Photo by F. Alferez

Photo by M. Zekri

Figure 1. Individual protective covers can be used in a large-scale commercial groves (top) and on resets (bottom).

IPCs for HLB prevention in young trees

By Fernando Alferez, Susmita Gaire, Ute Albrecht, Ozgur Batuman, Jawwad Qureshi and Mongi Zekri

Controlling the Asian citrus psyllid vector of huanglongbing (HLB) is critical, especially in young trees. Reducing HLB incidence is essential for tree survival and productivity under current endemic conditions.

Individual protective covers (IPCs) are a novel strategy based on psyllid exclusion by means of a protective mesh bag. This system provides an alternative to soil drench and foliar insecticides, which reduce psyllid populations but do not efficiently prevent infection. In addition, there are concerns on increased use of pesticides and the negative impacts they pose to human health and the environment. The situation is further exacerbated by increasing levels of psyllid resistance to the insecticides, resulting in even more pesticide use. Hence, psyllid exclusion using IPCs is a promising tool. In addition to protecting trees from psyllids, IPCs can also protect the trees from other harmful insects.

Growing citrus under protective screen (CUPS) has been proven effective in excluding psyllids and allowing for high yields of premium fruit. However, this production system is not affordable for many growers and is not economically feasible for larger plantings of juice orange trees or for resetting, but IPCs can be advantageous in these situations (Figure 1).

Ideally, IPCs should be placed during planting to prevent any exposure of trees to psyllids. The period of time IPCs can stay on trees varies with the rootstock/scion combination, grove management, age of the tree and size of the cover. Multiple sizes of IPCs are now available to accommodate fast-growing trees on vigorous

rootstocks or with vigorous scions such as Sugar Belle®.

With all these factors in mind, University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) researchers established a citrus field trial in February 2018 to evaluate IPC efficacy and potential effects on tree growth and physiology. The trial was planted at the UF/IFAS Southwest Florida Research and Education Center (SWFREC) in Immokalee and consists of 90 trees of Valencia on Cleopatra rootstock arranged in a completely randomized design.

Trees were either not covered or covered with IPCs and received three different rates of neonicotinoid insecticides every six weeks. Researchers monitored psyllid populations, determined infection incidence, and measured *C*Las titers, leaf chlorophyll content, vapor pressure deficit (VPD) and other physiological and horticultural parameters.

NO HLB; GREATER GROWTH

In the 18 months since the trial was established, no psyllids were detected in the trees that were covered. PCR analysis of leaves detected no bacteria, and consequently leaves did not display any HLB-like symptoms. In contrast, trees without IPCs had psyllids, high incidences of HLB and displayed typical HLB disease symptoms.

IPCs modify the atmosphere within the covered canopy by lowering the VPD compared with uncovered trees. A lower VPD means that the air contains more moisture, which allows the stomata to remain open, and in turn extend the duration of active photosynthesis compared with high VPD conditions. Under IPCs, the canopy was denser, the leaf area was larger, leaf chlorophyll content was higher, and trees flushed earlier, more intensely and in a more synchronized pattern.

ADDRESSING CONCERNS

However, like any other tool or strategy, IPCs are not perfect. There are several concerns that must be noted:

Other Pests

Although IPCs were effective in eliminating psyllids and preventing HLB infection, other pests were

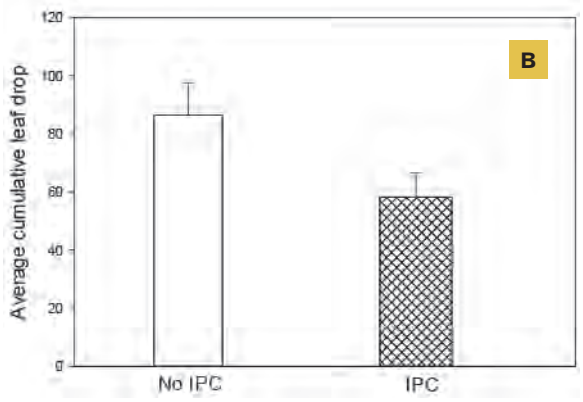

Figure 2. Leaves accumulate inside IPCs (A), but cumulative leaf drop is higher in non-covered trees (B). Leaf drop was measured during a three-month period.

identified within the covers. These include scales, mites, leafrollers, aphids and armyworms. It appears that the armyworm moth was able to lay eggs on the foliage through the mesh or on the mesh, and the first instars went through it. This resulted in larval infestation and feeding damage. Therefore, insecticide applications may be necessary, and scouting the trees for pests should be done regularly.

Incidence of Other Diseases

So far, SWFREC researchers have not seen any higher incidences of other common diseases such as citrus canker or greasy spot in trees under IPCs. They are monitoring this regularly to assess any potential seasonal factors that may be associated with disease outbreak.

Leaf Drop

Several growers and colleagues have stated that leaf drop appears to be more severe in trees under IPCs (Figure 2A). To investigate if this is indeed the case or just a visual perception, cages were installed around non-covered trees to collect and count the dropped leaves. Interestingly, the comparison showed less cumulative leaf drop in IPC trees than in non-covered trees during a three-month span (Figure 2B).

Branch Bending

As the tree grows, the restricted space under the cover results in the bending of branches and overcrowding. This suggests that the small covers may need to be replaced with larger ones as the trees grow (Figure 3, page 15). This is an additional cost that the grower will need to take into consideration if the IPCs are intended to be used for a relatively long period of time (more than two years). In turn, this may result in trees growing HLB-free

well into their productive stage, with the potential of producing high-quality fruit and yield.

FURTHER RESEARCH

As the industry in Florida is moving toward growing new cultivars for fresh fruit production, an understanding of flowering requirements and fruit set ability is needed to adapt tree cultivation to IPC systems and maximize high-quality fruit production and yields. UF/IFAS received funding from the Citrus Research and Development Foundation to expand its studies to some of these new varieties, including Sugar Belle®, Tango and Early Pride. Continuing studies will help answer important questions regarding horticultural performance, need for pollinators, and fruit-set management requirements (i.e., hormonal aids).

Current practices include removal of the IPCs at the beginning of the productive stage of the trees (usually around two years after planting). By doing so, trees will be exposed to psyllids and eventually become infected, although those two years of protection under the IPC are likely to be advantageous in retaining tree health during the most sensitive stage of early development. However, keeping the trees under the IPC for a longer time would prolong protection and in turn extend their productive lifespan.

Another important objective of the research is to assess alternative netting layouts for more cost-effective protection. This takes advantage of the edge-effect concept, which is based on the knowledge that infection and distribution of HLB are not uniform in a grove and that psyllid infestation is usually observed in trees located at the outer edges of groves. This has important consequences for pest management and may determine the most efficient IPC layouts in the grove. Different netting layouts will be evaluated through cost-benefit analysis to determine the most cost-effective and protective IPC layout.

Studies on IPCs will provide growers with timely and reliable information on how to use these tools to maximize their investment and, ultimately, improve fruit yield in their groves.

Figure 3. As the tree grows, smaller individual protective covers can be replaced by larger ones.

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