Hit the bulls-eye
Know pest, plant canopy and pesticide to boost sprayer efficiency in vegetables

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By Doreen Muzzi

The trick to getting the best application coverage possible while also minimizing spray drift is to match the application method with the canopy you are trying to treat, according to sprayer technology research conducted on pepper plants.

"There isn't necessarily one specific nozzle that will do the job for every plant in every different production system and environmental condition," says Richard Derksen, an agricultural engineer with the U.S. Department of Agriculture"s Agricultural Research Service in Wooster, Ohio.

Working together with his ARS colleagues and Ohio State University researchers, Derksen conducted various sprayer experiments to determine the effectiveness of controlling insects, such as European corn borer, and diseases, such as bacterial soft rot, using several different nozzle or sprayer types.

Although the trials involved fresh-market peppers in Ohio, Derksen believes the research results may be applicable to other regions of the countrr and to other vegetable crops, such as tomatoes, potatoes, melons and pumpkins.

The 2004 trials looked at the efficacy of an electrostatic sprayer, an air-assist sprayer and a conventional tractor-mounted sprayer using both low-drift nozzles and twin-fan nozzles. The fungicide and insecticide applications were made at speeds of 4 and 8 miles per hour over the course of a growing season to fresh-market bell peppers.

The low-drift nozzle produces relatively large droplets at both application speeds, while the twin-fan nozzle produces relatively small droplets.

In comparison, the air-assist sprayer is basically a traditional sprayer, but with air blowing around the nozzle at 40 mph. This helps move the spray down into the canopy and seems better able to penetrate the canopy and provide coverage to the underside of leaves, Derksen says.

The electrostatic sprayer is different in that it produces very small droplets with a negative electric charge, which"in theory"would make the droplets more attracted to the canopy and less likely to drop to the ground below the plant.

Pepper plants in the study were monitored for disease progress and insect damage during the year and then harvested when they turned red. Researchers then determined total fruit and the percentage of clean fruit vs. damaged fruit.

As an engineer, Derksen says his task was to use the damage assessments and spray deposits on leaves in both the upper and lower canopy to assess sprayer performance and coverage.

"What we found was that while spray coverage deposits were different with different sprayers, it didn't seem to matter when it came down to controlling insects and diseases as much as we had expected based on previous field work," he says.

The reason, he says, may have more to do with production and environmental factors than with sprayer technology efficacy. In 2004, cold, wet weather conditions resulted in relatively small pepper plants with an average plant height of about 16 inches. Plant canopies were also not as dense as would be expected during a typical year.

"Another caveat is that we sprayed every seven days, which may have helped reduce differences between sprayers," Derksen says. "Also, almost all of the treatments used a half-rate of product with 30 gallons of water per acre. Because of the smaller plant canopy last year, that half rate was enough for control."

All of the spray treatments included in the study performed significantly better than the unsprayed control plot. The untreated plot suffered significantly more insect and disease damage and yielded a lower quality fruit, according to Celeste Welty, an OSU fruit and vegetable entomologist.

In previous years with taller plant canopies, the air-assist system has performed better in terms of spray penetration lower into the canopy and putting the pesticide material on the back side of the leaf, Derksen says.

In 2004, it did only slightly better than the electrostatic sprayer, which did have difficulty penetrating the plant canopy with its smaller droplet size.

"As canopies get more dense and difficult to treat, I think the differences between application techniques become more evident," he says. "In any cropping situation, growers should investigate the potential for air-assist technology or low-drift nozzles in their production system. Reducing spray drift means getting more on target and applying pesticides more efficiently. It will also help make growers better stewards of the environment."

Derksen believes that large droplet applications with low-drift nozzles may be as effective as small droplet applications using cone nozzles at high pressure.

However, he says, it is important for growers to talk with their consultants or pesticide distributors and ask them what kind of spray quality is needed, what kind of coverage is needed for the particular product being applied and the pest problem being targeted.

"The low-drift nozzles may not just be for herbicide applications," Derksen says. "They may have a place in your pest management tool box for insecticide and fungicide applications.

"Low-drift nozzles definitely produce significantly less spray drift than traditional cone or fan nozzles, and used in the appropriate situations, may provide growers with the level of pest management they need to achieve.

"Air-assist nozzles may also help improve pesticide and fungicide coverage in pumpkins or other melons. These crops have a canopy that is very low to the ground. And because of that, it is often difficult get adequate coverage on the underside of the leaves. Producers may be able to take advantage of air-assist technology to stir up the canopy and provide better product coverage."

Much of Derksen's sprayer technology research will be repeated in 2005. In addition, the USDA and OSU research team will add other variables including different densities of plants per acre, and single row production systems compared to twin-row production systems.