



# Bio.Bulletin

## Biological Crop Protection in Ornamental Greenhouses in North America.



and operating the 8 acres operation with 5 acres of greenhouses and an additional 3 acres of outdoor space. The benches in the greenhouse can be rolled outside during springtime to produce 'outdoor acclimated' plants for their customer base, garden centers in and around NJ and NY.

They focus on high quality standard acclimated spring bedding plants and hanging baskets and also produce potted chrysanthemums and ornamental cabbage for the late summer and fall. Most of the propagation is done in-house from seed for the spring crops and the chrysanthemum cuttings are rooted/propagated by another van Wingerden family member out of Ohio, Green Circle greenhouses.

### Grower's interest and input

In 2006, Rich Densel the grower at OVW, was battling Thrips in the spring crops and that continued to be a challenge in the fall chrysanthemum production. In addition to this, also Two Spotted Spider Mite was present in the fall chrysanthemum crop, which gave another extra challenge. The traditional strategy was time consuming (evening spraying in the summer for both Rich and his brother Brian on

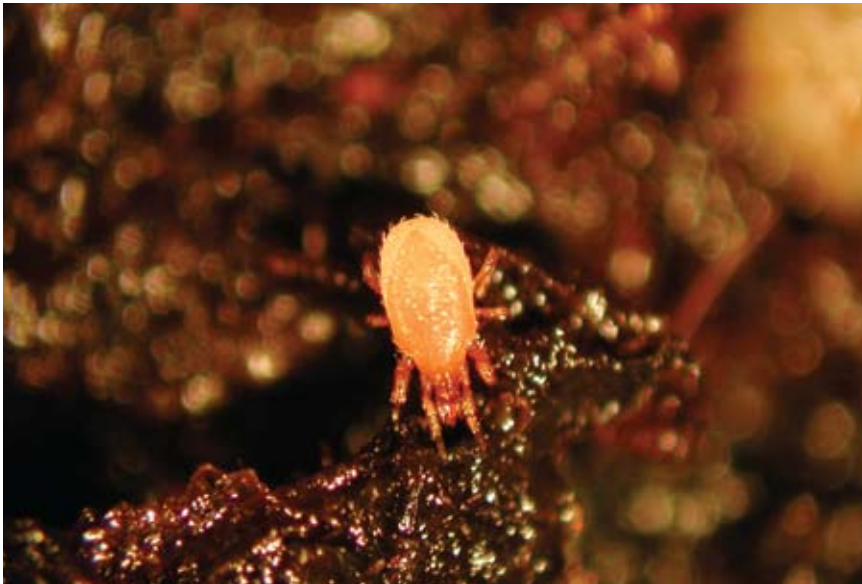
In this article we are highlighting 3 greenhouse operations in different parts of North America. Especially in the last few years biological control has become increasingly a part of the overall pest management strategies in North America's Ornamental greenhouse production. Growers especially look for alternatives when existing strategy with traditional pesticides are failing to control pest problems. Not many new pesticides are coming down the pipeline and also registration of new product is difficult. Preserving of the pesticides that still work by using other tools in pest management can help to reduce resistance development. Especially Thrips and White Fly (Q-type *Bemisia tabaci*) have been increasingly more problematic for growers in the last few years.

houses.com) is based on Farm Road, New Jersey, about 30 kilometers west of New York City. This is the location where the van Wingerden Family originally landed in the USA from Ridderkerk, the Netherlands many years ago, and today Farm Road is an active greenhouse location. OVW has been operating since 1958 and was founded by Mr. Orie van Wingerden. Alan van Wingerden is the next generation that is now owning

OVW greenhouses Inc., Pompton Plains, New Jersey, USA.

OVW (Mr. Orie van Wingerden) Greenhouses Inc ([www.ovwgreen-](http://www.ovwgreen-)





a too frequent basis) and in addition to this not as effective as they would hope for.

In the fall of 2006 Rich met with Biobest to discuss other options. OVW had played around a bit with biological control agents in the past, but without too much success. However, in the meeting, Biobest looked at OVW biggest challenges pest wise and explained to Rich what the various BCA's do and how they are affected the actual pest. For example, *Amblyseius cucumeris* only attacks the first larval stage of thrips, so releasing *A. cucumeris* 4 weeks after seeding will lead to possible problems. Rich together with Biobest developed a strategy for OVW based on their production planning which was then translated in what BCA's were needed each week. At the end of November, well before the propagation started, a strategy was ready and in December 2006 the first BCA's, *Amblyseius cucumeris*, *Hypoaspis miles* and *Atheta coriaria* were released in the greenhouse.

