Revolutions that transformed US agriculture

A recent article caught our eye. It examined the development of dual-pesticide resistant Palmer amaranth that is threatening to significantly reduce soybean yields (https://tinyurl.com/zpfaad27).

To put this pesticide issue into context, we want to begin by briefly examining three great revolutions that transformed agriculture during the first half of the 20th century.

The first was the development of farm equipment propelled by internal combustion engines. Gas and diesel tractors, combines, and other assorted equipment enabled farmers to manage more ground than ever before. In an hour, a series of field-passes with one of these machines could cover more ground with less work than a farmer and a draft-animal could in a day or two. This allowed for the growth in the size of farms. While there were those who loved working with their animals, most farmers were quick to take to the convenience these new machines offered.

The second revolution was the development of synthetic nitrogen-based fertilizers. Before this development, farmers would either abandon land along the Eastern seaboard for virgin land along the frontier or implement crop rotations, often with the expansion of family-size livestock operations. Each choice had its challenges and disadvantages, especially if one were growing a non-food crop like cotton where maximum production was the goal and land devoted to diversified crop and livestock operations represented diminished income.

The last great agricultural revolution of the early 20th century was plant breeding and the development of hybrid crops, particularly corn. From the end of the Civil War until the 1930s, corn yields had remained the same, with annual variations depending on weather and plant pests. After the introduction of hybrid corn by Henry Agard Wallace in the early 1930s, yields grew steadily. This trend continues today. Even crops that were not hybridized have seen yield increases due to the work of plant researchers.

Synthetic plant herbicides came to the fore in the second half of the 20th century with glyphosate dominating those that came before it. Like motorized agricultural equipment, plant herbicides reduced the amount of work a farmer had to put into any given acre of cropland.

Synthetic herbicides particularly glyphosate reduced the need for multiple tillage passes to kill weeds in corn and walking beans to cut weeds in soybean rows (a rite of summer in many communities). Walking beans and detasseling corn—to produce hybrid corn—were two of the ways kids in town could earn money in the summer.

When glyphosate came out, farmers and consumers were told that it was the ideal herbicide with few of the toxic risks posed by other herbicides and a low risk of inducing herbicide-resistant weeds.

It turns out we lacked the level of research and depth of analysis necessary to support that conclusion. The examination of 100 acres or so that had been sprayed with glyphosate was not adequate to predict what would happen when 100s of millions of acres were sprayed year after year. It only takes a few glyphosate-resistant plants on the larger acreage to survive and go to seed to create the problem we have today.

A few plants here and a few plants there and soon glyphosate-resistant weeds replace the weeds that were killed by the spray. As a result, farmers find themselves with a weed problem reminiscent of the time before the introduction of synthetic herbicides. To date, researchers have identified over 50 different glyphosate-resistant weeds and some of them are resistant to as many as 6 different herbicides.

In the short-run, there is nothing on the shelf that can replace glyphosate. Even if there were, it would only work for a limited period of time before resistance reared its head again. There is a reason for this. Herbicides select for those one-in-a-million plants with a genetic anomaly that allows them to survive. It also makes room for these survivors to grow and reproduce with little competition. Soon fields are overrun with tough herbicide-resistant weeds.

It goes without saying that these problems are not significant on organic farms. First, they don't use herbicides that select for resistance. Second, they generally use physical methods like tillage tools, burn down, crop rotations, cover crops and mulches to control weeds, so genetic selection of weeds is not an issue.

In the short-to-medium-run, the choices for conventional crop farmers are limited. They can return to earlier practices that depend on physical methods to control weeds. Overtime they could move toward increased use of crop rotations and cover crops.

Undoubtedly there some creative groups out there working on mini Roomba-like machines that would roam around the field zapping weeds; there are already Roomba-like vegetable crop harvesters in development. Perhaps, such robotic weed destroyers could move to a row-end when sunlight is needed to recharge their batteries.

Of course, in the interim there is always the option of returning to the "walking-the-beans" type of weed control. (Speaking as someone who walked that walk for hundreds of miles in his youth, Daryll doubts that many would choose to exercise that option.)

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