

Of Weeds, Milkweed, and Monarchs

We continue to add material to our “Unintended Effects of Genetic Manipulation” website (nontarget.org). The following is derived from two of the more recent reports. The references, not supplied here, are available at http://natureinstitute.org/nontarget/misc/monarch_disappearance.php and http://natureinstitute.org/nontarget/misc/glyphosate_resistance.php

Farmers began spraying glyphosate on their crops back in the 1970s. A broad-spectrum herbicide marketed by Monsanto under the trade name “Roundup”, glyphosate was just one of a number of effective herbicides, and for the next two decades no weed resistance to glyphosate was observed. Meanwhile, Monsanto was genetically modifying certain crops—corn, soybeans, canola, and cotton—so that they would not die when sprayed with glyphosate. These Roundup-resistant crops, first commercially planted in 1996, made it possible for farmers to use the herbicide much more intensely. They could spray glyphosate (and thereby control weeds) not only before the crop emerged above ground, but afterward as well.

As a result, the use of glyphosate expanded dramatically. While 15 million pounds of the herbicide were sprayed on corn, cotton and soybeans in 1996, 159 million pounds were sprayed in 2012—a 10-fold increase (Food & Water Watch, 2013; based on USDA/NASS data). This had consequences.

For example, before herbicide-resistant crops were available, “weed control required a higher level of skill and knowledge” (Mortensen et al. 2012). But then farmers were offered one simple method to control weeds—spraying glyphosate—and they began planting the same crops year after year on the same fields. The monocultures of industrial agriculture became more and more pronounced. This, together with the greatly increased volume of glyphosate usage, helped to create ideal conditions for the development of weed resistance.

And the weeds responded, leading to a vicious circle of increasing herbicide use and increasing resistance. At first, farmers began spraying more glyphosate, but then, as the resistance problem grew more acute, they added additional herbicides to try to kill the resistant weeds. Farmer expenses for herbicides have risen significantly; for example, farmers who used to pay \$25 per hectare for herbicides are now paying \$160 per hectare (cited in Service 2013; see also Food & Water Watch, 2013).

But this is no long-term solution, since already some glyphosate-resistant weeds have become resistant to multiple herbicides, making them even more difficult to kill (Heap

2014). Moreover, the problems to consider go far beyond the arms race between resistant weeds and ever more powerful herbicide cocktails. There is, you might say, also “collateral damage.”

It happens, for example, that milkweed is common in many midwestern areas where glyphosate is used (along with other herbicides) most heavily. One study estimates an 81% decline in milkweeds in Midwestern agricultural fields between 1999 and 2010 (Pleasants and Oberhauser 2012; see also Hartzler, 2010). And that has a bearing on various insects, including the monarch butterfly.

Monarch larvae feed on milkweed leaves. After metamorphosis, and later in the season, the adult butterflies that live in the Midwest and eastern U.S. make their long migration journey to a remarkably small area in the forests of central Mexico, where they overwinter. It is estimated that 92% of the monarchs wintering in Mexico fed on common milkweed when they were larvae, and that over half of that winter population originated in the Midwest (see Pleasants and Oberhauser 2012). Since monarch larvae are milkweed specialists, and they lay nearly four times more eggs on plants in agricultural fields than on plants in other habitats, it would not be surprising if this substantial loss of food plants were to result in a substantial reduction in the number of Monarch butterflies. And this is the case.

While it is difficult to measure the exact size of the overwintering monarch butterfly population in Mexico, surveys make it clear that there has been a drastic decline in population between 1996 and 2013 (Rendon-Salinas and Tavera-Alonso, 2014). No one would attribute all this decline solely to midwestern herbicide spraying, but it seems apparent that the use of genetically modified, herbicide-resistant crops has been a contributing factor (Brower et al. 2011).

A precipitous decline in monarch butterfly populations was certainly not what either the Monsanto researchers or farmers had in mind when they deployed glyphosate on vast swaths of the American heartland. But there is no good reason why such unintended—and predictable—effects should not now be front and center in our minds.