pest. It is important to know the mode of action in order to effectively design rotation programs that involve using insecticides and/or miticides with different modes of action – not chemical classes. Initially, we used to discuss rotating chemical classes; however, several chemical classes have similar modes of activity. For example, organophosphates and carbamates, despite being different chemical classes, have identical modes of activity. In insects, one of the major neurotransmitters is acetylcholine (ACh), which is responsible for activating sodium channels, thus allowing nerve signals to travel through the central nervous system. The enzyme, acetylcholinesterase (AChE) will eventually (within micro-seconds) break down or deactivate acetylcholine from the nerves, which closes the sodium channels, halts nerve signals from “firing,” and clears the way for another signal transmission.

Insecticides in the chemical classes organophosphate and carbamate, inhibit or block the action of acetylcholinesterase by attaching to the enzyme. This causes nerve signals to continue sending impulses or “firing” resulting in an accumulation of acetylcholine, an exhaustion of energy, and then death. So, using acephate (Orthene), an organophosphate, for two successive spray applications during the generation of an insect pest, and then switching to the carbamate methiocarb (Mesuro), would not

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Why Is It Important to Know Mode of Action?

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constitute a proper rotation scheme since the insect pest population is being exposed to the same mode of action.

Similarly, although pyridaben (Sanmite), fenpyroximate (Akari), and acequinocyl (Shuttle) are in different chemical classes (pyridazinone, phenoxy-pyrazole, and naphthoquinone, respectively) they are all active on the mitochondria electron transport system (these insecticides/miticides are often referred to as mitochondria electron transport inhibitors or METIs), which is responsible for energy production, so these miticides should not be used in succession. However, the target site differs among these three miticides. For example, pyridaben (Sanmite) and fenpyroximate (Akari) inhibit mitochondrial electron transport at the NADH-coenzyme Q reductase site of Complex I whereas acequinocyl (Shuttle) inhibits respiration of the mitochondria at Complex III (cytochrome c reductase) by binding to the ubiquinol oxidation site (QO) in the electron transfer chain (Figure 1).

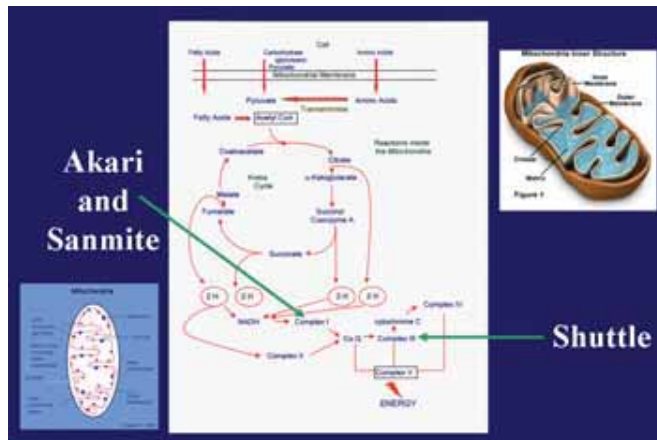


Figure 1. Target sites in the mitochondria of three miticides: fenpyroximate (akari), pyridaben (Sanmite), and acequinocyl (Shuttle).

The chemical class neonicotinoid contains five systemic insecticides that are registered for use in greenhouses: imidacloprid, thiamethoxam, acetamiprid, clothianidin, and dinotefuran. All the neonicotinoid-based insecticides act as agonists of the insect nicotinic acetylcholine receptors located in the central nervous system. Since all the neonicotinoids have similar modes of activity it is important to avoid using them in succession as this will increase the “selection pressure” on the target insect pest population and may potentially enhance the development of insecticide resistance. It is recommended to utilize an insecticide (or two) with a different mode of activity either before or after having used a neonicotinoid-based insecticide.

Most of the insecticides and miticides labeled for use in greenhouses have specific modes of action – that is they are only active on one particular target site. However, some insecticides have broad modes of activity or are active on multiple target sites. For example, microbial-based insecticides

containing the active ingredient *Bacillus thuringiensis* (Dipel and Gnatrol) work by binding to specific receptor sites on the stomach epithelium resulting in degradation of the stomach lining and eventual starvation of the target insect. Crystals release protein toxins (endotoxins) that bind to stomach membrane receptor sites creating pores or channels. This paralyzes the digestive system and ruptures cell walls, allowing ions to flow through the pores, disrupting potassium and pH balances. As a result, the alkaline contents of the stomach spill into the blood (hemolymph) resulting in paralysis and eventually death.

