

## 2010 Crop Recommendations Woody Ornamentals

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### Overview:

Woody Ornamentals are successfully being controlled of pests by Beneficial Insects in Europe and North America. For years, Dutch growers have realized that not only do the Biological Controls work, but they also get larger and healthier plants as a result. Trials in Aalsmeer over 9 years ago showed that even a simple IPM program, where spraying is only done if needed and some Biological Controls are used when possible yielded plants that were 15% larger at the end of the first year. Most growers using the IPM programs have since moved even farther with using Biological Controls because they are cheaper to use, if used properly and they help maintain the effectiveness of the remaining chemical sprays that they can use.

The traditional view of using Biological Controls, where a balance of pest and predator is achieved, needs to be thrown away. In its' place, the successful program is based on prevention.

At Applied Bio-nomics we have found that fresh beneficial insects and mites perform better and faster. We have, as a result, minimized or eliminated the storage of the products where there is a degradation in quality and performance over time. These "fresh" products fly farther, live longer, lay more eggs, and are actually smarter than the stored product available else ware. The result is that "fresh" beneficials are capable of prevention of pests at low, regular introductions.

As always, the movement of people in the greenhouse is a major form of dispersal of the crawling pests, such as spider mites. Whenever possible, restrict the movement of people in known hot spots. Enter the hot spots last and then directly leave. Coveralls should be frozen overnight or washed each day, especially for the people that worked in a known infested area.

### Prior to Propagation:

The house should be thoroughly cleaned. Walls, floors, posts, wires etc should be washed with soap or another suitable cleaning product. Whitefly and Aphids will persist in cool greenhouses for well over 1 week without any plant material available, but they will be killed with a thorough cleanup.

If the house has a history of spider mites, they will be hiding in the ground around the posts and the walls. An introduction of *Hypoaspis miles* (25 mites per square foot, more if high levels of spider mites were present) at each post and along the walls will help kill the overwintering spider mites.

### At Propagation:

Because fungus gnats can have a significant impact on the rate of growth of your plants, it is essential that they are controlled immediately. Apply *Hypoaspis miles* at a rate of 5 ml per plant (125 mites). Skipping plants can work in clean houses, as the *Hypoaspis* will disperse themselves quite well. A recommended technique is to broadcast them over the finished crop using a "whirlybird" hand spreader or even a modified "Echo" blower with the optional hopper.

Within one week apply nematodes at the recommended rate. This application will have two effects; first, they will kill some of the fungus gnats and second, they will act as a food source for the *Hypoaspis*, which will help them disperse into the entire crop and establish.

If there is a very high count of fungus gnats you should consider altering the soil mix slightly, as even subtle variations in the soil mix will have significant impact on whether or not the fungus gnats will explode in population. Raw potato slices should be used to monitor the relative numbers and stages of the fungus gnat larvae. Try placing a slice of potato on the soil surface for a known time. The fungus gnat larvae are attracted to the potato and, when lifted, will give you a relative count. Repeated monitoring for the same duration of exposure will give you an indication whether the problem is getting better or worse. If the soil is loose, *Atheta coriaria*, the Rove beetle should also be applied at 0.1 to 1.0 per square meter, just once.

If the crop is susceptible to whitefly, apply *Encarsia Max* at a rate of 0.25 per square meter if no whitefly is detected. At one to two whitefly per yellow card per week increase rate to 1 per square meter. If using regular *Encarsia*, the rate should be doubled. See below; Whitefly Strategy Overview.

Aphid prevention can be achieved by introducing *Aphidoletes aphidimyza* at a rate of 3,000 per hectare per week. They should be released away from any known aphid hot spots, which will force them to disperse and seek out new infections. Any known hot spots should be dealt with directly, releasing about 100 adults from the shipping container at each hot spot.

