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Using Plants to Fight Pests

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Believe it or not, Albert Grimm of Jeffrey's Greenhouse uses eggplant to keep greenhouse whitefly away from his poinsettias. "A few years ago, we had a situation where our chemicals were no longer keeping the whitefly in check on poinsettias. Now the retailers are educated as to what to look for to detect whitefly, and a truckload of poinsettias can be rejected for the presence of one whitefly on one plant. The only way that we can maintain whitefly levels that low is with biological controls."

Albert's eggplants were part of a trial coordinated by Greenhouse Floriculture IPM Specialist Graeme Murphy in Ontario, Canada. The eggplants served as "trap plants," luring whiteflies from the poinsettias. Nine of twelve growers that conducted the trial used no whitefly pesticides all season long.

"We call plants that help manage pests in the greenhouse 'guardian plants' because they help to guard the grower's crops against pest damage," says Carol Glenister, entomologist and president of IPM Laboratories, a supplier of beneficial insects. "Guardian plants protect greenhouse crops in many ways. Some guardian plants attract pests away from the crop and are called 'indicator' or 'trap' plants. Other guardian plants attract natural enemies by offering food such as pollen or nectar and are referred to as 'habitat' plants. Still other plants support insects that serve as food for natural enemies. These are called 'banker' plants."

Carol chose the term "guardian plants" to overarch the multiple functions these plants can serve. For example, an eggplant can be an indicator plant one day and a few days later become a trap plant. Likewise, an indicator plant can become a banker plant when it's chosen by beneficials as a reproductive site.

Banker Plants. A banker plant purposefully supplies prey or hosts for the support of beneficials. By supplying beneficials with a ready food source banker plants promote on-site production. These prey or hosts are normally themselves plant pests, but not always pests of the crop the banker plant protects. For example, the papaya whitefly doesn't threaten greenhouse crops. It's used to support the reproduction of whitefly parasites on papaya banker plants. Should a pest require pesticide treatments the grower protects the banker plant and resident natural enemies by temporarily removing them from the greenhouse before spraying.

Habitat Plants. Habitat plants are guardian plants that support natural enemies by supplying food and shelter to beneficials. Pepper grower Chuck Obern of C&B Farms, Clewiston, Florida, found that pepper fields with sunflowers (an Orius refuge) planted along the edge increased Orius numbers, resulting in a 30% reduction in pepper fruit damage (compared to fields without sunflowers). Habitat plants necessarily include any plants that serve as natural enemy habitat, including banker plants. For those natural enemies that only require pollen, nectar, resting or egg laying sites, habitat plants differ from all other guardian plant types in that they need not host any pests at all.

Indicator Plants. Indicator plants attract pests and possibly natural enemies: many pests show a distinct preference for certain plants over other plants. Often natural enemies will follow them there. Indicator plants can be more accurate than sticky cards, because they give evidence of non-flying as well as flying stages of pests. When beneficials are drawn into indicator plants, the pest manager can get a picture of the natural enemy/pest balance that is occurring in the greenhouse. If substantial parasitism or predation occurs on an indicator plant site, it has become a trap plant because pests are attracted to their death (the grower can use this plant as a kill site). Examples of indicator plants are petunias for virus, eggplants for whiteflies and spider mites and marigolds for thrips.

Trap Plants. In fall 2005, grower Don Banyar of Banyar's Greenhouse, Shickshinny, Pennsylvania, kept a couple tomato plants in the poinsettia greenhouse to keep his family supplied with fresh tomatoes. He observed that the whiteflies were going to the tomatoes, but not to the poinsettias. He concluded that the tomatoes were literally drawing the whitefly out of the poinsettias. His pest control program consisted of biweekly releases of a mixture of *Encarsia formosa* and *Eretmocerus mundus,* which did a thorough job of searching the poinsettias. "The poinsettias were clean!" says Banyar.

