Photo by Lauren Diepenbrock

Figure 1. IPCs can protect trees from Eastern lubber grasshoppers.

Pests, pathogens and IPCs

By Lauren Diepenbrock, Megan Dewdney, Fernando Alferez, Jawwad Qureshi and Ozgur Batuman

Individual protective covers (IPCs) are becoming commonplace in citrus production to support the development of young trees after planting. IPCs are made of fine mesh and are intended to keep Asian citrus psyllids (ACP) off young plants. Because ACP can transmit the pathogen that causes citrus greening/huanglongbing, preventing ACP feeding is crucial so trees can establish healthy roots and reach production before the disease develops and impacts fruit quality and yield.

PEST PROTECTION

IPCs work as intended to prevent ACP from accessing flush.

An unexpected benefit of IPCs is that they also prevent citrus leafminer (CLM) from infesting the abundant young leaves available on trees grown in IPCs. Preventing CLM access has a two-fold benefit to trees. Heavy CLM pressure, as seen in open field resets, can impede plant growth by reducing photosynthetic leaf area. Feeding from CLM also leaves microscopic holes where citrus canker bacteria may enter. By preventing CLM infestation, growers can avoid the risk of this pest on their young trees.

Additionally, IPCs that are adhered to the trunk prevent lubber grasshoppers from destroying young trees (Figure 1). Lubbers consume massive quantities of plant material throughout their development, and insecticides are not particularly effective on this pest, making IPCs an ideal deterrent to their feeding pressure.

PEST PROBLEMS

Unfortunately, some insect and mite pests are highly successful at establishing within IPCs. The habitat within IPCs is conducive to spider mite, rust mite, caterpillar, scale and mealybug populations. IPCs provide protection for these minute pests from predators and weather events that could minimize pest buildup in open groves. While rain and insecticide/miticide sprays do penetrate IPCs to some extent, it is not enough to knock off mites or get good spray coverage, as it would be in trees without IPCs. That, coupled with long dry periods, enables mite populations to build to a point of causing leaf drop.

Similarly, scales and mealybugs that establish within bags (IPCs) are generally free of predators

Photo by Barry Kostyk

Figure 2. Southern armyworm egg masses have been found on IPCs.

Photo by Lauren Diepenbrock

Figure 3. Upon hatching, southern armyworm first instar larvae (tiny caterpillars) drop into the IPC, feed on leaf tissue and continue developing.

and minimally impacted by most spray programs unless sprayers are calibrated to ensure penetration into bags. Green and brown soft scales, purple scale, Caribbean black scale, long tailed mealybugs, citrus mealybugs and lebbeck mealybugs are commonly seen inside IPCs. They are challenging to manage once established in this system.

Growers are often surprised to find caterpillars inside IPCs. Southern armyworm has been found to lay eggs on the outside of IPC mesh (Figure 2). Upon hatching, first instar larvae (tiny caterpillars) drop into the IPC, feed on leaf tissue and continue developing (Figure 3). Early feeding often goes unnoticed, but feeding damage will increase with each successive developmental stage (Figure 4).

EFFECTS ON DISEASES

Recent work has demonstrated that IPCs protect young trees from HLB infection. While that benefit was expected, other diseases are also affected by the altered environment in the bags.

Citrus Canker

Citrus canker is often problematic on young trees as it can contribute to defoliation but also allows inoculum to become established and troublesome in future seasons when fruit are present. Trials running for four years at the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) Southwest Florida Research and Education Center (SWFREC) and one year at the Citrus Research and Education Center (CREC) show that the level of canker infection within the IPCs was much lower than in trees without IPCs. While there were leaves with lesions, the number of lesions was considerably lower, and they affect less of the infected leaves.

Two factors likely contribute to this outcome. First, the mesh slows the speed of the water droplets landing on the tree surfaces, so wind is less able to force bacteria-carrying water droplets into leaves. This means the bacteria are forced to find their own way into the stomates, which is challenging for them. Second, the reduced leafminer damage is beneficial because damage from leafminer feeding is highly susceptible to infection and amplifies the amount of inoculum produced from infections. Researchers used the tree immune system stimulator Blockade to manage canker with the IPCs and regular copper applications in the summer.

Photo by Barry Kostyk

Figure 4. Southern armyworms can significantly damage trees inside IPCs.

Greasy Spot

Another positive outcome of the CREC trial in Central Florida is the reduced level of greasy spot lesions on the leaves in the first year. This contrasts with the results obtained at SWFREC, suggesting that disparate climatic conditions may play a role

in the establishment and evolution of this disease. At SWFREC, incidence of greasy spot was more severe on the trees covered with IPCs than in the non-covered trees.

The accumulation of dropped leaves inside the IPCs could also have promoted severity and incidence of this disease since the decomposing leaf litter is where the fungus produces spores. Greasy spot also can cause premature defoliation which weakens trees, so it needs to be kept in check.

> *One disease problem that was greater than expected in IPCs is sooty mold.*

While there was little delay of greasy spot onset in the first year of the CREC trial, and nearly every tree had the disease, the extent of the lesions was reduced. The copper for canker will help keep the level of greasy spot low, but summer oils in mid-May to mid-June also would be beneficial on late-harvest sweet oranges.

Sooty Mold

One disease problem that was greater than expected in IPCs is sooty mold. This is made more challenging with the insect pressure described above. The fungus responsible for sooty mold grows on the honeydew from the insects. The level of sooty mold intensified as the insect pressure increased. The best way to manage the disease in an IPC environment is to get the insects under control.

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