Below are examples of rotation schemes for aphids, thrips, twospotted spider mite (*Tetranychus urticae*), whiteflies, mealybugs, and fungus gnats using insecticides or miticides (active ingredients are listed) that have dissimilar modes of action. Each insecticide or miticide is applied once per week:

Aphids: Pymetrozine→Imidacloprid→Paraffinic Oil→Bifenthrin

Thrips: Spinosad→Abamectin→Chlorfenapyr→Methiocarb

Twospotted Spider Mite: Bifenazate→Spiromesifen→Etoxazole→Acequinocyl

Whiteflies: Dinotefuran→Pyriproxyfen→Spiromesifen→Buprofezin

Mealybugs: Acetamiprid→Acephate→Potassium Salts of Fatty Acids→Kinoprene

Fungus Gnats: Pyriproxyfen→Cyromazine→Kinoprene→Chlorfenapyr

A list of the major modes of activity for insecticides and miticides used in greenhouses (common name and trade name) that may be categorized under each specific mode of activity is presented in Table 1. In addition, the Insecticide Resistance Action Committee (IRAC) mode of action designations is included. These are what appear on a number of insecticide or miticide labels, which will expedite the process of developing effective rotation and resistance management programs thus allowing you to deal with insect and mite pests more effectively. Anyone interested in obtaining additional information regarding the mode of action of insecticides and miticides should refer to the IRAC web site (www.irac-online.org).

This article has discussed mode of action as it relates to insecticides and miticides registered for use in greenhouses. As such, it is important that greenhouse growers exercise judicious use of insecticides and miticides with different modes of action in order to avoid or overcome the problem of resistance, and preserve the longevity of currently available products.

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Table 1. Mode of action of commercially-available insecticides and miticides registered for use in greenhouses, and arthropod (insect and mite) pest activity.

Mode of Action	Pest Control Materials	Type	Pest Activity (based on label)												
			WF	AP	TH	MB	SM	FG	SF	LM	CA	SL			
Acetylcholine Esterase Inhibitors (1A & 1B)*	Acephate (Orthene)	C, S, T	X	X	X	X									
	Chlorpyrifos (DuraGuard)	C		X	X	X			X	X	X	X			
	Methiocarb (Mesurol)	C		X	X										X
GABA-Gated Chloride Channel Blockers (2A)	Endosulfan (Thiodan)	C	X	X											
Sodium Channel Blockers (3)	Bifenthrin (Talstar/Attain)	C	X	X	X	X	X	X						X	
	Cyfluthrin (Decathlon)	C	X	X	X	X		X						X	
	Fenpropathrin (Tame)	C	X	X	X	X	X				X	X			
	Fluvalinate (Mavrik)	C	X	X	X		X							X	
	Lambda-cyhalothrin (Scimitar)	C	X	X	X	X	X				X	X			
Nicotinic Acetylcholine Receptor Disruptors (4A)	Acetamiprid (TriStar)	C, S, T	X	X	X	X		X		X	X				
	Clothianidin (Celero)	C, S, T	X	X		X									
	Dinotefuran (Safari)	C, S, T	X	X	X	X		X			X				
	Imidacloprid (Marathon)	C, S, T	X	X	X	X		X			X				
	Thiamethoxam (Flagship)	C, S, T	X	X		X		X							
Nicotinic Acetylcholine Receptor Agonist (5A)	Spinosad (Conserve)	C, T			X		X				X	X			
GABA Chloride Channel Activators (6)	Abamectin (Avid)	C, T	X	X	X		X				X				
Juvenile Hormone Mimics (7A, 7B, & 7C)	Fenoxycarb (Preclude)	C	X	X	X	X	X					X	X		
	Kinoprene (Enstar II)	C	X	X	X	X		X							
	Pyriproxyfen (Distance)	C, T	X	X		X		X	X	X					
Chitin Synthesis Inhibitors (15, 16, & 17)	Buprofezin (Talus)	C	X			X									
	Cyromazine (Citation)	C						X	X	X					
	Diflubenzuron (Adept)	C	X					X	X	X	X				
	Etoxazole (TetraSan)	C, T					X								
	Novaluron (Pedestal)	C	X		X						X	X			
Growth and Embryogenesis Inhibitors (10A)	Clofentezine (Ovation)	C					X								
	Hexythiazox (Hexygon)	C					X								
Selective Feeding Blockers (9B & 9C)	Flonicamid (Aria)	C, S, T	X	X	X	X									
	Pymetrozine (Endeavor)	C, S, T	X	X											
Disruptors of Insect Midgut Membranes (11A1 & 11B2)	<i>Bacillus thuringiensis var. israelensis</i> (Gnatrol)	ST						X							
	<i>Bacillus thuringiensis var. kurstaki</i> (Dipel)	ST												X	
Oxidative Phosphorylation Uncoupler (13)	Chlorfenapyr (Pylon)	C, T					X	X					X		
Oxidative Phosphorylation Inhibitor (12B)	Fenbutatin-oxide (ProMite)	C					X								
Ecdysone Antagonist (18 & 26)	Tebufenozide (Confirm)	C												X	
	Azadirachtin (Azatin/Ornazin)	C	X	X	X	X		X	X	X	X				
Mitochondria Electron Transport Inhibitors (21 & 24)	Acequinocyl (Shuttle)	C					X								
	Fenpyroximate (Akari)	C					X	X							
	Pyridaben (Sanmite)	C	X				X								
Desiccation or Membrane Disruptors	Neem oil (Triact)	C	X	X		X	X								
	Paraffinic oil (Ultra-Fine Oil)	C	X	X	X	X	X	X			X				
	Petroleum oil (PureSpray Oil/Ultra-Pure Oil)	C	X	X	X	X	X	X			X				
	Potassium salts of fatty acids (Insecticidal Soap)	C	X	X	X	X	X								
GABA-Gated Antagonist (25)	Bifenazate (Floramite)	C					X								
Lipid Biosynthesis Inhibitor (23)	Spiromesifen (Judo)	C, T	X				X								
Unclassified by IRAC	<i>Beauveria bassiana</i> (BotaniGard)	C	X	X	X	X								X	
	Sodium tetraborohydrate decahydrate (TriCon)	C	X	X		X	X								