Trap plants draw pests away from crop plants and provide a localized venue where biological control or chemical interventions can be applied. In fact the trap plant system requires that some type of control be exerted so that you're not inadvertently providing pests with a reproductive base. When biological controls are applied to trap plants, the plants may become banker plants for those beneficials by supporting their reproduction.

The Benefits of Guardian Plants

1. Economic rewards. According to Carol, using guardian plants to retain natural enemies offers a strong cost/benefit ratio as follows: a) start-up costs are minimal; b) ongoing investment is low; c) the risk from failure is low because pesticides can be used when necessary, and d) the demand on grower's time is low.

Guardian plants can help:

- Protect grower investment in natural enemies by enticing beneficials to establish in the greenhouse
- Attract wild natural enemies
- Reduce expense for lab-reared natural enemies (fewer orders necessary)
- Reduce expense for overnight freight charges
- Save grower's time (habitat offers an efficient focal point for accurate scouting)
- Reduce pesticide use. In the absence of natural enemies indicator plants can improve the timeliness and thereby effectiveness of pesticide applications. This in turn reduces the need for more pesticides.

2. A diverse natural enemy population means broader pest control. Augmenting and conserving beneficials are critical components of an effective integrated pest management program. Supporting the plants that support the beneficials that control pests enables growers to remain or become more "green" by reducing their reliance on chemical pest control measures.

Augmenting and conserving natural enemies "shifts pest management strategies from reactive to proactive, encouraging a beneficials-centric instead of pest-centric approach," says Carol.

3. Ease of Scouting. "Scouting the indicator plants made my life a lot easier," says Michelle Ten Eyck, scout for IPM Laboratories. "I knew what to look for and where to look instead of feeling like I was searching for a needle in a haystack." Effective and efficient scouting can be a challenge. For one thing, early greenhouse pests are difficult to spot and the first beneficials are even more elusive. For another, greenhouse staff don't always have the time to scout the entire production area looking for potential pest problems. But without being able to measure pest presence growers won't be successful in managing pest numbers. Guardian plants offer significant assistance for scouts because they offer a specific site where insect presence can be accurately assessed. Pest managers often

use certain plants as an indication of the direction pest and beneficial populations will take.
For growers using natural enemies, Guardian plants increase grower confidence by making it easier to evaluate the pest/natural enemy balance.

In Conclusion

For growers like Bakers Acres, site of the NeSARE trials, the ever-constant bloom and pollen resources make green pest management more efficient and more effective (see Table summary). “Using habitat fit our 25-year vision statement which includes an increasing emphasis on sustainable growing practices,” says owner Reenie Sandsted. “More importantly,” she adds, “it works. Herbs usually attract a lot of pests, but by the end of the first season with the guardian plants we only had to treat that house once.”

WEB EXCLUSIVE: More on Guardian Plants & Research

Types of Guardian Plants

Banker plants (supply beneficials, a mini-rearing lab): A banker plant supplies prey or host food. This food is normally a plant pest, but not always a pest of the crop the banker plant protects. For example, the papaya whitefly does not threaten greenhouse crops. It is used to support the reproduction of whitefly parasites on papaya banker plants. The grower would not normally apply chemical treatments to this site because it is the refuge for the greenhouse’s beneficials, however, should the pest population get too high, the grower would turn the banker plant into a “trap” plant and kill the pests at the plant site.
Habitat plants for natural enemies (beneficials oriented): Habitat plants supply food and shelter to beneficials. They necessarily include any plants that serve as natural enemy habitat, including banker plants. Where natural enemies only need pollen, nectar, resting, or oviposition sites, habitat plants differ from all the other plant types in that they need not host any pests at all.
Indicator plants (attract pests, and possibly natural enemies): Many pests show a distinct preference for certain plants over other plants. Often natural enemies will follow them there. By attracting both pests and their natural enemies, the indicator plant may indicate the status of insect/natural enemy balance in the greenhouse. Indicator plants can be more accurate than sticky cards, when they give evidence of non-flying as well as flying stages of pests. When beneficials are drawn into indicator plants, the pest manager can get a picture of the natural enemy/pest dynamic that is occurring in the greenhouse. If substantial parasitism or predation occurs at an indicator plant site, it has become a trap plant. Pest managers have long used indicator plants to detect the first arrival of a pest. They may also be used to indicate the status of beneficial populations.
Trap plants (attract pests to their deaths): Trap plants are indicator plants where crop pests are killed. Trap plants draw pests away from crop plants and provide a site where biological control or chemical interventions can be concentrated. The trap plant system requires that some type of control be exerted so the grower is not inadvertently providing a place for pests to multiply. When biological controls are applied to trap plants, the plants may become banker plants for those beneficials.

