Farmers Need New Tactics Against Weeds - Hartford Courant Editorial - October 29, 2016

by Faye Flam

Some 12,000 years ago, with the invention of farming, humans started a war against weeds — and the weeds are still a step ahead. As farmers advanced from using hard labor to protect their crops to using chemicals and genetic engineering, the weeds survived thanks to the oldest weapon known to living things: evolution. Now, while scientists work on new technology to ward off the weedy menace, some worry they're speeding up the development of heartier, more herbicide-resistant foes.

Weeds may seem benign compared to crop-eating insects, but they pose a major threat to agriculture. They compete for scarce resources with crops, sucking water and nutrients out of the soil they share. Ton for ton, farmers use more weed killers than any other kind of pesticide. Without weed control, some crop yields would be cut in half.

Adding to the challenge is the fact that herbicides are plant-killers, so it's hard to spray them without damaging the crops they're meant to protect. That's why so many farmers adopted a system designed by the agricultural giant Monsanto, spraying the weed-killer Roundup on plants that have been genetically engineered to withstand the chemical assault.

Genetically modified crops proved popular with farmers: They now make up most 63 percent of U.S. corn and 92 percent of soybean crops. Meanwhile, glyphosate, the active ingredient in Roundup, has become the most widely used agricultural chemical in the world. The problem is that weeds can evolve fast. More than 300 weed species that have evolved resistance to at least one herbicide, including some that grow happily amid Roundup-sprayed crops.

But technology evolves. too, and so the farmers' side is about to adopt new tactics. In September, Monsanto purchased rights to alter commercial seeds using a newer, more powerful kind of genetic modification — a form of so-called gene editing called CRISPR. While "traditional" GM technology relies on transferring genes from one organism to another, CRISPR allows scientists to directly rewrite the DNA. The old technology is like being able to edit a text by pasting in words from other texts, without much control over where they land. CRISPR is like direct, precision editing

Tom Adams, Monsanto's vice president for biotechnology, said the company could employ gene editing to endow plants with resistance to drought, viruses, fungi or insects. But there's no known way to engineer a corn plant that can kill weeds directly, since the weeds aren't infecting or feeding on the crops. So herbicides are still part of the package.

And although the new technology offers efficiency and flexibility, it doesn't prevent weeds from evolving resistance. Chemicals work well for a year or so, but then nature fights back with resistant weeds, and the farmers respond with more chemicals.

Natural selection is based on competition between individuals of the same species, and those individual weeds that spring up with somewhat better resistance to Roundup will quickly dominate. So while the chemicals don't create resistant weeds, they enable the spread of those that already exist in the population.

Increasing use of herbicides is not only expensive for farmers, it raises concern among some scientists because the chemicals can get suffused through the environment. Scientists have detected traces in drinking water and rainwater. And short-term tests on laboratory animals or human cells can't rule out harm over the long term, said Mortensen. The more herbicide is in the environment, the greater the chance of an adverse effect on human health or wildlife. "Given the uncertainties about exposure data and impact on human health," he said, "we should be taking a critical look at technologies that enable increased reliance on pesticides." That includes CRISPR.

For scientists such as Owen and Mortensen, the way to win the war on weeds is to diversify tactics. For them, that means combining limited herbicide use with a variety of techniques, including tillage, crop rotation and planting of certain cover crops that can block weeds. The other techniques make it much more unlikely that resistant weeds will spread out of control. It's a way of thinking a step ahead of evolution.