Pest Activity Codes
 WF=Whiteflies AP=Aphids
 TH=Thrips MB=Mealybugs
 SM=Spider Mites FG=Fungus Gnats
 SF=Shoreflies LM=Leafminers
 CA=Caterpillars SL=Slugs

Type Codes
 C=Contact
 S=Systemic
 T=Translaminar
 ST=Ingested

* Values in parentheses are mode of action designations, based on the Insecticide Resistance Action Committee (IRAC), which appear on product labels

Ask the Doctor

Dr. Steve Carver, OFA
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Quality – From Fords to Flowers

I remember quite a number of years ago seeing a Ford Motor Company commercial that emphasized their new slogan, “Quality is Job 1.” The Japanese auto makers had captured a significant portion of the domestic auto market largely because their cars were more reliable and, in many cases, cheaper than their American counterparts. The response of domestic automakers, as epitomized by Ford, was to try to sell the perception that American car companies were making great strides in the quality of their products and that the American buying public should give them another try. Fast forward to today; a perusal of *Consumer Reports* yearly auto issue that comes out each April, still shows cars from Japanese auto makers are typically still rated higher than American cars. In addition the portion of the U.S. auto market held by the Japanese auto makers has grown. Did our auto industry lie to us? No, the quality of the vehicles coming from Detroit have improved, but so have the Japanese cars both imported and those now made here in the U.S.

Now shift gears and look at bedding and potted plant growers. A similar picture, though perhaps a little more convoluted since the source of competitive pressure is internal, can be painted for these portions of the floriculture industry. The introduction of flowers into new retail channels, i.e. grocery stores then box stores brought “boom times” to our industry in the late 70’s thru early 90’s as just about any grower, large or small, good or not so good, could sell all the product they could grow. By the mid 90s, though, the rate of the industry’s overall growth slowed, and many small and mid-sized growers and independent garden centers (IGCs) started to feel squeezed by box stores and the large growers supplying them which continued to grow.

To maintain margins that many small- to medium-sized growers need to offset the “economy of scale” advantages often enjoyed by large growers, a number of them started retailing their own product. They and those supplying IGCs consoled themselves with the thought that they still held a trump card – quality. While their smaller size cost them the ability to match price points of larger growers, their size often lent them flexibility in production needed to produce a higher quality product. The common assumption was and is that quality correlates closely with consumer satisfaction. There are several problems with this assumption, not the least of which is that perceived quality doesn’t always equal quality “performance” in the landscape. How many times have you heard of consumers who bought good looking bedding plants only to have them just “sit” in the landscape because they had been hit hard with PGRs shortly before shipment to “preserve quality” in the retail environment.

