

An ounce of prevention

Rotate and tankmix weed-control methods to slow herbicide resistance in trees and vines

By Marni Katz

When triazine herbicides stopped controlling weeds late in the season, Bob Carini, a blueberry grower in Port Sheldon, Mich., feared he had an herbicide-resistance problem.

Tests conducted by Michigan State University showed the weeds weren't resistant. But Carini says the scare reinforced the need to accurately identify weeds, properly time herbicide applications, rotate chemicals and use mechanical weed control, where possible.

More than 115 weed species in the United States are resistant to herbicides, and growers of permanent crops are encountering an increasing number of those.

In California, for example, Central Valley grape growers have found horseweed—also known as marestail—that's resistant to the popular broad-spectrum herbicide glyphosate.

Marketed under the brands Roundup, Touchdown and about 50 other names, the herbicide kills weeds by inhibiting ESPS synthase, an enzyme required to make essential amino acids.

University of California Cooperative Extension farm adviser Kurt Hembree blames the glyphosate-resistance problem, in part, on growers switching to a broad-spectrum, post-emergent herbicide program from the once-standard pre-emergent program.

Pre-emergent herbicide use in California had been declining even before regulations



Photos courtesy of USDA PLANTS Database

If you suspect weeds, such as horseweed (pictured), in your permanent crops are glyphosate resistant, use an herbicide from a different class of chemicals with a different mode of action.

designed to protect groundwater severely restricted the use of simazine, diuron and other pre-emergents. But the restrictions hastened the switch.

"More growers are finding themselves in groundwater-protection areas, which happen to be where most of our vineyards and orchards are located," Hembree says. "So those growers who would typically use those pre-emergent products have switched over to post-emergent herbicides, and Roundup or generic glyphosate would be the product of choice."

The problem is complicated as more vineyard and other permanent fruit crop growers try to reduce weed-management costs.

"With fluctuations in prices in peaches, raisin grapes and other grapes, we've seen a lot of reduction in weed-control costs," Hembree says.

"Growers will typically, in that case, go to generic glyphosate for \$2 to \$3 per acre for product and make repeated applications versus \$30 to \$40 an acre for a pre-emergent that might last all season.

"In that case, you could essentially have four or five applications a year of the same product in orchards and vineyards. And if you do that for two or three seasons, you really increase the likelihood of resistance."

A growing problem

Since glyphosate-resistant horseweed was first confirmed in California in 2005, it has become widespread in four Central Valley counties.

Hembree says researchers have identified 80 percent to 85 percent of horseweed in some locations is resistant to the herbicide.

"It's pretty widespread in the Central Valley, and the rates of resistance are pretty high," he says.

Horseweed is naturally tolerant to glyphosate, but it also possesses traits that make it more likely to develop true herbicide resistance.

It produces up to 200,000 seeds that can travel up to 20 miles on wind currents. Once a plant develops herbicide resistance, the problem can spread quickly through the large numbers of seeds produced.

And the problem isn't limited to horseweed, either, Hembree says.

"There are currently 16 weed biotypes in California that have developed resistance to various herbicides, and we are



Michigan researchers have confirmed marestail and ladysthumb (above) found in blueberry fields are resistant to triazine herbicides.

seeing some increases in some classes of herbicides," he says.

Most recently, glyphosate-resistant rigid ryegrass has been isolated in 5,000 to 10,000 acres of California almonds, largely as a result of repeated glyphosate use and a

genetic variability that makes the weed susceptible to resistance.

UC integrated weed specialist Anil Shrestha is studying reports of glyphosate-resistant hairy fleabane, another broadleaf in the same family as horseweed.

"We started hearing about fleabane about a year ago and are collecting seed from various locations with suspected resistance to confirm it is in fact resistance," says Shrestha, who is based at UC's Kearney Agricultural Center near Parlier.

Nor is weed resistance unique to California fruit crops.

Since 2001, Michigan growers and researchers have documented several cases of triazine-resistant horseweed and ladysthumb, says Eric Hanson, a Michigan State University horticulture professor in East Lansing.

Is it resistance or not?

Before growers jump to the conclusion of herbicide resistance, experts recommend they first determine whether poor application methods caused the lack of weed control.

Poorly timed applications, applying herbicides to too large of weeds and using less-than-labeled rates can contribute to weed-control failures, Hanson says.

So can poor application technique.

"There are a lot of failures in weed control that aren't resistance," he says. "Perhaps the nozzles on the sprayer aren't set up correctly or the applicator isn't mixing correctly."

Regardless, Hanson says it's important

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that growers of permanent crops consider herbicide resistance when drafting their weed-management programs.

"They ought to be thinking about this and starting to rotate their herbicide programs into different chemicals that have different modes of action to control resistant populations, but also to prevent this from happening in the future," he says.

Get a jump on resistance

Although blueberry grower Carini's weeds tested negative for herbicide resistance, he still takes precautions to prevent it from developing.

He monitors his fields regularly and bases chemical choices on the weed populations present. Carini also rotates chemistries to prevent repeated use of triazines, when possible.

Rather than repeatedly use Princep or Karmex, which share a single mode of action, he rotates it with another pre-emergent, typically Solicam or, if grasses are more a problem, Sinbar.

"Some fields, if we don't have too big a problem, we don't put anything down at all," Carini says. "We have some fields that, other than spot treatments with Roundup or Gramaxone, we haven't put herbicides on in a few years."

Hanson says blueberry growers have a number of alternatives to the traditional pre-emergents, such as triazine—marketed as Princep—and the nontriazines Sinbar or Karmex.

All three of those herbicides have the same mode of action—they inhibit photosynthesis.

Even if growers rotate from one of the three to another, they still would be setting themselves up for weed resistance problems, Hanson says.

Two substitutes are Solicam and Surflan, which inhibit chlorophyll pigment, he says. Most rotational materials, however, have some limitations, such as higher costs or a limited weed-control spectrum.

Nevertheless, Hanson says growers should invest in protecting themselves against resistance by working the alternatives into their weed-control programs.

Mix it up

UC's Hembree suggests grape growers rotate chemistries and use pre-emergents at

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least every two to three years to keep ahead of resistant populations.

A grass pre-emergent, such as Prowl, mixed with a broadleaf pre-emergent, such as Goal or Chateau, should provide a broad weed-control spectrum, he says.


Growers can clean up any escapes with a shovel or with post-emergent products, such as Roundup, Rely or Gramoxone.

Application time is equally crucial, Hembree says.

"Don't wait until all the weeds are up," he says. "Apply when you have a good flush up and weeds are 3 to 4 inches tall. "The thing with horseweed is the weeds really have to be small to be controlled effectively. Herbicides need to be applied to weeds before they are bolting, at about 12 to 14 leaves."

Hembree says growers also should survey their fields to determine the weed spectrum and level of herbicide control.

As part of an integrated weed-control program, Hembree recommends using mechanical cultivation, when possible.

"Horseweed is highly susceptible to cultivation," he says. "Some type of cultivation in addition to herbicide tankmixes is probably the smart way to go." 

Contact Grower editor Vicky Boyd at (209) 571-0414 or vlboyd@att.net.

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Herbicide Resistance Action Committee—
Guidelines to the Management
of Herbicide Resistance:
<http://www.plantprotection.org/hrac/Guideline.html>

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