Cornell University
Cooperative Extension

Aphid Management in Winter Tunnel Greens

Lessons learned over 4 seasons of on-farm applied research

Growing greens in high tunnels (minimally heated or unheated greenhouses) can be an effective way to market fresh produce during the fall and winter in colder climates, but there are challenges to success. Although plant growth slows during this time, aphids continue to feed and damage greens crops in tunnels. We have found that growers can successfully manage aphids with sustainable techniques such as biopesticides, beneficial insects and variety resistance. The success of these techniques depends on timing and other management skills. Below, we share examples from our four years' experience on several farms that employed these strategies.

Challenges

The wide variety of greens crops grown for winter production in tunnels includes:

- Spinach
- Lettuce
- Swiss chard
- Kale
- Asian greens like mizuna & pac-choi

A number of aphid species will attack these common winter tunnel crops, including:

- Green Peach Aphid
- Fox Glove Aphid
- Potato Aphid

Proper aphid identification is essential for some specific biological controls, but control of multiple aphid species is possible with proper management. It is also crucial to catch populations early. Our scouting program used an action threshold of one aphid per leaf. Through this project, we have learned that employing broader control methods that affect multiple species at the onset of population growth is a key management practice.

Solutions: Biological Controls

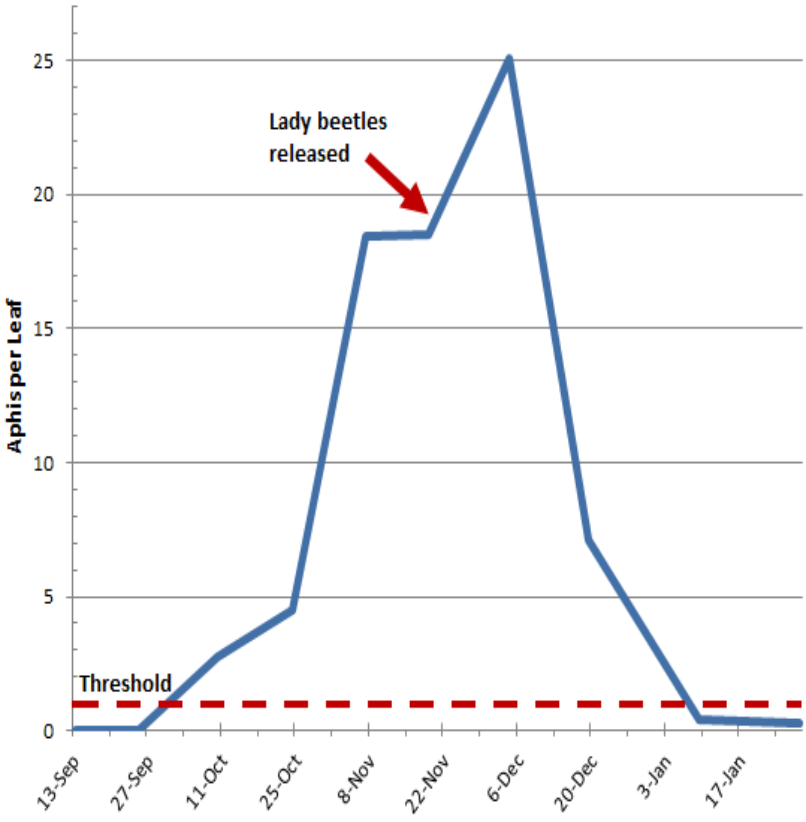
Parasitoid Wasps

As mentioned above, species identification is essential for some biological controls. Each parasitoid wasp species has specific target species of aphids. Identification is often not practical in a commercial setting, so the release of multiple species of parasitoid wasps to create a broader range of target aphid species is an effective option. Parasitoid wasps search out live aphids and lay their eggs inside them. The developing wasp egg eventually kills its host and an adult wasp emerges from the aphid mummy to parasitize more aphids. Our wasp releases contained the species *Aphelinus abdominalis*, *Aphidius colemani* and *Aphidius ervi*.

Aphid (left) and parasitoid wasp (right)

At one cooperating farm, biological controls reduced an aphid population by 90% on a high tunnel pepper crop. As on many farms, a summer crop preceded winter greens. On another farm, the release of 500 mixed parasitoid wasps under row cover in early September resulted in outstanding control of the aphid population. Research has shown that low temperatures decrease parasitoid wasps' ability to control aphids, with optimum results at 77°F. This makes timing a key factor. Successful winter aphid management with parasitoid wasps requires release in fruiting summer crops to reduce an aphid population prior to the planting of winter greens.

Lady Beetles



Aphid control in Mizuna with Lady beetles

Adult lady beetles

As temperatures drop, we refrain from the release of biocontrols with one exception: lady beetles. Under row covers, lady beetles provided excellent control of aphids at some cooperating sites. Adult and larval stage lady beetles seek out aphids as prey within the canopy. Our experience in this project indicates that lady beetles are relatively more tolerant of cooler temperatures than parasitoid wasps. This makes them an option later in the season.