Another problem for many small- to mid-sized growers is the same as experienced by American auto manufactures – quality is a moving target. Larger growers are learning to produce higher quality crops on thinner margins. Additionally, large growers involved in vendor managed inventory relationships with their retailers “see” first hand the impact of adjustments to production practices and variety selection on postharvest quality and presumably the potential for consumer satisfaction. A similar advantage is afforded to smaller growers who retail their own product. The point is that while intrinsic quality is not the “end all” for a successful operation, it is still a cornerstone for consumer satisfaction. So where does that leave growing and retail operations that lack postharvest quality feedback or control over production?

This meandering flow of thought was spurred by an article that appeared recently in *HortTechnology* (October-December 2007. 17(4). Pgs 544 – 551) titled, “Postharvest Decline Symptoms after Simulated Shipping and During Shelf Life of 21 Cultivars of Vegetative Annuals,” by Terri Starman, Shannon Beach, and Kristen Eixmann at Texas A&M University. The objective of their study was to “simulate shipping for 0, 1, or 2 days to determine qualitative and quantitative shelf life longevity of 21 cultivars of cool- and warm-season vegetative annuals to determine the effect of shipping duration and to characterize postharvest decline symptoms. This study was designed to lead to further investigation of production methods and postproduction environment parameters to increase postharvest longevity of vegetative annual garden plants grown in small containers.” In explaining the need for the series of studies of which this one is just the first, the authors state, “Cultivars that are more resistant to the adverse effect of shipping or retail displays will provide consumers with a higher quality product. Unfortunately, detailed postproduction information is not available for all species, and there is considerable variability between species and cultivars. Increased information would make growers more conversant to help retailers care for plants, and retailers would be more knowledgeable in designing retail spaces for marketing potted garden plants. Production practices keeping postharvest longevity in mind would also give consumers longer lasting products and would make them more satisfied, repeat customers.”

So this study was intended to establish a base line for comparison of treatments in subsequent studies; their “research is continuing to investigate effectiveness of production practices such as fertilizer toning and 1-methylcyclopropene treatments on prolonging shelf life and preventing flower abscission of vegetative annual garden plants.” The plants that they trialed were: ‘Caritas Lavender’ angelonia (*Angelonia angustifolia*); ‘Comet White’ and ‘Sunlight’ argyranthemum or marguerite daisy (*Argyranthemum frutescens*); ‘Dreamtime Copper’, ‘Dreamtime Cream’, ‘Florabella White’, ‘Florabella Gold’, ‘Sundaze Bronze’, and ‘Sundaze Golden Yellow’ bracteantha or strawflower; ‘Liricashowers Deep Blue Imp’, ‘Starlette Trailing Purple’, and ‘Superbells



Trailing Blue' calibrachoa; 'Sun Chimes Coral' diascia; 'Lucky Lemon Cream' and 'Lucky Peach Sunrise' lantana (*Lantana camara*); 'Aromatica White' and 'Vanilla Sachet' nemesia; 'Cascadias Pink' and 'Suncatcher Pink' petunia; and 'Bridal Showers' and 'Candy Floss Blue' sutera or bacopa (*Sutera hybrida*). Treatments included three shipping durations 0, 1, or 2 days in a simulated shipping environment at about 80°F and 50 percent humidity with no light. Following shipping, plants were placed for 3 weeks in simulated garden center environment at about 70°F with an average light intensity of about 30 footcandles for 9 hours a day. Quality measurements were taken just before and after being placed in the shipping environment and again 1, 2, and 3 weeks after being placed in the garden center type environment.

A key take home message of this initial study is, "Each species in this study had one or two postharvest decline symptoms common to all cultivars of that species. However, cultivars within species also varied in their postharvest decline symptoms and longevity." Specific responses of individual cultivars is not critical for this discussion, though that of subsequent studies should be. Complete results can be obtained at the website: <http://horttech.ashspublications.org/cgi/content/full/17/4/544>.

Until the authors have specific recommendations to share that will be drawn from future studies, they repeat recommendations that others have generated from their studies with seeded annuals and pot plants. "To maintain quality, the postharvest environment should be equipped with low light, shaded with 50% to 60% shade material, and have good air circulation. The shading and air movement will help keep the temperature cooler. Experiments with seed-propagated bedding plants produced in flats have shown cool temperatures are the most important environmental factor in increasing shelf life. Exposure to ethylene should be avoided during shipping and in the retail outlet. In addition, to prolong shelf life irrigation should occur at the onset of water stress."

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ofa Academic Update

The Certified Horticulturist Program

by Karen L. Panter

Come July, the first Certified Horticulturists will emerge from the annual conference of the American Society for Horticultural Science (ASHS). The Certified Horticulturist program (ASHS-CH) has gained momentum over the last two years and is about to come to fruition.

