GROWERTALKS

Pest Management

10/1/2021

Efficacy of IRAC Group 9 & 29 Insecticides Against Aphids

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For an entomologist, aphids are amazing creatures. Their diversity (over 1,300 species in North America alone) is a thing of wonder. Some species feed on only one plant species, some alternate between a different summer and winter host, and some feed on hundreds of plant species.

Many species can reproduce without mating and many also give birth to live nymphs instead of eggs. Imagine how quickly a population can grow if you can grow to reproductive age in less than a week and don't have to spend time looking for a mate or waiting for an egg to hatch. When a plant gets too crowded or when it's time to migrate to a different host species, some individuals will grow wings and fly away to start a new colony.

As amazing as they are, some aphid species are problems—melon or cotton aphid, green peach aphid, foxglove aphid, potato aphid, chrysanthemum aphid and root aphid, to name a few. Aphids suck out plant sap and nutrients that the plants need to grow and stay healthy. After extracting proteins, amino acids and nutrients they need from the sap, aphids expel the extra sugary sap from their cornicles (or tailpipes). This sugary sap is called honeydew, which makes surfaces sticky and shiny, and it's great for trapping aphid skins and growing black sooty mold. Ants are attracted to the honeydew, too. Some ant species even herd and protect the aphids so the ants can harvest the honeydew. This relationship gives aphids another common name—ant cows.

Aphids are troublesome and a constant headache, but the good news is they aren't too difficult to manage (unless, of course, you're trying to control root aphids). There are a number of excellent insecticides, biopesticides, predators and parasitoids for managing aphids. One group of insecticides that have my attention recently because they've been promoted as alternatives to neonicotinoids are the chordotonal organ modulator insecticides.

"Chordotonal organ" shall be the fancy entomological term you'll learn this week. You can think of chordotonal organs as the sensors between segments that tell insects how they're positioned relative to their environment. For example, the chordotonal organs on the antennae tell an insect if it's flying or how strong the headwind may be. Those on the leg joints tell the insect if it has landed or the surface is even.

Messing with the chordotonal organs will destroy an insect's ability to perceive its environment, and to maintain balance and normal movements. Insects poisoned by chordotonal organ modulator insecticides become disoriented and can't hang on to their host plants, fly or feed.

Four chordotonal organ modulator insecticides are registered for management of sucking insects on indoor and outdoor ornamental plants. Endeavor (pymetrozine), Rycar (flupyradifurone) and Ventigra (afidopyropen) are IRAC

Group 9 insecticides, which target TRPV channels on the neurons of the chordotonal organs. The target site of Aria (flonicamid), although still on the chordotonal organs, is recently found to be different from that of Group 9. Hence, flonicamid has now been separated from Group 9 and placed in a group of its own—Group 29. From now on, I'm just going to call the chordotonal organ modulator insecticides the Group 9 and 29 insecticides.

I conducted a series of greenhouse and laboratory experiments to answer a few practical questions on how best to use the Group 9 and 29 insecticides in an aphid management program. Much of the research on the efficacy of Group 9 and 29 insecticides was conducted on melon aphid and green peach aphid, which are the two most common species, so I decided to conduct the experiments on two less-studied, but no less important, species: potato aphid and chrysanthemum aphid.

Which of the Group 9 and 29 insecticides is the most effective against aphids?

This experiment was conducted in a greenhouse at Clemson University's Pee Dee Research and Education Center in Florence, South Carolina. I sprayed roses (infested by potato aphid) and garden mums (infested by chrysanthemum aphid) once with one of two label rates of each insecticide (all rates are per 100 gal.): Endeavor (2.5 and 5 oz.), Rycar (2.4 and 3.2 fl. oz.), Ventigra (1.4 and 4.8 fl. oz.) and Aria (0.7 and 2.1 oz.). Note that Ventigra has only one label rate for aphids (1.4 fl. oz.), but I decided to use the whitefly rate (4.8 fl. oz.) as the high rate. I also sprayed some plants with water as the untreated control. I didn't use any surfactant in this trial and the application volume was 100 gal. per acre.

