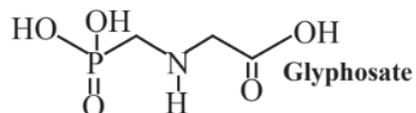


## 12.1: Pigweed's Revenge

Glyphosate, marketed by Monsanto under the brand name Roundup, has been an ideal herbicide that is effective against a broad spectrum of weeds, with low toxicity to animals, and readily degraded in the environment. In the 1990s Monsanto began selling "Roundup ready" seeds of corn, soybeans, and cotton genetically engineered to resist the herbicidal action of glyphosate. These crops could be sprayed directly with glyphosate, killing competing weeds and leaving the crops untouched. This enabled a revolution in agriculture eliminating the need to till the crops and facilitating the adoption of environmentally friendly conservation (no till) crop production, saving large amounts of fuel formerly consumed in tillage. By 2010 in the U.S. about 90% of the soybeans and 70% of corn and cotton were glyphosate-resistant varieties.



Unfortunately, not long after the introduction of Roundup ready seeds, glyphosate-resistant weeds began appearing including horseweed, giant ragweed, and several of a number of species in the genus *Amaranthus* (pigweed) that by 2010 had afflicted 7-10 million acres of the approximately 170 million acres of corn, soybeans, and cotton planted in the U.S.. Pigweed has been an especially bad actor that can grow 7 or 8 centimeters in a day, reach heights of 2 meters, and with stalks so thick and strong that they can damage harvesting machinery. The first glyphosate-resistant weeds appeared in California in year 2000. In 2003 in the U.S. such weeds had been observed in 10 states, in 2006 14 states and in 2009 20 states. By 2010 there were known to be 10 glyphosate-resistant weed species infesting 7-8 million acres of soybeans, cotton, and corn in 22 states.

Dealing with glyphosate-resistant weeds is a major challenge to the agricultural industry. In response to this problem crop varieties resistant to other herbicides including glufosonate, Dicamba, Sygenta's Calliston, and 2,4-D are being developed.

It is interesting to note that some of the amaranth species that include pigweed have the potential to serve as a major food source with leaves that can be consumed as leafy green vegetables and seeds that can be made into a protein-rich flour. Now sold in some health food stores, amaranth has been a staple food in some native cultures in Peru and Mexico.

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