Patterned after the very successful national Certified Crop Advisor program administered by the American Society of Agronomy, the program is geared toward those who may or may not have a four-year college degree but who are actively working in our industry. Another highly successful model of a visible, effective certification program is that of the International Society of Arboriculture which administers the Certified Arborist program. The ASHS-CH program will be administered by ASHS, which also runs a sister program called the Certified Professional Horticulturist (CPH). The CPH program, however, is targeted to those with a combination of at least a four-year degree in horticulture or related field, plus extensive professional experience in the field.

ASHS has long been the cornerstone of research, Extension, and education in horticulture and is well-positioned for active

promotion of the discipline as a science and a career. The question is how to encourage young Americans to think about and pursue horticultural career opportunities. How can ASHS help develop not only new young talent, but new horticultural market niches and increase the visibility and professionalism of the science? The long term strategy involves the notion that the public understands and expects some level of professionalism, including licensing and certification. This includes CPAs, RNs, MDs, CCAs, and PEs.

So what is the purpose of the ASHS-CH program? Its purpose is to define and validate the horticultural competency of practitioners with a minimum of three years of paid experience in the industry, with or without a four-year college degree. The ASHS-CH program is designed to enhance the professional image of the discipline and industry of horticulture.

The target audience includes professionals in production, horticultural services, or other related horticultural endeavors. Production might include orchards, groves, greenhouses, nurseries, propagation, vegetables, etc. Horticultural services

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The Certified Horticulturist Program

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could include commercial scouts, pest control advisors, cooperative Extension personnel, horticultural consultants, suppliers, tree care firms, etc. The last category would also include botanic gardens, garden centers, golf courses, sports fields, and municipal governments.

Currently, the program is for general horticultural certification, with the possibility of expanding to specializations as the program grows. It does not supplant or negate other certification programs in existence. It is designed to work in conjunction and cooperation with quality individual state and other national programs already in existence for the various commodities. ASHS-CHs will initially have to pass a general exam and adhere to a code of ethics. Thereafter, the ASHS-CH will need to complete continuing education units (CEUs) to retain certification. Eventually the CPH program will also require passing an exam, but that step has not yet been taken.

The committee within ASHS working on the ASHS-CH program has narrowed the program to 35 knowledge or competency areas from which tasks and exam questions are currently being developed. Through countless conference calls and meetings, the core group has worked on the program for almost two years. The 35 competency areas were further refined in a job task analysis workshop, held in October 2006. Fourteen individuals from across the country gathered together to determine specific tasks related to various horticultural operations. The group initially identified 57 specific competencies. By May 2007, the Job Task Analysis Results document had been produced by Ray Talke of Minds in Action, a Massachusetts-based company specializing in development of certification programs (www.mindsinaction.net) and the coordinator of this project.

Following release of the 308-page Job Task Analysis document, an Objectives Ranking Survey was open via an ASHS-hosted web site, from early June through August 31, 2007. The survey was taken by industry professionals and potential ASHS-CHs from across the country. They critiqued the 57 tasks, resulting in the reduction of the number to the current 35. These 35 general tasks have an accompanying 1,835 enabling objectives from which the exam is being developed. Then last December, another group from across the country met for a five-day exam writing workshop. They developed two 200-question exams. Exam validation workshops are being held this spring. Following validation, statistical analysis of the tests must be done and the final product should be finished late spring 2008. The first ASHS-CH exam is scheduled for the ASHS conference July 21-24 at the Rosen Plaza Hotel in Orlando, Florida. Check the ASHS web site at www.ashs.org or contact Michael Neff at mwneff@ashs.org for additional information.

Development of the program has involved countless industry professionals as well as within ASHS. The committee has worked hard to ensure each industry group was well represented. Geographic diversity has been a priority as well. Each of the workshops has involved different individuals from throughout

The core committee developing the ASHS-CH program is:

Fred T. Davies, Texas A&M University, committee ASHS-CHair

Mary Lamberts, University of Florida

Terry Ferriss, University of Wisconsin – River Falls

George Fitzpatrick, University of Florida

Susan Steinberg, University of Houston

Karen Panter, University of Wyoming

Michael Neff, Executive Director, American Society for Horticultural Science

Ray Talke, Minds in Action

Janet Cole, Oklahoma State University

The committee would like to thank ASHS for their support of this project, Ray Talke for his guidance, and all the participants in the workshops held to date.

the United States, thus increasing the validity of the tests and the program.