Early Season (Indoors):

Spider mites should be watched carefully, as the damage is permanent. Preventative releases of *A. fallacis* in the granular carrier should be made prior to the historical arrival of spider mites and after the plants have been removed from any humidifying chamber. For houses that have a history of spider mites, bean plants should be grown around the walls and touching table legs. The beans will attract the spider mites and show damage very quickly, which will help with monitoring. Once spider mites are present, apply *P. persimilis* to the beans at an approximate ratio of 1 to 100. The bush beans will become bankers, releasing *Persimilis* up, onto the tables for as long as the spider mites survive. In most cases, this will be a long time, as the spider mites come out of hibernation over a very long period of time. Bean leaves that display a ratio of 1 to 10 (*Persimilis* to spider mites) can be used to treat remote infestations. *Feltiella* may volunteer in a cool season crop, but their habit of pupating on the plant leaves may cause more problems. If the spider mites are under control, it is unlikely that *Feltiella* will populate the crop.

Whitefly must never be given a chance to increase. A count of over 2 whitefly per week on the yellow sticky cards should be reacted to immediately. Rates of *Encarsia Max* should go up to 6 per square meter per week (regular *Encarsia* up to 8 per meter) and *Delphastus catalinae* should be introduced at a minimum of 100 per hectare every two weeks, until the counts are brought back in line. Once the leaves become sticky with honeydew, the parasitoids movement becomes impaired. *Delphastus* releases should be increased up to 5,000 per hectare if control is at stake. The use of Eggplant, strategically located along the aisles at a rate of 4 to 6 per hectare, will help draw the whitefly out of the crop. The Eggplant is preferred by the whitefly and can be used to trap and can be a very effective banker system. High levels of whitefly on the Eggplant should be vacuumed off, taking care to freeze the vacuum bag to kill the whitefly. A daily vacuuming of the Eggplant can strip a significant number of whitefly adults out of the crop. *Orius*, *Delphastus* and *Encarsia* should be introduced to the Eggplant, as it will become a nursery for the beneficials. The presence of the thrip predators in the crop will also help with whitefly control, as they will

feed on whitefly eggs and larvae. *Aphidoletes* also feeds on whitefly larvae when they are starving for aphids. See below; Whitefly Strategy Overview.

Watch for Aphids entering the house. Rates of the preventative release are 3000 per hectare per week. Hot spots should be directly attacked with releases of adult *Aphidoletes*, but control of the Melon aphid will only occur by prevention, as the Melon aphid reproduces and disperses faster than the biocontrols can handle. For major infestations, rates of 6000 per hectare per week should be neutrally released until the numbers are back in manageable levels. In order to achieve quick recovery, the ratio of *Aphidoletes* to aphids must be in the order of 1 to 100. This could required extremely large numbers of *Aphidoletes* for a quick cure or a longer time frame for recovery. All species of aphids are controlled by *Aphidoletes*. *Aphidius matricariae* will easily control and cycle with Green Peach Aphid, but will leave behind “mummy” casings.

### **Summer Season (Indoors):**

2 Spotted Spider Mites should be surrounded by *P. persimilis*. The treated area should be the hot spot and then two more unaffected plants, as the spider mites are probably on these unaffected plants. The *persimilis* should be placed low on the treated plants as they instinctively move upwards. A ratio of 1 *persimilis* to 100 spider mites will achieve control in 2 weeks. A typical attack on a single plant hot spot would be 1000 *persimilis* on the affected plant, 500 *persimilis* on the immediate adjacent plants, and 200 *persimilis* on all of the plants within the treatment circle. The hot spot should be flagged and traffic should be diverted. As the humidity drops in the house, the volunteering *Feltiella* will disappear. Hot spots will flare up more frequently due to the decline in the flying predators. *Stethorus punctillum* should be released at a rate of 500 per hectare every 2 weeks. The *Stethorus* are not intimidated by low humidity and high temperature and will easily be seen feeding on the dome of the plants. See below; Spider Mite Strategy Overview.

Whitefly should be under control based on the preventative releases. Any weekly count of over 2 whitefly per card should immediately be responded to by doubling the rate of *Encarsia*. *Delphastus catalinae* will remove very large numbers of whitefly eggs and can be used to reduce outbreaks. If *Bemisia* are present, *Delphastus* should be released every two weeks at a rate of 1000 to 10,000 per hectare, depending on level of infestation. In extremely hot situations (over 30 Celsius) whitefly adults will only live for a few days (instead of months) and will not lay eggs. See below; Whitefly Strategy Overview.