I followed the number of potato aphids on one terminal per rose plant over 28 days. I found that all Group 9 and 29 insecticides reduced the number of aphids within one day of application. The aphids were just about all gone in five days after application. Although plants treated with the low rate of Endeavor had some aphids lingering on, the densities were much lower than those on the untreated plants and weren't statistically different from other insecticide treatments.

The chrysanthemum aphid seemed a bit harder to manage. Instead of a quick knockdown like the potato aphids, I didn't see a significant reduction in chrysanthemum aphid density (number per three leaves) until the third day after treatment. The chrysanthemum aphid population was also not completely wiped out and made a comeback on plants treated with the low rate of insecticides within 28 days of treatment.

Overall, I found all Group 9 and 29 insecticides and the two application rates of each product to be similar in their efficacies against the potato and chrysanthemum aphids. There's certainly a difference between the two aphid species in terms of their susceptibility. Chrysanthemum aphid population took longer to reduce and was faster in bouncing back, and therefore, may need a second application to completely control.

How long does one application of Group 9 and 29 insecticide last?

The greenhouse experiment was conducted against aphid populations that weren't reinforced with winged adults coming in from outside of the greenhouse. In this case, one application did quite well against the potato aphid population. Group 9 and 29 insecticides are translaminar insecticides, so insecticide residue may remain in leaf tissues and they should have some level of residual toxicity after treatment. What if there's a constant migration of aphids from the outside through the open side panels? Would one application still last 28 days?

To answer that question, I collected leaves from rose and garden mum plants treated with water or the Group 9 and 29 insecticides (same products and rates as before) at one, three, five, seven, 14, 21 and 28 days after treatment, and brought the leaves back into the laboratory. I cleaned the leaves of all aphids and reintroduced 10 healthy rose or chrysanthemum aphids (collected from other untreated plants) onto each leaf. Then I came back six days after treatment to see how many aphids had died or had been produced over that time. If I see substantial increases in the number of aphids at six days after introduction, I can say the residual toxicity has been overcome and estimate

the residual longevity of each product at each application rate.

The data from this laboratory experiment were detailed enough to detect differences among products, application rates and residual ages that I couldn't detect in the greenhouse experiment. I found significant increases in the numbers of potato aphids (in other words, a potential break in residual efficacy) at 14 days for both rates of Endeavor and Aria, and at 28 days for both rates of Ventigra. The breaks in Rycar's residual efficacy came at 14 days for the low rate and 28 days for the high rates.

For the chrysanthemum aphids, once again, the population wasn't completely wiped out by the insecticides, but some noticeable breaks in residual efficacy can be detected. The breaks in Endeavor residual efficacy came at 14 days at the low rate and 21 days at the high rate. The breaks were 14 days for both rates of Rycar, and 21 days for both rates of Ventigra and Aria.

Now, am I saying that you can spray mum plants with Ventigra and completely ignore them for at least 21 days? No! Remember that Group 9 and 29 insecticides are translaminar insecticides, meaning that they'll have residual efficacy on the leaves that you sprayed. The active ingredients do not move throughout the plants, therefore, the residue doesn't protect any new leaves and flowers that appear after the application. While you could expect 21-day residual on the older leaves, you still need to make additional applications weekly or biweekly to protect the new leaves, depending on the growth rate of your crop. **GT**

An insecticide rotation program is necessary when you plan to make multiple applications against the same pest population. Remember, because Endeavor, Rycar and Ventigra are from the same IRAC group, rotating among these products isn't a true rotation program.

