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UC scientists find herbicide-resistant horseweed in California

Weed ecologist Anil Shrestha, left, and farm advisor Kurt Hembree look over their horseweed project

A weed that five years ago was seen only occasionally in California is now growing prolifically on irrigation canal banks, vacant lots, orchard and vineyard floors, roadsides and gardens. One reason, University of California scientists can now confirm, is that biotypes of horseweed have evolved that are unaffected by the most commonly used herbicide – glyphosate.

Glyphosate is the active ingredient in 55 brand-name and generic herbicides registered for use in California. The most common brand is Roundup. According to the California Department of Food and Agriculture, 5.7 million pounds of glyphosate were used by the agricultural industry in 2003.

Horseweed is a particularly sinister vegetative foe. Also known as mare's tail and by its botanical name Conyza Canadensis, it grows straight upright on a central stem surrounded by long, thin leaves. Horseweed is difficult to pull. Mowing makes the problem worse instead of better. Unabated, it grows 8 to 10 feet tall, competing with agricultural crops for water, nutrients and sun, and getting in the way of farm equipment and laborers. In untended yards or vacant lots, horseweed forms a tangled jungle. And perhaps most ominously, each plant produces 150,000 to 200,000 seeds on yellowish fluffy flowers that a breeze will spread for hundreds of yards.

UC Integrated Pest Management weed ecologist Anil Shrestha and UC Cooperative Extension weed management farm advisor Kurt Hembree, both based in Fresno County, began to suspect the herbicide resistance in horseweed a few years ago when the distinctive plant became more prevalent.

"You see it everywhere now," Hembree said. "In 2000, I had a garlic field with just a few horseweeds. Now it is completely infested. That is just one example on the west side of the (San Joaquin) valley. On the east side, it is common especially between the rows in orchards and vineyards. Large numbers of horseweed are now popping up from Napa County in the north down through Southern California."

A call from a Dinuba irrigation district manager spurred the research project at the UC Kearney Research and Extension Center (KREC) near Parlier. The irrigation district was controlling weeds in a Pest Management Zone, an area where most herbicides are banned because they threaten groundwater contamination. Glyphosate is the only herbicide permitted in these zones since the chemical is considered environmentally benign.

"The irrigation district was using glyphosate year after year," Shrestha said. "This continuous use was, in effect, selecting for horseweed that was resistant to the chemical."

The scientists collected horseweed seed from the Dinuba site to compare with horseweed seed collected in western Fresno where glyphosate had seldom been used. The weed seeds were planted in pots in a greenhouse at KREC and treated with three rates of glyphosate at five different growth stages. Generally, the weeds from west Fresno died when exposed to the herbicide. The plants from Dinuba grew robustly, even when sprayed with four times the recommended amount of glyphosate.

Glyphosate-resistant horseweed was first reported in 2000 in Delaware. It has since been found in ten other states. This is the first confirmation of the resistant weed in California. Even though the study focused on weeds from the Dinuba site, Hembree and Shrestha believe that glyphosate-resistant horseweed may exist in other areas as well. They have heard from farm advisors, farmers, pest control advisors and other land managers from several parts of the south Central Valley that glyphosate isn't

killing horseweed like it used to.

The scientists believe that another weed, hairy fleabane, may also be evolving glyphosate resistance, a phenomenon that has been confirmed in hairy fleabane in only two other areas worldwide – one in Spain and the other in South Africa. Hairy fleabane and horseweed look similar when immature and grow under similar conditions, but hairy fleabane reaches just three feet in height.

Farmers and other land managers who notice a great number of horseweed or hairy fleabane should begin using a diversity of methods to bring them under control. By any means, make sure the weeds do not go to seed, Hembree said. Cultivation, hand pulling and pre-emergent herbicides will control the pest.

Crop rotation will also be a valuable tool. The glyphosate-resistant horseweed can be a problem when farmers grow Roundup Ready crops. In this growing system, farmers plant seed that has been genetically modified to be resistant to glyphosate. Then the herbicide may be sprayed over the top of the crop, leaving the desired plants unaffected and killing the weeds. However, now that a glyphosate-resistant weed is known in California, farmers must watch for weeds that are surviving the herbicide treatment.

“We are lucky we can grow so many crops in California. Crop rotation is a factor in our favor that they don’t have in the Midwest,” Hembree said. “If resistant horseweed turns up on a farm, the grower will want to avoid glyphosate-resistant crops and vigilantly monitor horseweed until it is under control.”