Extension Connection

Asian citrus psyllids are among the pests that have developed resistance to certain insecticides.

Preventing pesticide resistance

By Lourdes Pérez Cordero

Insects in general are often thought of as pests. Although some organisms of the class Insecta can become harmful to important agricultural crops, not all insects should inherently be considered pests. A pest can be any organism that competes, injures, or spreads diseases to humans, domestic animals and desired plants. Historically, humans have utilized chemical mixtures to minimize the effects of pests on economically important agricultural crops. Throughout the years, many plant-based chemicals have been discovered that have served this purpose.

According to the U.S. Environmental Protection Agency (EPA), in the 1940s DDT was the first modern synthetic insecticide to be developed and used, not only to control agricultural pests, but also to combat insect-borne diseases like malaria that could affect humans. The success of DDT was short-lived. It was banned by the EPA in 1972 due to its hazardous effects on the environment and to public health. Many of the pest species treated with DDT became resistant to the chemical.

Pesticide resistance is when an insect, fungus, weed, rodent or other pest develops the ability to tolerate the effects of a pesticide that once controlled it. DDT was not the first time in the history of pest control that insect resistance has been recorded. The resistance of San Jose scale to lime sulfur in 1908 was the first documented case. Since then, hundreds of cases have been documented. More than 600 species are known to have developed resistance to some type of chemistry. Additionally, more than 400 weed biotypes and plant pathogens are known to have developed chemical resistance.

WHY PESTICIDE RESISTANCE DEVELOPS

To ensure continued survival of the species, all living organisms possess a great ability to respond to diverse factors that may cause them stress. The presence of toxic chemicals in their surroundings creates a big stressor. Therefore, pests sometimes learn to evolve unique traits that help them survive and reproduce. This means that with each generation, they can become more and more tolerant to their stressor.

RESPONDING TO RESISTANT PEST POPULATIONS

The modes of action refer to the way in which the chemicals of a product work. On the label of each product, the group number identifies the mode of action. For example, if applying a pesticide of group number 22, which works by impairing nervous function in the organism, applicators must make sure to rotate to a pesticide of a different mode of action group. This prevents the target pest from getting used to the chemistries. Keep in mind that just switching to another product with a different brand name does not ensure that you have changed the mode of action. Some products may have different brand names but still have the same active ingredients or modes of action. Always look at the group number on the label to make sure.

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TAKE-AWAY MESSAGE

Although pesticides are a valuable asset to integrated pest management (IPM) programs, they must be applied correctly and at the right time in order to continue their use. Pesticide resistance is unfortunately a big concern since it impairs management programs and limits the options available to growers when it comes to chemical control. One way to prevent this from happening is rotating the mode of action of the chemicals used. Make sure to read the label and pay special attention to the pesticide group number. Identifying different chemistries that work for your IPM program and creating a rotating schedule can help growers stay ahead of pesticide-resistant pest populations.

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Two Promising Projects

By Rick Dantzler, CRDF chief operating officer

As one who is not a scientist, it has been fascinating to see how the scientific process works. One discovery leads to another, which leads to another, and so on, until hopefully a helpful outcome is achieved. It is symmetrical and logical. Occasionally, though, an idea comes along that turns this model on its head.

One such idea is a field experiment conducted by Randy Niedz and Michelle Heck, U.S. Department of Agriculture-Agricultural Research Service (USDA-ARS), in Ft. Pierce, Florida, and Ithaca, New York. Their team is taking molecules or compounds identified by Brian Scully, retired USDA-ARS scientist, as possibly having antibacterial properties and injecting them into trees of fruit-bearing age to see how they compare with trees injected with oxytetracycline (OTC). The traditional scientific model would dictate that the molecules first be tested in an assay of sorts. Then, if sufficient antimicrobial qualities of *C*Las (the HLB pathogen) are demonstrated, the molecule would be tested in a greenhouse before going to the field.

It's all very logical. One discovery leads to another, and so on. However, this takes time, which is not on the side of growers. So Niedz and Heck bypassed all of this and went straight to the field. "How it performs in the field is the only assay that really matters," says Niedz.

So far, they have injected 88 molecules, 13 of which appear to be equal to or outperforming the OTC control trees. Scully has found another 50 or so that need testing. This is important for several reasons, not the least of which is the need to have a backup ready if *C*Las develops resistance to OTC.

On the day this field screening trial visit occurred, I heard a second presentation on another exciting project. The USDA-ARS team is working on a way to deliver antimicrobial peptides to citrus trees. Antimicrobial peptides are small proteins that can have the same effect as OTC, but which are typically much more expensive to produce. This approach is called symbiont technology.

Symbiont technology operates by modifying agrobacterium's T-DNA, causing it to produce specific plant growth regulators and antimicrobial peptides. This results in a cluster of plant cells, referred to as symbionts, which grow on a fixed site of the trunk of the citrus tree to connect to the tree's vascular system. The symbionts continuously generate these antimicrobial peptides, which then flow into and distribute throughout the tree.

The team developed symbionts for over 40 antimicrobial peptides and found four to be effective against HLB in initial greenhouse tests. "Symbionts are to citrus trees what insulin pumps are for diabetic patients," says Heck.

The researchers secured 10 acres in the Indian River Citrus District and met Environmental Protection Agency and Animal and Plant Health Inspection Service criteria for field testing symbionts. If successful, this approach should be affordable to growers as the antimicrobial peptides are produced continuously throughout the symbiont's life.

Exciting projects are underway. OTC has given us time. Let's take advantage of it and develop more durable solutions.

CRDF Grower Dollars at work for you

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