

Targeting weeds at the genetic level aids battle against herbicide resistance

To a farmer, weeds might be the ultimate enemy. For as long as farmers have been cultivating crops, weeds have always been there, choking off crops and causing untold damage. Weeds are powerful adversaries: they adapt quickly, changing their genetic codes to survive in the fields.

How do they do that? It seems like the weeds always have the next trick up their sleeves; to beat them, we would have to be able to predict how changes in the weeds' genomes occur that confer resistance. In this [Modern Farmer article](#), Alexa Kurzius describes how [weed genomics](#) can help scientists figure out how and why herbicide resistance develops and how weeds become more invasive.

Put simply, a genome is the blueprint for an organism's bloodline — the traits passed down from parent to offspring. It's usually encoded in the DNA. Using different DNA sequencing techniques, some have partially or fully mapped various crop weed genomes.



Waterhemp

Crop weed scientist Patrick Tranel's research group from the University of Illinois at Urbana-Champaign began sequencing part of the waterhemp's genome in 2009. Waterhemp has remarkable genetic diversity, giving it "a quick and cunning ability to adapt to its surroundings," including herbicide resistance. Tranel was looking for genes that might be involved in herbicide resistance; today, his lab has begun testing specific gene mutations in waterhemp that provide resistance. Another plant scientist, Neal Stewart from the University of Tennessee has focused his efforts on sequencing the entire horseweed genome. Horseweed will be the first weed to have its entire genome sequenced, and the genetic information is expected to be released to the public later this year.

"By studying resistance mechanisms we're hoping to understand these kinds of weaknesses for the farmers' benefit," says Doug Sammons, a chemist at Monsanto who has partnered with Stewart for the last ten years. The horseweed genomic information will likely help determine the best methods to manage the weed rather than just new herbicide discoveries.

That doesn't mean that the scientists are planning to genetically modify the weeds. Instead, the information would ideally be used to first help scientists understand how resistance develops in a weed, and then design herbicides that target specific genes in the weed.

The dream? That work done by his lab and other scientists will help chemical companies develop herbicides that target specific genes, akin to designer drug development in the pharmaceutical industry.

"That's our hope in the long term," says (USDA research plant scientist David) Horvath.

This new understanding of weeds should give farmers a distinct advantage when combined with current methods for combating weeds: mechanical weeding, herbicides, biotech crops and crop rotations. And while many have [blamed genetically modified crops](#) for today's herbicide-resistant weeds, genetic and genomic technology – pairing biotech crops with designer herbicides – plus integrated pest management might be exactly what farmers need to truly fight weeds.

XiaoZhi Lim is a freelance journalist and former GLP editor and writer.