The future of the program depends on assistance from ASHS, as well as people in Extension, industry, university alumni, and others. Exams are not static and must be periodically updated, validated, and statistically verified. And marketing the program is the next large item for the planning committee to coordinate. Thankfully, the board of directors of ASHS has been solidly supportive of this endeavor, not only in principle, but also monetarily. Eventually the ASHS-CH program should be highly visible certification and a steady revenue stream for ASHS, enabling expansion and improvement of the program.

Who benefits from the ASHS-CH program? Everyone benefits from the ASHS-CH program – the individual ASHS-CHs, businesses that employ ASHS-CHs, the industry, ASHS, other certification programs, you name it. By becoming a ASHS-CH an individual shows they are a cut above. The company hiring the ASHS-CH knows they have a valuable, knowledgeable candidate. Our industry wins by gaining prestige, visibility, and professionalism by promoting the ASHS-CH program. Additionally, benefits to industry will be a long-term effort to gain more public "pull-through" to expect certification from the horticultural trade. We expect the ASHS-CH to help existing state and regional certification programs to enhance their revenue stream since CEUs for maintaining an ASHS-CH could be taken at state or regional industry educational events. And ASHS wins too, as the spearhead of the project and the entity committed to its success.

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ofa Marketing

Building a Network

by Marty Grunder

Editors note: Reprinted with the permission of *Lawn & Landscape*, October 2006. Visit www.lawnandlandscape.com for more information.

When we hear the word “network,” we often think first of that snarl of cables in our offices that connect all the computers to one another.

This month I want you to think about a very different network. This network comprises all of the people you know who could purchase your products and services or who know other people who could. This is the network every green industry sales professional needs to maximize in order to be successful.

How do you find people who want to buy your products and services? You go out and look for them, of course, and you become obsessed with the search. The following four tactics have worked well for me and may pay off for you.

Tactic #1

The CEO of the company that moved into the old manufacturing plant in town recently stated in the news that he was committed to making a difference in the community. You drive by the site and notice the grounds need work – the lawn should be reseeded, trees should be replaced, and the entrance could use some color. Clip the story from the paper and attach it to a handwritten note welcoming the CEO to town. Tell him you’re confident your company could help him make a difference by improving the look of his site. You might not receive a response, but you’ve established your presence and made an initial overture toward a professional friendship. It’s the first important step toward adding the CEO and his company to your network.

Tactic #2

Suppose you drive by a home under construction. You see the roof is going on and you know it’s a good four months before the owner takes residence in the home. Pull your marketing materials together, put them in one of your company’s large envelopes and print in big letters “FOR HOMEOWNER.” Staple

the packet to a wood stud in the garage so the homeowner sees it when he or she checks on the house’s progress. Again, you might not get a job out of this – though I bet you will – but you will certainly succeed in getting your name out and begin the process of adding this prospective customer to your network.

Tactic #3

Join the local chamber of commerce. Obvious? You bet. Underestimated? You bet, again. We join the chamber to get better health insurance and workers’ compensation rates, but you can use it to tap into the vast network of other business owners in the area. Likewise, you’ll be privy to news of all the new businesses coming to town. Likewise, think of the new market of landscape customers you could capture by getting to know local homebuilders – all of whom are likely chamber members. Go to the meetings a couple times a year. Play in the golf outing. Get involved.

Tactic #4

Show up at events your customers or potential customers are likely to attend. If you sell high-end landscaping, get involved in a local cultural institution by joining an event committee. Or help sponsor a charity event, like a fund-raiser for the local hospital or private school. Such gatherings are likely to attract a well-heeled crowd who have the income to spend on improving the appearance of their homes. Be sure to show up with business cards in hand, introduce yourself to as many people as you can, and collect as many cards in return as you can. When I attend these types of events, I am careful not to overstep my boundaries. Remember, you’re not there to sell a job but rather to lay the groundwork for accomplishing that at a later date.

These simple, but effective, tactics find people who can buy your products and services.

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Nominees for 2008-09 OFA Officers

All active OFA members are encouraged to vote for officers and board members. OFA is **your** organization. All active members will be mailed the ballot by early April. The ballots must be returned to OFA by **May 12, 2008**.

President



William Robert (Bobby) Barnitz, Mason, West Virginia, is vice president of Bob's Market & Greenhouses Inc., a family-operated wholesale/retail operation. He is a graduate of Gallipolis Business College and has worked in the greenhouse business for nearly 30 years. A recipient of the 2005 Ernst & Young's Entrepreneur of the Year Award, the company is a Gold Supplier for Ball Seed and has been awarded Ball Seed's Top Plug Topper Award. Bobby was also named as the 2001 *GrowerTalks* "Up and Comer." He has served on the OFA board of directors since 2003.