Aphid control should shift entirely to *Aphidoletes*, as *Aphidius* will now be infested with hyperparasites. Any aphid banking system should be converted to *Aphidoletes* by introducing *Aphidoletes* directly onto the bankers. Please note that we do not recommend any Aphid Banking System. See below; Aphid Strategy Overview.

### **Late Season (Indoors):**

This is the most important time of the year for spider mites. What you do at this time will determine how bad the next year will be. Every effort should be made to eliminate all of the spider mites before the beginning of September. Once the daylength begins to noticeably decrease and the evening temperatures drop, the spider mites begin diapausing. In a diapause state, spider mite are more resistant to chemicals and are not as attractive to the beneficials. If chemicals should be used, it would be at this time. Hopefully the whitefly is under control so a spray of Avid will not cause a whitefly outbreak.

If the whitefly is not in good control, it will begin to runaway in the fall. Adding trap Eggplants will help if the plants are vacuumed daily. Adding parasites beyond 6 per square meter

will have very little effect, as there are just too many whitefly and the stickiness of the honeydew will begin to impair the movement of all of the parasitoids. *Delphastus* will continue to work at very high whitefly densities but their impact will not be quickly seen, as they will graze on the eggs and the adult whitefly will live on for months.

Aphids must be in good control going into the fall as the *Aphidoletes* will stop cycling due to diapause. Preventative releases will still work, as they are not being asked to cycle. *Aphidius* can work very well in the fall, especially if they were not used in the summer, reducing the pressure of the hyperparasites.

### **Planting into the field:**

As soon as the plants are set out, release *Hypoaspis* miles at a rate of 10 to 20 liters per acre. *Hypoaspis* will establish permanently and will control Fungus Gnats, Springtails, overwintering Spider Mites and soil pupating Thrips, to name a few pests.

### **Early Season (Outdoors):**

Spider mites can be prevented and chronic infestations can be cured by the release of *A.fallacis*. A general release rate of 10,000 per acre should be modified so that 5,000 are evenly dispersed and the other 5,000 used directly on infested plants or susceptible ones. This is usually a “one-time” introduction, as the *fallacis* will establish and persist in the plants for years.

### **Mid-Season (Outdoors):**

Overhead watering helps prevent spider mite establishment. When many growers began switching to drip irrigation, they found the spider mite problems increased. *P. persimilis* should be used for serious 2 spotted spider mite problems. *Stethorus puntillum* beetles will also work very well and will persist in the crop as long as the spider mites are there.

Aphid infestations are controlled by releasing *Aphidoletes* directly at the infestation point. An approximate ratio of 1 *Aphidoletes* to 100 aphids will bring control back within 3 weeks. The *Aphidoletes* will cycle in the field and over winter so subsequent seasons should see fewer aphid hot spots. *Aphidoletes* should be released at dusk, after the wind has died down.

### **Spider Mite Strategy Overview:**

Cleanup is essential. Physical spraying, chemical spraying, and *Hypoaspis* will all have extremely high returns on investment. Cleanup must occur before the fall weather becomes apparent. Once spider mites begin developing the “red phase”, they will become unattractive to the predatory mites and more resistant to the chemical sprays.

Frequent animal traffic assists in the dispersal of spider mites. Whenever possible, have the staff avoid the known hot spots until the end of a shift. The coveralls of every worker should be washed or frozen every night in order to minimize dispersal of the spider mites.

Fans should be carefully directed so that they achieve the desired effect but don't blow directly onto the plants. Increased air movement lowers the humidity at the leaf surface, chasing away the predators. The result is that the spider mites will enjoy a predator free area that will lead to plant death and an out of control hot spot.

*P. persimilis* is still the main beneficial, but only in the case of the 2 spotted spider mite. The leaf product will work about twice as fast and with half the inoculums compared to the product in a granular carrier. During hot weather, the *persimilis* will avoid the exposed tops of the

plants in order to prevent themselves from drying out. Stethorus will quickly move into the exposed tops of the plants and feed on a tremendous number of spider mites, but must be applied before the plants are damaged, as the damage is permanent and will reduce the humidity so that the persimilis will still avoid the area after it has moved down into the canopy. Therefore, prevention and preventative control is the key to spider mite management.