#### Propagation and timing of introduction:

Out of the explanation from Biobest how various BCA's are actually affecting the pest problems, Rich was now very aware of the importance of timing the introductions of the BCA's. Especially for thrips he made sure to introduce the thrips predatory mite

*Amblyseius cucumeris* immediately after the seeding tray comes of the seeding line, and not a week or 2 weeks later. The *Amblyseius cucumeris* is released in little piles of breeding material to ensure release of *Amblyseius cucumeris* for weeks during the time of propagation. Overhead watering is not affecting the breeder piles. Propagation is done all in-house for the spring crops, which gives complete control of what is released in propagation. Also *Hypoaspis miles* and *Atheta coriaria* are released immediately after seeding for the control of Fungus Gnats and Shore Flies.

After propagation, which takes anywhere between 4 and 6 weeks depending on the plant, Rich follows up immediately after transplanting

with another pile of *Amblyseius cucumeris* breeder material on all pots and hanging baskets. He also releases another introduction of *Hypoaspis miles* and *Atheta coriaria*.

The propagation of the chrysanthemum cuttings is done off site and the cuttings are coming in rooted, ready for transplanting. All cuttings are dipped preventively in a *Steinernema feltiae* nematode solution to limit the chance and level of thrips on the incoming cuttings. Rich then makes sure that all pots receive a breeder pile of *Amblyseius cucumeris* immediately after planting. He orders his product based on his production planning for the following week, which is pro-active vs. reactive.

#### Banker and trap plants:

In the strategy discussions, the option of the use of Banker and Trap plants was discussed and this was something that Rich was very interested in. He decided to use all-available options of banker and trap plants that are applicable for the pest problems he was battling. He used the following bankers and trap plants:

- Aphid banker plants: Brian got his carpenter skills out and built a cage to start producing barley plants with cereal aphids to establish a population of aphid banker plants with the parasite *Aphidius colema-*



*nii* in the greenhouse. The added benefit that Rich did not realize at that point, but has seen happening in his greenhouse in both 2007 and 2008, is that the presence of aphid banker plants attracts naturally occurring bio-control agents such as syrphid flies and lacewings in the spring once the weather turns outside.

- Pepper banker plants for *Orius*: Rich purchased pepper plant plugs of the ornamental variety Black Pearl early January 2007. They were transplanted at arrival, received some *Amblyseius cucumeris* and late March *Orius insidiosus* was introduced. By the end of June, Rich counted well over 20 *Orius* per sticky card and less the 5 thrips per sticky card in his weekly card counts. In July the *Orius* went up as high as 40 per sticky card and virtually no thrips to be found in his crop.
- Bean trap plants: In previous years, Two Spotted Spider Mites showed up in the chrysanthemum crop. He introduced bean plants as bean plants are highly attractive to TSSM and also show symptoms a lot easier and sooner than the hardier chrysanthemum leaves. The idea is to use these bean plants as an indicator plant (an alternative "yellow sticky card" for TSSM). In both of the 2007 and 2008 season, Two Spotted Spider Mite was never found in the crop or on the bean



plants. Why???? Did the high level of *Orius* keep'm under?

#### Results:

In Alan van Wingerden's words: "We have hit a home run with our bugs this year" after his first season in 2007. In the complete 2007 growing season, Rich sprayed only 2 small spot sprays for Aphids in the spring crop of approximately 1.000 sq feet (excluding fungicides, which they reduced as well due to the fact that the crop was not wet as often due to sprays in the evening). They repeated their strategy in 2008 with the exact similar results: "A second home run".

With Alan's and Rich's success come all the other benefits of not having to spray. Bio-control does not require any REI's, which especially during the busy spring shipping season is very helpful. Both growers Rich and his brother Brian were extremely happy as they did not have to spray at all during the summer months, which means no demands on evening time. Bio-control can be released by any employee and does not require a pesticide license. The quality of the plants increased. Just mention a few.

Alan's and Rich's idea on cost: "In a good year bio-control might be more expensive. In a bad year, bio-control might be cheaper. But overall, the bio-control is easier to budget as it is a pro-active preventive approach based on your production planning."