Vice President



Danny Takao, Fresno, California, is President of Takao Nursery, a mid-sized propagator of perennials, tropicals, vines, roses, and woodies. As the company visionary, Danny is responsible for its direction, overseeing the daily operations, and cultivating and maintaining business relationships. Primarily self-taught, Danny's passion for plants and his enthusiasm to learn and grow is the driving force behind the company. With his perseverance and dedication he has acquired a wealth of hands-on, real-world knowledge.

Grower At-Large (1 elected)



Joe Moore, Monroeville, New Jersey, is the head grower for Lucas Greenhouses. He oversees all areas of production, including growing, crop planning, and propagation programs. Joe was named one of *Greenhouse Grower's* "40 Under 40" in 2003. Lucas Greenhouses has 635,000 square feet of greenhouse and 30 acres of outdoor production.



Lloyd Traven, Kintnersville, Pennsylvania, is a managing partner for Peace Tree Farm, a wholesale grower of starter plants and finished pots, pre-finished baskets, and combos. Lloyd is responsible for marketing, promotion, information systems, production planning and scheduling, purchasing, strategic planning, and organic and sustainable certification. Lloyd was the 2005 *Greenhouse Grower* Grower of the Year.

Ohio Grower (1 elected)



Mark Foertmeyer, Delaware, Ohio, is the owner of Foertmeyer and Sons Greenhouse, a wholesale/retail grower of annuals, hanging baskets, poinsettias, and fall mix. In addition to serving as the general manager, he is responsible for sales, marketing, and combo design for baskets and planters. His greatest honor is receiving the "Dad of the Year" coffee mug in 1999 from his four sons.



Ron Robben, Cincinnati, Ohio, is the owner of Robben Florist Garden Center. He is the grower for their 40,000 square feet of greenhouse production space, and also super-vises the retail and garden center department. He attended the DuPage Horticultural School, and is a past president of the Cincinnati Flower Growers Association.



and the Board of Directors

Allied Trade (1 elected)



David Kuack, Fort Worth, Texas, is the editor of *GMPRO* magazine, a commercial horticulture trade magazine and online resource. He is responsible for writing, coordinating, and supervising the articles and layout for the magazine and weekly e-newsletter. He received his M.S. degree in horticulture from The Ohio State University, and was the first recipient of the Horticulture Initiative Award presented at the 1995 Southeast Greenhouse Conference.



Marvin Miller, West Chicago, Illinois, is the market resource manager for the Ball Horticultural Company, a breeder, producer, and distributor of floricultural inputs worldwide. He earned his Ph.D. in Agricultural Marketing from the University of Florida. He is the current president of America in Bloom, and has received numerous industry awards including the 2006 Southeast Greenhouse Conference Horticultural Initiative Award and the 2005 Distinguished Alumni Award from Purdue University.

Ohio Garden Center (1 elected)



Bob VanCura, Delaware, Ohio, is the president of A Proper Garden, an upscale retail garden center and specialty landscape design and construction company. Bob oversees the daily operations, provides vision and oversight to 32 employees, positions business branding, develops new business, and constantly strives to find ways to better connect with the customer. He holds a degree in greenhouse production from The Ohio State University.



Jerry Dill, Groveport, Ohio, is the owner of Dill's Greenhouse in Groveport, Ohio. He oversees the total operations of the 1.5 acre greenhouse that specializes in a large selection of the newest plant material available. They grow 90 percent of the plant material they sell. Jerry is a graduate of The Ohio State University with a degree in marketing. He is a past president of the Central Ohio Flower Growers Association.

Interior Plantscape At-Large (1 elected)



Lael George, Indianapolis, Indiana, is the vice president of Engledow Group. The company offers a full line of horticultural services for commercial businesses including landscape design and installation for both interior and exterior; irrigation design, installation, and maintenance; special event planning; and holiday design and installation. She has a horticulture degree from Purdue University.



Dan Johnston is the president/owner of Tri State Foliage Inc in Cincinnati, Ohio. The company supplies tropicals to interiorscapers and retail garden centers in Ohio, Kentucky, Indiana, and Michigan. Dan is responsible for purchasing of plant material, overseeing the daily operations, and meeting with suppliers. He holds a degree in business administration from Bowling Green State University.