Case Studies

Guardian Plant Research: New York and Vermont

In 2005, Carol Glenister of IPM Laboratories, Locke, New York, initiated a two state, multi-site experiment funded by NeSARE (Northeast Sustainable Agricultural Research and Education) to determine if plants could be used to attract and support diverse populations of beneficials. A large central New York grower, Bakers Acres, and two university greenhouses (Cornell and University of Vermont) participated.

That study used habitat pots containing marigolds, alyssum, lantana and fennel, as well as an aphid banker plant (barley infested with cereal aphids) to provide a continuous source of pollen, nectar, cereal aphids, shelter and reproduction sites.
Observations demonstrated the on-site reproduction of three released species of beneficials and more than five wild species of beneficials, and control of aphids and whiteflies.
For more information on this study visit: http://www.sare.org/reporting/report_viewer.asp?pn=ONE05-037&ry=2006&rf=1

Guardian Plant Research: British Columbia
Plant: Eggplant
Beneficial: Orius
Don Elliott of Applied Bionomics found that eggplant is a good habitat and indicator plant for Orius, an important thrips predator. Eggplant produces pollen, which sustains the predator when prey is absent.
He notes that eggplant can "attract and build up whitefly, thrips and spider mites if not watched, but if the correct natural enemies are added preventively, I have never seen individual eggplants cause a problem. An added benefit of this system is that beneficials build up sufficiently so growers can readily see them."

Guardian Plant Research: Ontario
Crop: Poinsettias
Plants: Eggplant and Tomato
Beneficials: Encarsia formosa and Eretmocerus mundus
Number of Participants: 12 growers
Graeme Murphy, Greenhouse Floriculture IPM Specialist with the Ministry of Agriculture in Ontario, Canada, is working with Michael Short of Eco Habitat AgriServices to test trap plants in ornamentals for whitefly.
One of their growers reported excellent results using tomatoes to protect fuchsia stock plants from greenhouse whitefly (Murphy, 2004). The same system was also effective in poinsettias infested with greenhouse whitefly.
In 2005, Murphy and Short initiated a trial in several commercial greenhouses to test tomato and eggplant as trap plants for the whitefly in poinsettias. Encarsia and Eretmocerus were introduced to the both the crop and the guardian plants.
Though pest management results differed among the grower sites, all who participated felt the system had potential, resulting in expansion of the trial to 12 growers in 2006. As of November, 9 of the 12 growers in this trial had completed the season using no whitefly pesticides; two treated once with an insect growth regulator (IGR); and only one abandoned the project due to problems with sustaining the guardian plants. This trial points out that guardian plants have great potential, but further refinement is needed to ensure results over a range of commercial settings.

Resources and References
Murphy, G. 2004. Trap crops and banker plants – thinking outside the pest management tool box. Ontario Ministry of Agric web site: http://www.omafra.gov.on.ca/english/crops/hort/news/grower/2004/07gn04a1.htm
Northeast Sustainable Agriculture, Research and Education program: http://www.uvm.edu/~nesare/
Bakers Acres of North Lansing: http://www.bakersacres.net
IPM Laboratories, Inc.: http://www.ipmlabs.com

IPM Laboratories, Inc., Locke, New York, produces and distributes beneficial insects, mites and nematodes for the biological control of greenhouse pests. www.ipmlabs.com.