Courtesy Florida Division of Plant Industry; bugwood.org

Rethinking copper

Trials find many products don't curb bacterial spot in tomatoes

BY VICKY BOYD, EDITOR

Many forms of copper, which historically have been used to fight bacterial spot in tomatoes, appear to have grown ineffective and at times may actually be detrimental.

After conducting four trials over two seasons, Gary Vallad, a University of Florida associate professor of plant pathology at the Gulf Coast Research and Education Center in Wimauma, says he would not recommend using most forms of copper to control the disease in tomatoes.

"My advice would be no (copper) for bacterial spot," he says. "For other diseases, particularly with speck, we haven't sorted that out yet because there are resistance issues with speck as well.

"We're finding very little benefits (for managing bacterial spot and speck) with copper. When we have, it's in the spring when it's dry and you wouldn't really need to spray it anyway."

Vallad also was quick to point out that his recommendation is only for Florida and may not be applicable to other production regions.

Widespread resistance

He says he based his recommendation against using copper for bacterial spot control on two factors. Copper really only suppressed the disease years ago and never really did provide what could be considered effective control when the weather was favorable for rapid disease development. That was before the numerous strains found in the state became resistant to copper.

During 2011-12, Vallad and colleagues collected 175 samples of bacterial spot in Florida and south Georgia and assayed them for resistance. Of those, 133 came from fields and 43 from greenhouses.

All strains but one were resistant to copper, and populations had also shifted during the past several seasons from race T3 strains to race T4 strains.

The concern is that the race T4 strains may be more aggressive, leading to more spotting on the fruit, depending on weather conditions.

The results also mirror those obtained in 2006-07, when 377 samples were collected by a group led by Diana Horvath. All of those samples showed resistance to copper.

Copper is used not only in the field but also in greenhouses producing transplants.

"I think for most medium- to large-sized growers, the equalizing factor is the transplant house because they're also using copper to try to manage (bacterial spot). And that's going to cause selection for copper tolerance," Vallad says.

Sensitivity varies within any pest population, with some individuals being more sensitive and some more tolerant of a pest-control product.

If the population continues to be treated with the same compound, the sensitive individuals die off, leaving the tolerant ones to reproduce. Over several generations, the only pests remaining are the highly resistant ones.

Copper proved detrimental

Vallad's trials were conducted in 2012-13 at the Wimauma center and involved 20 different treatments and four replicates apiece. One of the treatments was an untreated check.

Each treatment comprised three 30-foot rows. One plant in the center of each plot was inoculated to create a single lesion. This would mimic how the disease would infect one plant, then naturally spread outward, Vallad says.

What the trial revealed was when Actigard, an SAR—or systemic activated response—material was used alone or in combination with non-copper products, it produced the best results.

And when copper was added to any of the treatments, more fruit ended up with lesions than even the untreated check.

"Anything that had copper did worse than anything that had Actigard," he says "Whenever you had copper, you had significantly reduced yields compared to when you left copper out."

Non-registered antibiotics looked promising

Two antibiotics, both of which are not registered for use on field-grown tomatoes, provided good control of the bacterial disease. But Vallad says they may never be approved because of concerns about the spread of antibiotic resistance to human pathogens.

Streptomycin is labeled for use in greenhouse production. But resistance already is a concern as 86 percent of bacterial spot samples collected from transplant houses were tolerant to the antibiotic compared with only 14 percent of samples collected from the field.

Kasugamycin, the other antibiotic, is not labeled for use in greenhouses or the field. Vallad says this product, formulated as Kasumin, may have a better chance of registration since it is not used for the treatment of human or animal diseases. It already is registered abroad, so U.S. import tolerances have been established.

In addition, assays of bacterial spot samples from both greenhouses and the field showed that all collected strains were sensitive to Kasumin.

The registrant, Arysta LifeSciences, is pursuing a label.

Another non-registered material also looked promising in the trials, but Vallad says he needs to conduct further field trials before drawing conclusions.

As part of the trial, Vallad calculated costs for each treatment. The cost of a program that used eight sprays of copper-mancozeb was comparable with one using weekly Actigard treatments, $113 per acre versus $114 per acre, respectively.

Other treatments ranged from a low of no money for the untreated check to a high of $625 per acre for a hybrid treatment that involved rotations of Regalia, streptomycin, kasugamycin and Quintec. Quintec is not yet registered for use on tomatoes.

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As its name implies, bacterial spot causes spot-like lesions on tomato leaves. Severe infections can cause leaf loss, reduced plant vigor and yield loss.

David Langston, University of Georgia; bugwood.org

What is bacterial spot of tomatoes?

As its name implies, bacterial spot is caused by four species of bacteria: *Xanthomonas euvesicatoria* (T1), *X. vesicatoria* (T2), *X perforans* (T3, T4) and *X gardneri.*

It is considered one of the most devastating diseases of tomatoes and peppers worldwide and can cause significant yield loss if conducive conditions are present.

Bacteria enter through natural openings on the leaf surfaces and through wounds on the leaves and fruit.

Like many other bacterial plant diseases, it can be spread by machinery, humans, tools, splashing water and wind-driven rain, and contaminated seed. High-volume sprayers that are used to apply insecticides and fungicides in large volumes of water under high pressure may hasten the spread of the organisms.

The younger the plant is when infected, the more severe the symptoms.

The disease is particularly troublesome on transplant plugs and young plants, where it causes leaf lesions that resemble sunscald and defoliation.

The bacteria are most active when temperatures are above 80 degrees Fahrenheit and humidity is high.

The bacteria also can infect young fruit causing scab-like lesions that render the fruit unmarketable. But as fruit mature, they become less susceptible to the bacteria.