Rich's and Alan's commitment, developing and following a strategy, and their pro-active approach has paid back in a very successful pest management program. Congratulations OVW Greenhouses Inc!

Colonial Florist Inc. St. Catharines, Ontario, Canada

Colonial Florist Inc. was founded by 'Gebroeders van der Zalm', 3 Dutch brother, over 40 years ago. The 7-acres greenhouse operation is based in St. Catharines, Ontario, Canada, about 20 minutes from Niagara Falls and a bit over an hour from Toronto.  
(www.colonialfloristltd.com)





The current management members are Rob, Paul, Ron and Jim van der Zalm, the second generation van der Zalm's, and often Clemens and Jim Sr are still found active in the greenhouse. Colonial Florist is specialized in propagation of ornamental plant production and provides customers in Canada and the USA with high quality rooted plugs. The un-rooted cuttings are either produced in-house or are coming from well-known producers such as Dummen and Selecta. Over 95 % of the assortment that Colonial Florist propagates for other growers, they also grow as finish product themselves for their own local Ontario Canada market. This allows them to maintain the "know-how" and "hands on" growing experience of the propagative materials they produce which allows them also to support their customers with their growing needs. In the summer and fall, Colonial Florist produces Cyclamen, Poinsettia and Selaginella (Frosty Ferns).

#### Importance of pest management and propagation:

As propagators and growers, Colonial Florist Inc. knows the importance of a solid pest management strategy. Clean plants are important, for their customers and their own production. However, a clean plant these days has a double definition. A clean plant is not only a plant clean of pest problems, but also free pesticides with long residual negative effects on biological control agents. More and more greenhouse ornamental growers are implementing bio-control as part of their pest management strategy, which means that pesticides with a long residual effect (especially the older generation pesticides such as Thiodan, Orthene) are not the greatest choice at propagation level. This certainly does not mean that any pesticides are used or can't be used, but an integrated pest management strategy can use bio-control as well as compatible pesticides that are not affecting bio-control agents or have very short residual effect on bio-control agents. This allows Colonial Florist's customers to choose their pest management strategy with confidence that if they choose to use a bio-control program or otherwise. The BCA's will



start of without any negative effect of pesticide residuals. (For side effects of pesticides, check [www.biobest.ca/sideeffects](http://www.biobest.ca/sideeffects))

Rob van der Zalm and Scott de Vries, the grower team at Colonial Florist, are very involved with the pest management strategy that includes weekly detailed monitoring in the crop and sticky cards as well as discussing the results. These results are then a base to see if and where the strategy need yo be adjusted. Biobest Canada Ltd is assisting Colonial Florist with their pest management strategy and discussing the overall pest management status on a regular basis.

#### A well thought out start

About 5 years ago Rob van der Zalm had his first experience with Biological Control. At the time an outside scouting service would come in on a weekly basis to check sticky cards and based on the results Rob would make decisions on what needed to be done. However, 7 acres, with a multitude on different crops, stock plants and so on, this isn't an easy task, and certainly also not an easy task for an outside scout. So the decision was made to return to traditional control strategies. A switch from a traditional pest management program to a pest management program that includes bio-control should not and cannot be done over night and certainly

should not be rushed. All aspects that are necessary to make a switch successful should be considered. Especially thinking of a detailed and solid monitoring procedure, what pest problems are most dominant, history of pesticide use (residual effects) to mention a few.

In the fall of 2006, pest pressure with especially thrips in the cyclamen was difficult and it was also clear that constant pesticide pressure was certainly not increasing the effectiveness of sprays. Rob and the management team decided that it was time to look at alternatives. In the fall of 2006, together with Biobest, a strategy was set up to start in-house monitoring on a weekly basis to learn more about the pest dynamics within the facility, and also to determine if pesticide sprays actually are effective as they should be. This was also in preparation and transition from a traditional pesticide program to an IPM program. Early 2007 Scott de Vries was brought on into the grower team with Rob van De Zalm. In the spring of 2007, Rob implemented the first step of bio-control by starting introductions of the predatory mite *Hypoaspis miles*, the rove beetle *Atheta coriaria* and the nematode *Steinernema feltia* for fungus gnat and shore fly control. These BCA's are much more compatible with many foliar pesticide application as these BCA's predominantly live in the top layer of the soil, and therefore protected.



