Almost 10 years have passed since the first detection of greening (HLB) in Florida.

How have we done against the world’s most devastating citrus disease? Clearly, the impact has been great, with costs of $4.54 billion and more than 8,000 jobs in the first six years, according to one estimate.

Another casualty was the former integrated pest management (IPM) system for processed orange production in Florida. Post-bloom and summer oil sprays were usually all that was needed back in the day. Now, 12 or more insecticide sprays to control the HLB-spreading Asian citrus psyllid (ACP) are common, with all their attendant costs and risks of secondary pest outbreaks and insecticide resistance.

On the other hand, growers have been successful in bringing ACP populations lower every year, in part by synchronizing sprays in regional Citrus Health Management Areas (CHMAs). Effective ACP control, better tree care programs and higher prices have allowed many operations to remain profitable in spite of HLB.

Thresholds for Asian citrus psyllid in two high-HLB incidence groves

By César Monzó and Phil Stansly
Still, it may be timely to ask, how many sprays can be added to a program before it reaches the point of diminishing returns? More specifically, what criteria can we use to decide whether or not another spray is warranted?

The traditional answer to this question in many crops has been to apply the concept of economic injury level, defined as the pest density at which yield losses balance the cost of control. At first, it was impossible to determine this with ACP due to uncertainty regarding risk of infection and consequent losses due to HLB. Now, however, many groves are completely infected, leading many to wonder if there is still value in controlling ACP. The answer is a definitive yes! Our research reported below and in earlier trials makes it clear that the fewer the psyllids the better the yield, even with 100 percent HLB incidence. Still, spraying has its costs as well as benefits, so the question should be, “What level of ACP control will earn greatest profits?”

To help answer this question and with support from the Citrus Research and Development Foundation (CRDF), we ran replicated trials for four years in two highly infected commercial citrus blocks to test four levels of ACP control: (1) “calendar” insecticide sprays (10–11 per year), (2) sprays based on a threshold of 0.2 ACP per tap plus two during the dormant season, (3) two sprays at a threshold of 0.7 adults per tap plus one during the dormant season, and (4) no ACP insecticide management. Calculations based on two juice price scenarios: $1.37 and $1.76 per pound solids. Monitoring costs of $57/year/acre were added to treatments 2 and 3.

<table>
<thead>
<tr>
<th>Program</th>
<th>Insecticide Sprays</th>
<th>Average ACP per tap</th>
<th>Pest management cost ($/acre)</th>
<th>Marginal income ($/acre)</th>
<th>Marginal profit ($/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Calendar</td>
<td>10</td>
<td>0.03</td>
<td>490</td>
<td>894</td>
<td>404</td>
</tr>
<tr>
<td>2) 0.2 thsld</td>
<td>5</td>
<td>0.04</td>
<td>251</td>
<td>748</td>
<td>497</td>
</tr>
<tr>
<td>3) 0.7 thsld</td>
<td>3</td>
<td>0.10</td>
<td>156</td>
<td>383</td>
<td>227</td>
</tr>
<tr>
<td>4) Check</td>
<td>0</td>
<td>0.67</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

At $1.37 per pound solids

At $1.76 per pound solids

Figure 1. Experimental design for the two blocks where four ACP insecticide management treatments were tested: 1) calendar (10-11) insecticide applications (blue), 2) insecticide applications during the growing season at 0.2 ACP adults per stem-tap threshold plus two dormant sprays (white), 3) insecticide applications at a 0.7-ACP-adults-per-stem-tap threshold plus one dormant spray (yellow), and 4) no insecticide applications for ACP control (red). A) Block 1: Valencia oranges, and B) Block 2: Earlygold oranges.

Figure 2. Orange crop during 2013 harvest in HLB-infected Earlygold trees receiving regular foliar nutrient applications plus insecticide to control the Asian citrus psyllid.
check and 0.7 threshold treatments, with intermediate numbers in the 0.2 threshold treatment. Yields varied accordingly, with the most fruit harvested from trees sprayed approximately monthly and the least fruit harvested from check and 0.7/tap threshold trees (Figure 3). However, when marginal costs from insecticides were subtracted from the marginal benefits from the harvest, the 0.2 psyllids per stem-tap threshold proved to be the most cost-effective treatment at delivered-in prices of $1.37 and $1.76 per pound solids (Table 1, page 18).

Spraying at a threshold of 0.2 ACP adults per tap may have been more cost-effective than just following scheduled applications in these trials. But is this an optimum threshold? Numerous variables go into calculation of economic threshold, including juice market price, yield, insecticide and application costs, and effectiveness of treatments. For this reason, it is not possible to define a fixed threshold for all scenarios. Nevertheless, it may be possible to estimate a threshold when the values of these variables are known or can be estimated. The critical parameter is the relationship between stem-tap results and yield (Figure 4). Once this relationship is known and given insecticide application costs, juice price and juice quality, we can estimate the cumulative number of ACP as monitored by stem taps which should trigger an insecticide application (Table 2).

These results relate to a specific variety, time and place. They should not be generalized until more such trials are run under different conditions. Also, the grower should keep in mind that possible effects of threshold-based spraying on resets or nearby young blocks have not been taken into account. Nevertheless, we are hopeful that this research will serve as a starting point toward the goal of building economically sustainable ACP management programs.

César Monzó and Phil Stansly work for the University of Florida-IFAS at the Southwest Florida Research and Education Center in Immokalee.