For any other spider mite you must use *A. fallacis*. A single application of *A. fallacis* will stay with the crop for months, if not years. The fallacis will feed on pollen and other mites and will persist in the crop long after any pests have left. The fallacis has an added advantage in that they will overwinter and persist in any indoor or outdoor environment. For ornamentals that have a history of spider mite damage and produce persistent pollen, such as evergreens, fallacis is the ideal predator/preventor and should be inoculated into the entire crop at a rate of 10,000 per acre.

### **Whitefly Strategy Overview:**

Whitefly is an insidious pest. Low numbers can give the grower a false sense of security. The longevity and fecundity of the whitefly can lead to overwhelming situations very quickly. The only sure way to control whitefly is to start clean and prevent any significant buildup.

Weekly releases of preventative *Encarsia* must be considered similar to an insurance policy. *Encarsia Max* will reduce the weekly cost by allowing you to use very low rates ( as low as 0.25 per meter square). *Encarsia Max* live longer, fly farther, and are actually smarter than refrigerated *Encarsia*. All of Applied's *Encarsia* are held above 11 degrees Celcius and are never refrigerated. *Encarsia Max* is guaranteed to be no older than 48 hours from harvest.

Using Eggplant as a trap/banker can be very effective, although, in our experience, *Encarsia Max*, starting clean, will be all you need. Whitefly have a very advance sense of smell and will move onto the Eggplant in a very profound way.

If *Bemisia* have established, parasitoids are at a disadvantage because they are all reared on Greenhouse whitefly and parasitoids always work best on their established host. All parasitoids will adapt to *Bemisia* and will all host feed aggressively. The use of *Delphastus* will have a major impact on *Bemisia*, and, if started early, will eliminate the *Bemisia* before they move on to the Greenhouse whitefly. *Bemisia* are much harder to monitor because they don't evenly distribute themselves the way Greenhouse whitefly does.

### **Thrip Strategy Overview:**

Prevention of thrips is impossible. They can penetrate any screen and will always get in. Monitoring is essential to determine when they first arrive. Yellow or blue sticky traps are preferable over waiting to see damage on the crop. Once thrips arrive, your response must be immediate and overwhelming. *A.cucumeris* should be applied at a rate of at least 10 mites per plant. They can be shaken out onto the crop from the bulk tube, scattered over the crop by using a hand spreader, puffed out over the crop by pouring the bulk product into a rose duster (the bran will stay behind) or blasted over the crop using a modified and governed Echo backpack leaf blower. The *cucumeris*, however, can only feed on the early instar thrips. The eggs of the thrip are injected into the plant tissue, making them unavailable to predators. For many thrips, pupation is away from the plant, further impairing the predators' ability to gain the upper hand. Adult thrips are rapid movers and capable of flight. Therefore *cucumeris* needs help. *Hypoaspis* at the pupating site will help prevent the thrip from successfully cycling in the house. *Orius* are aggressive predators and will feed on all mobile stages of thrips as well as loopers, aphids, and whitefly, but are expensive and will leave the house if conditions are not to their liking.

Major inflows of thrips occur when they are disturbed from their outside habitat. Develop a communication with local farmers so that you are aware when they are about to harvest or mow their crop of alfalfa or hay. Unfortunately they usually only mow on a sunny day, which means the wind will be up and the vents will be open, but reducing the opening gap and duration can have a significant reduction in the number of thrips that will move into the house.

The use of blue sticky cards helps track the arrival of thrips because only thrips like blue, to a significant level. The incorporation of vanilla to the traps will increase the trapping of the adults and can have a control effect.

Plants such as fennel will give the thrips a sweeter alternative than your crop and will concentrate the *Orius* with the thrips. The fennel will also attract local *Orius* species from outside, into the house.

### **Aphid Strategy Overview:**

In recent years, the range and species of pest aphids has dramatically increased.

Regular, low releases of *Aphidoletes* will prevent the establishment of all species of aphids. A rate of 3000 per hectare per week will protect the crop from aphids. Aphid hot spots must also be treated by direct release of *Aphidoletes*. *Aphidius* will leave “mummies” behind.

For outdoor use, release directly into the infestation. *Aphidoletes* will cycle and over winter.