### The next step up:

In the early summer of 2007 Rob thought it was time to step it up to the next level. After finishing the spring crops successfully and a scheduled clean up/disinfection of the greenhouse, Colonial Florist started their Poinsettia production by bring in un-rooted cuttings as well as the cyclamen production with rooted plugs from an outside supplier.

In the poinsettia production the decision was made to go with a complete bio-control program. Rob also based this on the successful results that Graeme Murphy, IPM specialist with the Ontario Ministry of Agriculture and Rural Affairs, had in the 2006 season with extensive work with other Poinsettia growers in the Niagara region. Rob and Scott immediately started with releases of *Encarsia formosa* and *Eretmocerus mundus* for both greenhouse whitefly and sweet potato whitefly. At first in propagation and introductions continues into second half of October, about a month before first shipping took place. Early on, immediately after transplanting, also *Hypoaspis miles* and *Atheta coriaria* for fungus gnat and shore fly control were introduced as well as mix of *Amblyseius cucumeris* and *Amblyseius swirskii* for thrips and whitefly control. These however are a once only introduction in most cases. The poinsettia crop was completed without any application of pesticides to control whiteflies.

The cyclamen production, which was certainly a challenge for thrips control in 2006, Rob decided to take an aggressive approach by starting immediately with *Amblyseius cucumeris* and *Amblyseius swirskii* as a breeder pile introduction. Also *Hypoaspis miles* and *Atheta coriaria* for fungus gnat and shore fly control were introduced. The cyclamen crop was completed without any spray during the complete cycle.

### Banker Plants:

Rob was able to get some miniature pepper plants from his neighboring greenhouse grower. He and Scott

set those up as *Orius* pepper banker plants and *Orius* was released on those pepper plants late June and early July. By August *Orius* was found and by September *Orius* was well established in these pepper banker plants and *Orius* showed up on sticky cards as well when monitoring sticky cards. The miniature pepper plants were also used in the start of their stock plant areas, which start at the end of August.

*Orius* played an important role of keep thrips under control in this area. However, with the fall and winter approaching it was expected that *Orius* would start to decrease their population due to diapause, which did happen. In October the *Orius* population started to decrease, and by mid November the *Orius* was gone. This was compensated by releases of *Amblyseius cucumeris* and *Amblyseius swirskii* in a pro-active manner. However, when the growing lights were turned on in December, *Orius* started to show up again in January.

Scott and Rob also included Aphid banker plants in their approach. They turned a shipping cart into a banker plant cage and produced rye cereal with cereal aphids and release these in the greenhouse. Rob feels very comfortable with this technique, also knowing that there are some good compatible pesticides available that do not harm the BCA's.

### Today and the future:

Colonial Florist has successfully implemented the use of biological control agents in their overall production of propagative material as well as finished products. Rob van der Zalm took the appropriate approach and did not rush into a 'quick switch' but took a well thought out approach with a strategy in mind. It has resulted in less use of pesticides, which reduces the chance of built up of pesticide resistance and produces a healthier and cleaner plant. It has allowed them to tell their customers that they have a choice with their young plants that they receive from Colonial Florist. There are no harmful long-term residual pesticides on their young plugs, which allow their customers to continue with a bio-control program or if they are not ready yet to implement biological control, to continue with their existing pest management program. Both options are now open.

Colonial Florist will continue to optimize their pest management program to ensure high quality clean (young) plants. For example, Rob decided that this year the lights in the stock plant areas will be used earlier, to extend the day to avoid *Orius* from going into diapause. Rob van der Zalm: "There are extra cost involved by using lights earlier then we would normally do, but it is to be expected that *Orius* will





remain active. We are committed to a healthy and clean plant for our customer, without harmful pesticides residuals and even with some good bugs on the plugs already when they receive them”.

### Bevo Farms, Langley, British Columbia, Canada

BEVO farms Inc. is North America’s largest propagator of vegetable plants with a total 34 acres of state of the art facilities in Langley, British Columbia. (www.bevofarms.com) Founded by Mr. Jack Benne in the late ’80, BEVO farms grew to the existing size together with the growth of their customers, the greenhouse vegetable growers of British Columbia, Alberta, US and beyond. They did this also by setting high quality standards on all their products. The current day-to-day business is with Leo Benne, Jack’s son, and his team of highly trained professionals. However, Jack is still often found in the greenhouse talking with the staff and looking at the crops that are grown.