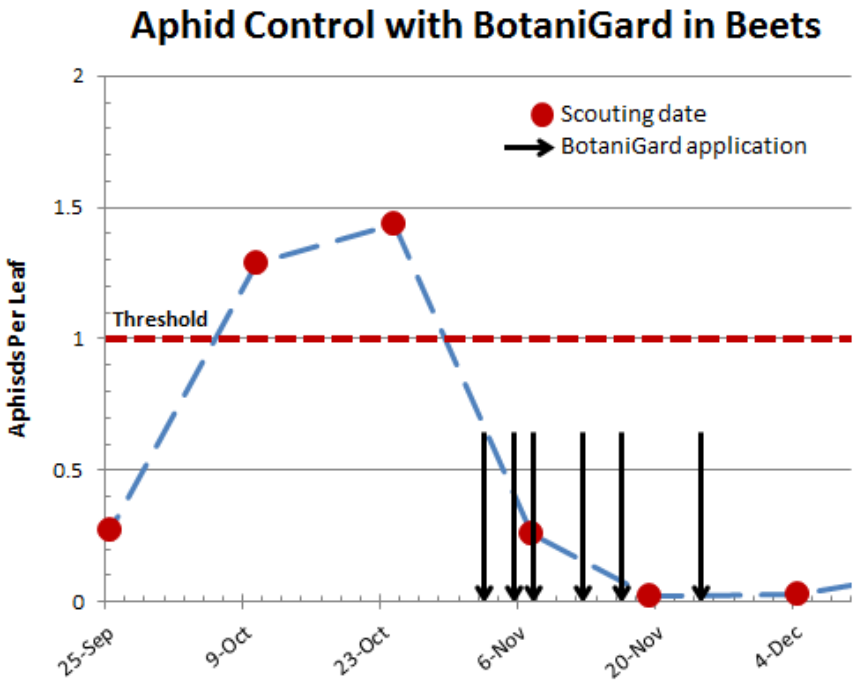
One cooperating farm released lady beetles on November 24 at a rate of 9 per square foot (1 quart of adults released). By early January, the lady beetles reduced aphid populations in mizuna by 98.5%. Parasitoid wasps could not achieve this level of control at this time of year.

Solutions: Biopesticides

Beauveria bassiana strain GHA

(BotaniGard or Mycotrol O)

Another successful control method studied in this project was the use of the biopesticide Mycotrol O or BotaniGard. These are commercial formulations of the aphid-attacking fungus *Beauveria bassiana.* The fungus penetrates and degrades the aphids' body. One cooperating farm first observed aphids on September 25 with populations increasing over the following month. The grower applied BotaniGard six times in early and mid-November. This practice reduced the aphid population by 98.4% in high tunnel beets. The initial spray reduced populations to below threshold, but follow up sprays are necessary to keep levels low. Beets' open canopy permitted excellent spray coverage, resulting in the best control of the aphid population. A number of farms reported a similar dynamic - a tighter crop canopy decreases spray coverage and reduces contact with the target aphids.



Appropriate planting density can help with both insect and disease control. Aphid materials such as BotaniGard or Mycotrol O (OMRI listed) require contact with the insect. When the greens canopy is closed, sprays cannot effectively reach the target (see photos below). High-density plantings also trap moist air within the canopy, which leads to diseases such as Gray Mold and Downy Mildew. Using wider spacing in winter greens can ease pest management and prevent diseases.

Left: A tight canopy increases disease and insect losses.

Above: Wide spacing decreases disease pressure and allows for spray penetration.

Important cultural considerations

Look at the whole system when developing an aphid management plan for a cool season tunnel crop. Key steps take place before the greens crop is in the ground. Summer tunnel crops can be a major source of pests of winter greens. Managing a high population of aphids becomes very difficult in cold conditions. Fortunately, using bicontrols and appropriate sprays in the summer or early fall can successfully prevent unmanageable populations in the winter crop. Controlling aphid outbreaks in transplant facilities is also an important way to prevent population influxes in high tunnels.

Other preventative practices complement the in-season strategies. Regular scouting allows for timely management of an aphid population. We often observed aphids on kale (on the undersides of lower leaves) before they were present on other crops. Weeds can host aphids, so high tunnel weed management plays a role in aphid control. For example, aphids preferring weeds in the Aster family, (e.g. sow thistles), may move into related lettuce crops in the tunnel as the weeds die back in late fall. Early scouting of these crops and weeds may reveal early aphid populations in or around the high tunnel.

A combination of the cultural practices, biocontrols and biopesticides detailed above can result in successful management of aphids in winter greens. Many of our most successful cooperating farms engaged multiple strategies to mitigate aphid damage on tunnels greens. Often farmers released parasitoid wasps or lady beetles while temperatures were warm, and followed up with multiple Mycotrol O sprays later in the season. A preventative approach sets growers up for success with natural pest management in winter greens.

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More details of our on-farm work in high tunnel greens are online. Visit http://tinyurl.com/nesarewintergreensproject to see yearly project reports.

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