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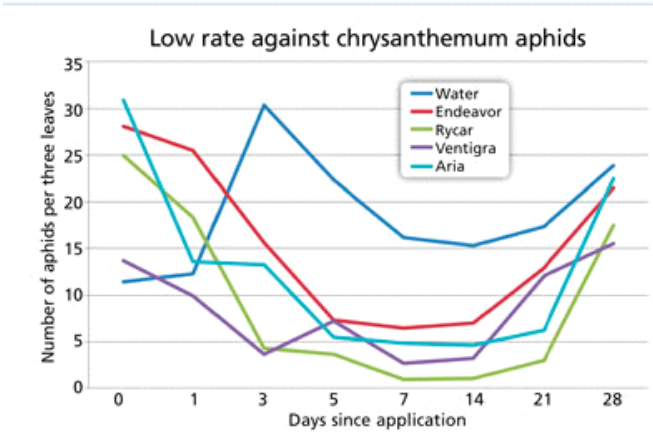
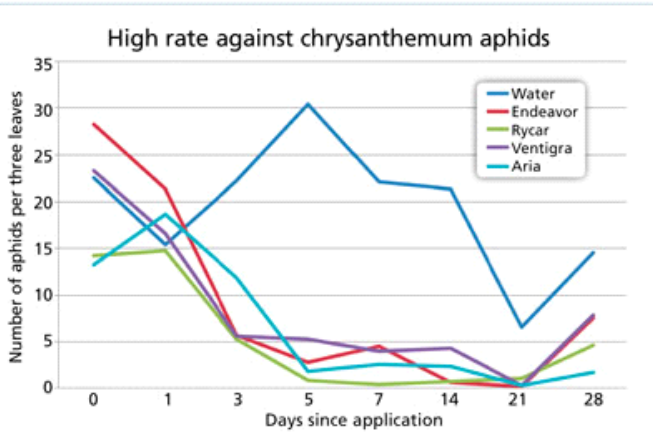
Left: Potato aphids on a rose plant. Center: Chrysanthemum aphids on a garden mum. Right: After extracting proteins, amino acids and nutrients they need from the sap, aphids expel extra sugary sap called honeydew, which makes surfaces sticky and shiny.


Low rate against chrysanthemum aphids
Number of aphids per three leaves
Days since application
Water
Endeavor
Rycar
Ventigra
Aria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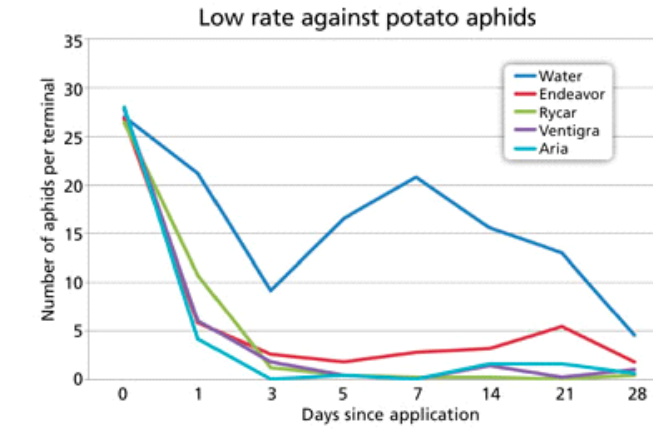
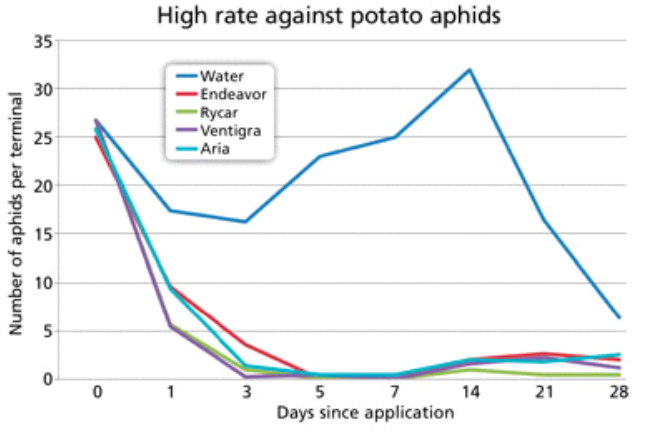

Low rate against potato aphids
Number of aphids per terminal
Days since application
Water
Endeavor
Rycar
Ventigra
Aria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