### Pest management and Biological Control at BEVO farms:

BEVO farms has been familiar with Biological Control for many years, as their core business originates in the greenhouse vegetable industry. As a propagator of young vegetable plants, the definition of a clean plant is very well known since the early start of BEVO farms. Greenhouse vegetable growers have been using biological control as their core pest management program for decades and a clean plants means a plant that is free of pest and diseases at delivery, but also doesn’t have any hard long-term residue pesticides that could harm the bio-control input after planting out at the customer’s greenhouse. BEVO has been successfully using a pest management strategy including biological control agents and were necessary only IPM compatible pesticides for many years already in their vegetable propagation season.

Having experience with biological control agents in the vegetable



propagation already, BEVO is now expanding the use and implementation of biological control in their other crop seasons. Traditionally, working with extreme low tolerance levels in ornamental bedding plant production and poinsettia production, pest management consisted regular pesticide applications, with again short residual pesticides in order not to create trouble with the vegetable propagation season. However, with the increase of bio-control agents available today, the knowledge base, and all the experience that BEVO already has with the use of BCA’s, it is an excellent opportunity and logical step to include BCA’s in BEVO’s ornamental season pest management strategy.

### Poinsettia and spring bedding plant season:

In 2007 BEVO farms decided to start their poinsettia season with the input of biological control agents. Being informed of the work that Mr. Graeme Murphy, IPM specialist with the Ontario Ministry of Agriculture and Rural Affairs, had done in previous years, BEVO and Biobest, together with their distributor The Bug Factory, set up a strategy based on each stage of the poinsettia crop cycle. *Encarsia formosa* and *Eretmocerus mundus* for whitefly control were release on a weekly basis from very early on in the

crop. *Hypoaspis miles* and *Atheta coriaria* were release once after transplanting for fungus gnat and shore fly control. BEVO’s poinsettia season in 2007 was concluded with great success of producing high quality clean poinsettia plants for their customers. BEVO’s 2008 poinsettia season is of on a great start and repeating their success of the 2007 season.

BEVO farms also is expanding and optimizing their strategy for the bedding plant season. Implementation of biological control in the bedding plant season has already become a part of the pest management strategy. New techniques with banker and trap plants are explored to improve the overall strategy.

### Experienced staff and a solid strategy: The key to success

BEVO’s growing staff has lots of experience with pest management and in particular also the different biological control agents that are used at BEVO. They have been active in the industry for many years and understand the necessity of a pro-active approach and solid monitoring procedures. In the regular contact with Biobest’s and Bug Factory’s bio-control and IPM specialists, BEVO’s growing team is kept up-to-date with the latest information as well as keeping the current pest management strategy up-to-date.



This leads to producing clean plants. The results:

- High quality poinsettia and bedding plants, ready for retail and creating a positive experience with the consumer.
- High quality clean vegetable plants for the vegetable growers, ready to start a successful biological control program in their greenhouse.

Biobest wishes BEVO farms continued success with their pest management

strategies in both vegetables and ornamental production.

The program(s) mentioned here were developed specifically for the crops and conditions existing at the client's greenhouse, and may not be applicable to all crops and conditions. Similar results may be achieved without the use of banker and trap plants. Your Biobest representative can help you develop a program specifically for your needs

Bio-control originally started in the late '60's, predominantly in greenhouse vegetable production in the Netherlands, Belgium and the UK. In those days growers often looked for alternatives for controlling their pest problems (Whitefly and Two Spotted Spider Mites) in their cucumber and tomato crops due to the failing results with the available pesticides. This also occurred at the family greenhouse where I grew up and my father started using 'good bugs' in 1971 in his tomato greenhouses. In a way, the growers from then were really ahead of their time by using biological control as a way of pesticide resistant management.

Today, Biobest Biological Systems produces more than 40 different BCA's, in 6 different production locations worldwide, for various pest problems for the greenhouse industry. In North America our location is in Leamington, Ontario, Canada. From this location we produce, ship and support all our activities in Canada and the United States with the help of our distributor network.

Especially in the last decade Biological Control also has made an entry in the greenhouse ornamental production. Various potted plants, bedding plants, hanging baskets, propagation of plugs, poinsettia, cut and potted gerbera production are now also produced with the use of BCA's in their pest management program. I specifically mention that they are using BCA's as a part of their pest management program as sometimes pesticides still need to be used, either as a correction spray or for a pest problem that we do not have a bio-control solution available for yet. Especially today, the newer generation pesticides are different from the products of over 10 years ago.