OFA Award of Excellence



Suggested Criteria for Consideration:

- Rare honor bestowed upon someone who has made an extraordinary lifetime contribution to OFA and/or the field of floriculture/horticulture.
- Unanimous endorsement by the OFA Board of Directors.
- Long-time OFA member.
- Nomination must be made by an OFA member.
- Letter of recommendation from at least three additional OFA members.

Rewards:

- Complimentary lifetime OFA membership with all benefits.
- Recognition at annual OFA conference with award/plaque of recognition.
- Name on plaque displayed at OFA headquarters.

Procedures for Nomination:

- Complete and turn in application (also available at the OFA office – phone: 614-487-1117; fax: 614-487-1216; e-mail: ofa@ofa.org; Web site: www.ofa.org). Mailing address: OFA, 2130 Stella Court, Columbus, OH 43215.
- Deadline for all applications is October 1.

Procedures for Implementation:

- Applications presented to Membership Committee at fall meetings for consideration, screening, and comments.
- Recommendations passed from Membership Committee to Board of Directors for final decision(s).
- Notify any award winners by March 1 of award year.

Application for OFA Award of Excellence

Date received by OFA office: _____

Nominee: _____ Submitted By (name): _____

Company: _____ Company: _____

Address: _____ Address: _____

City: _____ City: _____

State: _____ State: _____

Zip: _____ Zip: _____

Phone: _____ Phone: _____

Fax: _____ Fax: _____

E-mail: _____ E-mail: _____

Please explain why this nominee is deserving of the OFA Award of Excellence (attach any additional sheets as needed):

Signature (of person submitting nomination): _____ Date of nomination: _____



Attention Ohio OFA members: Safety Congress Coming Soon

A strong safety program can benefit the overall productivity of your business and protect the wellbeing of your employees. To be successful, you need the latest tools and techniques to improve workplace safety while reducing workers' compensation costs. Get this must-have information by attending the Ohio Safety Congress & Expo, April 1-3 at the Columbus Convention Center.

Some of the more than 150 sessions include safety program development, emergency planning, cost-cutting safety strategies, injury management, construction safety, and more.

Registration is free.

Visit www.ohiobwc.com for more information.

Welcome New OFA Members

Bank of the West – Temecula, California

Beautiful Blooms by Jen – Toledo, Ohio

Coe & Dru Inc – San Dimas, California

Cottage Garden Greenhouse – New Richmond, Ohio

Dennis Buttlerwerth Florist – Cincinnati, Ohio

Global Link Partners Ltd – Cleveland, Ohio

Green Solutions – Hebron, Connecticut

Heritage Greenhouse Products – Rapidan, Virginia

Kaddy Products – Ogden, Utah

Hingbo Huihuang Machine Company Ltd – Ningbo Zhejiang, China

Ornamental Plant Germplasm Center – Columbus, Ohio

Southern Land Company – Franklin, Tennessee

Stanley Swier, University of New Hampshire

– Durham, New Hampshire

Westchester Greenhouses – Hartsdale, New York

Welcome New OFA Subscriber

Thea Seery, TO Plastics Inc – Clearwater, Minnesota

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- Valuable cost savings
- Public outreach and education creating demand for flowers

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Calendar of Events

- | | |
|------------------|--|
| April 1, 2008 | Sympathy Designs Workshop
Designer: Noreen Drake
Location: Toledo, OH |
| April 2, 2008 | Sympathy Designs Workshop
Designer: Noreen Drake
Location: Parma, OH |
| April 8, 2008 | Sympathy Designs Workshop
Designer: Noreen Drake
Location: Dayton, OH |
| July 12-15, 2008 | OFA Short Course
Columbus, OH |
| July 14, 2008 | Ohio Certified Florist Testing
At the OFA Short Course, Columbus, OH |

Calendar of Events

- | | |
|---------------------|---|
| Sept 28-Oct 1, 2008 | 2008 International Plug & Propagation Conference
Orlando, Florida – Sponsored by Ball Publishing in Partnership with OFA |
| November 7-8, 2008 | GrowerTalks' Sustainability Conference 2008
Frisco, Texas (just outside Dallas)
Sponsored by Ball Publishing in Partnership with OFA |
| November 9-10, 2008 | Green Profit's Retail Experience 2008
Frisco, Texas (just outside Dallas)
Sponsored by Ball Publishing in Partnership with OFA |
| November 2008 | Grower Seminar
At Michigan Greenhouse Growers' Expo |
| November 2008 | Ohio Certified Florist Testing
At the OFA Office, Columbus, OH |

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