GROWERTALKS

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Trap-Cropping Solutions for Whiteflies

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In integrated pest management's four-pronged approach—biological, cultural, mechanical and chemical control—cultural control is one of the least-used strategies, typically because measures are difficult to test or demonstrate experimentally. But as a preventative approach to pest management, where some part of the growing environment is manipulated to make it less favorable for pest survival and reproduction, cultural control techniques, such as trap crops, mulches and crop rotation, could significantly reduce costs and pesticide usage.

There are two species of whitefly—*Trialeurodes vaporariorum* (greenhouse whitefly) and *Bemisia argentifolii* (silverleaf whitefly)—and they harm their host plants in several ways: excessive sap removal during feeding (and its byproduct sooty mold), inducing systemic disorders through feeding and by vectoring plant viruses. All whitefly stages occur on the undersides of leaves, which makes insecticide application difficult. But because growers oftentimes resort to chemical sprays, *B. argentifolii* has become resistant to nearly every class of insecticide—a strong case for adopting other methods of pest management.

One of most intriguing cultural management techniques is trap crops, which are defined as alternative host plants grown in or around the main crop to attract, intercept and/or retain pest insects. The best trap crop is one that 1) is very attractive to the pest you're looking to target; 2) will retain the pest population for its full life; 3) is not a host of any virus that the pest can vector; and 4) will not help facilitate pest reproduction. For whiteflies, because both *T. vaporariorum* and *B. argentifolii* co-occur in greenhouses, it's recommended that you find a trap crop that works for both.

When insects fly around, they receive chemical cues from their host plants that signal them to land. And, though it was once believed that trap crops could repel specific pest insects, they actually keep pests at bay because they act as "interception barriers." A trap crop's chemical cues intercept the pest, and because their chemical cues are slightly more tantalizing than the pest's host plant, they land to feed and lay their eggs. So, if a trap crop is planted around or throughout a main crop, less eggs will be laid on the main crop.

A trap crop will be most effective if it's planted as a ring around the main crop, but if the trap crops are planted within the main crop, planting them in rows will be much more effective than placing them in close-together clumps (which leave large portions of the greenhouse trap crop-less), with the slight downfall that increased oviposition will occur on the main crop closest to the trap crops.

Trap cropping often fails to reach management goals because pests leave the trap crop and re-enter the main crop. To prevent this re-dispersal, you should use supplemental measures, such as trap vacuuming, trap harvesting, sticky traps, planting a high proportion of trap plants, or applications of pesticides or beneficial insects to the trap crop.

Trap cropping strategies for your greenhouse

Eggplant

In a greenhouse experiment by Lee et al. (2009), eggplant interplanted with poinsettia attracted and retained significant numbers of adult *T. vaporariorum*, even though these benefits weren't any better than a poinsettia monoculture.

However, because there was oddly high adult *T. vaporariorum* mortality on the poinsettias, this meant that only low numbers could actually migrate to the eggplant, thus reducing the trap crop's effectiveness. If mortality on the main crop can be reduced, eggplant may function as a useful trap crop.

Pictured right: Eggplant interplanted with poinsettia attracted and retained significant numbers of adult T. vapiororum, even though these benefits weren't any better than a poinsettia monoculture. Adapted from the study by Lee et al. (2009).

Once a whitefly has probed a poinsettia's tissues and accepted it as its host, it won't respond to the eggplants' visual or olfactory cues, so to prevent this, another study by Bird & Kruger (2006) recommends using a "push component" to disrupt the whiteflies' visual and/or chemical cues, and Lee et al. (2009) list out the following successes:

- A plastic mulch whose metallic pigments reflected disruptive UV wavelengths
- Mineral oil
- Ginger oil
- Natural enemies, such as beneficial mites and predatory wasps

Eggplant plus yellow sticky cards

Despite Moreau & Isman's (2011) study results that neither yellow sticky traps, eggplant trap crops, nor squash trap crops were very effective at reducing adult populations of T. vaporariorum on sweet peppers, they still believe that eggplant is feasible for a trap crop.

- Experiments showed that when whiteflies on a host plant were presented with another of the same host plant or an eggplant, they more often migrated to the eggplant.
- Yellow sticky traps by themselves significantly increased adult whitefly departure and were very effective at trapping and retaining the adults. They also significantly reduced the number of eggs laid.
- Combining eggplant with yellow sticky traps didn't increase whitefly departure from pepper, but this may be the result of eggplant leaves blocking yellow sticky traps from the whiteflies' vision.

Squash

A study by Schuster (2004) found that more B. argentifolii adults and nymphs were on tomatoes surrounded by other tomatoes, compared with tomatoes that were surrounded by squash, though the differences weren't

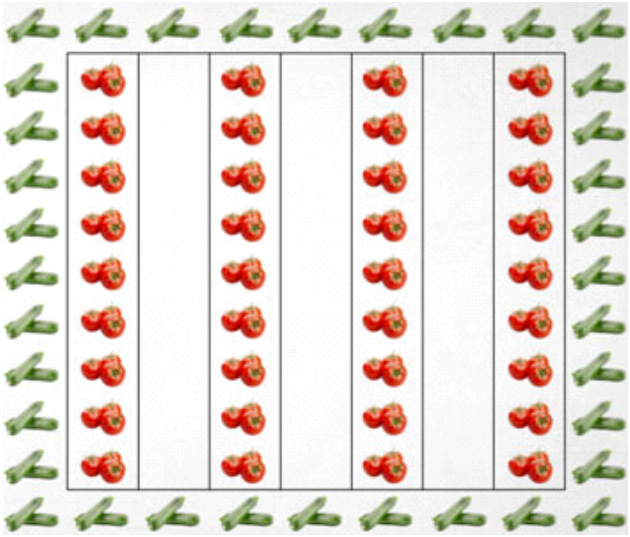
significant.

- Squash is a shorter-term crop than the tomatoes, so Schuster promoted flowering and suppressed fungal pathogens to prevent it from senescing.
- Hilje et al. (2001) emphasizes the fact that a trap crop's attractiveness diminishes with maturity, senescence and/or if it's overpopulated with pests.

Pictured below: This diagram was adapted from a study by Schuster (2004), which found that more B. argentifolii adults and nymphs were on tomatoes surrounded by other tomatoes, compared with tomatoes that were surrounded by squash, though the differences weren't significant.

Conclusion

Every pest is different. Scientists are still unsure about how each pest responds to chemical or visual stimuli and if they're even capable of separating those cues. So it's really important to watch how your pests interact with their host plants and the trap crops. How long do the insects spend on each crop and how often do they move from one plant to the next? Are they erratic in their flight pattern or do they fly straight? Answers to these questions can help you fine-tune the trap crop possibilities presented in this article. **GT**



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