Many newer pesticides are more specific and more compatible with BCA's. If you would like to check the compatibility of pesticides with BCA's, please visit our website at [www.biobest.ca](http://www.biobest.ca) and search the 'side effect list'. The side effect list is driven by active ingredient and BCA's that you would like to use in combination.

**Let good bugs and mites do the dirty work!  
How to start a biological control program in your ornamental greenhouse production!**



February 26th 2008 I was traveling with Peter Armando from Griffin Greenhouse supplies, a distributor with many locations in the East of the United States. In the conversation with one of his customers, the grower was telling us how much he always is looking forward to dress up on Sunday morning, put all the protective gear on and start spraying. He was mentioning that it was always giving him such a warm feeling.....of course this grower was being sarcastic about this. I am yet to meet any grower or anyone who enjoys this kind of work. So, why not let the good bugs and mites do the dirty work?

Today there are certainly other options available to minimize spraying, especially for insects and mite control. Biological control has developed into a very reliable way of controlling insects and mites. However, the approach of using these 'good bugs and mites' (in short (BCA's or Biological Control Agents) to combat the pest problems that we are often faced with is certainly different from the traditional way with pesticides. In order to start a successful program we always use the "10 keys to success" checklist and discuss this with you, the growers and owners of the greenhouse operations.



# 10 KEYS

## to a successful bio-control program

### Education

1. Educate yourself and your team about the BCA's and their target pest problems. Talk to IPM specialists, representatives and extension people. For example, it is important to know that the predatory mite *Amblyseius cucumeris* and *Amblyseius swirskii* will only attack the first larval stage of thrips. This means that if you already have a significant population of adult thrips that you see on your sticky cards or in the crop, you are too late with starting your biological control program.

### History

2. Review the pest problem that you have had in the previous years and which pest problems were more predominant to what crop.
3. Review pesticides use in the previous year, and more importantly, the last 3 to 4 months. For example, if you sprayed Orthene last week, the residual in the greenhouse (even if the crop is removed) will negatively affect most BCA's for another 8 weeks minimum. If you sprayed Avid, there is hardly any residual and your bio-control program can start without any problem.
4. If long residual pesticides have been used, develop a plan for a transition period that includes short residual pesticides.

### Strategy

5. Develop a bio-control and IPM strategy that fits for your situation. Biobest has 'crop-info' sheets available for several crops that are detailed guidelines of release rates and timing. Timing of release of biological control is critical to the program being successful or not. In a pest management program that includes BCA's, the idea is to look at all aspects of potential pest problems in your crop, and use BCA's as a first line of defense to control these pest problems. The strategy should also include 'plan B' of what to do if thresholds are reached. What pesticides can I use if needed.
6. Decide when the best time is to start your new biological control program. It is not a wise idea to start you program in the middle of your spring program or the middle of a crop cycle.

### Monitoring

7. Develop and start a solid and consistent monitoring program. This includes checking sticky cards and recording the data. This part of the program will tell you what the population dynamics are of your pests and potential problems can be caught before they become a real problem. Recording your pesticide use should be included in this monitoring program. Biobest has easy to use standard excel format spreadsheets available if you like to process the data on the computer. Biobest's experience has taught us that a good and solid monitoring program takes approximately 1 – 1.5 hour per acre weekly.

8. Especially in the larger operations it would be a good idea to delegate the responsibility  appoint someone within the organization that coordinates the monitoring, bio-control releases and other pest management related activities. Even when things get busy with other activities in the production process, monitoring is critical to any pest management program, so should be consistent at any time of the year.

### Propagation

9. Where possible, start the use of BCA's already in the propagation section. To start any crop with clean plant material is so much easier. This means that BCA's can (and should) even be released in stock plants and the propagation section of your facility. If your young plant material comes in from an outside propagator, inform him about your plans to start with a pest management program that includes BCA's. You can ask him for a list of products (pesticides and or BCA's) that are used in the propagation of your plugs. In Europe, it is very common these days that young plants and plugs arrive with a "plant propagation report" that includes history of pest management and potential pest that have been observed (monitoring data).

### Determination

10. Last but not least, do not give up, even if your first attempt is difficult. The switch from a traditional program to an IPM program is a step-by-step process that will take some perseverance and determination to succeed.