Addressing all farmers’ challenges: Taking ideology out of the glyphosate and ‘superweed’ debate

The issue of resistant weeds and the role of the herbicide glyphosate remain genuine concerns in modern agriculture—but the way the issue has been portrayed by NGOs committed to blocking the biotech revolution generally has missed the mark. It frames the issue misleadingly as solely the consequence of using GMOs.

It seems worth unpacking why so-called “superweeds” are not just a GMO issue and how we can address the problem less ideologically and productively.

So-called superweeds are not ‘super’ in any real sense of the word; they are just weeds that have evolved to evade a particular weed management strategy. If you have ever seen a dandelion so short that it has almost no stem, you’ve seen a superweed. That dandelion’s super power is crouching down, so that lawnmowers can’t get it before it goes to seed. But really, we are talking about weeds that have evolved to withstand applications of our most commonly used herbicides. And some of the most popular herbicides are paired with crops that have been genetically modified to survive the herbicides, the most common being RoundUp Ready crops that use glyphosate. Hardier weeds are increasingly common across the United States.

And as GMO critics have noted, the weed problems have increased along with GM crop adoption:

But these charts tell only part of the story. Is America really being overrun by forests of crop choking weeds? There is a sizable disconnect between the images conjured up by GM critics and the reality on farms. Missouri Farm Bureau head, Blake Hurst brought the misleading nature of the term into sharp relief recently:

I was recently contacted by a German filmmaker working on a documentary about herbicide-resistant weeds. She wanted to know if a) I had herbicide-resistant weeds on my farm, and b) if I would allow her to film them. I said sure, although a film about weeds in a Missouri soybean field does not strike me as Oscar material. It was clear from the conversation that she envisioned weeds resembling those from Little Shop of Horrors: monstrous, hideous creatures leaving carnage in their wake as they spread righteous retribution for the sins of Monsanto.

As you can see from Hurst’s comments, the correct phrase is “herbicide resistant weeds” (HR weeds). Andrew Kniss, Associate Professor, Weed Biology & Ecology at the University of Wyoming responding to a story in the journal Nature:

I was a little disappointed to see the term “superweeds” in any type of scientific publication. I have repeatedly expressed my displeasure with this term
, and my graduate students know better than to ever use the word around me. To see it in a publication as reputable as Nature is exceptionally frustrating.

Now that we have that out of the way, let’s take a look at the reporting and the first problem. **NBC News:**

“It is a crisis situation,” said Neil Harker, a weed ecologist at Agriculture and Agri-Food Canada. “We’re losing the effectiveness of herbicide tools against weeds going forward.”

“I’m in favor of GMOs, but they should be used judiciously,” he said.

This is disappointingly imprecise for an ag professional, as it’s the herbicides, not the seeds that can cause concern. It’s the herbicides that need to be used judiciously. One has to wonder if this quote was the casualty of a journalist with a story they are going to tell no matter what.

Here’s the hinge of the NBC story.

…the fight against weeds is hardly new, (and) that’s a reason to avoid putting all the blame on GMOs for the current infestation, said Justin Gardner, a professor of agribusiness at Middle Tennessee State University. “What’s going on is natural selection,” Gardner said. “Weeds were resistant before GMOs. The best way around this is to use different weed killers instead of the same one all the time.”

But the increased resistance by weeds to pesticides only highlights why GMOs are at fault, said Itzick Vatnick, a professor of biology, biochemistry and environmental science at Widener University. “With the introduction of GMOs engineered to resist glyphosate in the mid-1990s, genetic resistance of many weeds to it rose dramatically,” he said. “The problem is so severe that the agrochemical companies are now poised to introduce herbicides that are more toxic,” Vatnick argued.

So we are confronted with the journalist’s favorite crutch, the he said/she said trope. As I wrote above, I believe this is misleadingly framed as a solely “GMO” issue. Let’s look at the reasons why. For starters, the rate of weeds developing herbicide resistance has actually decreased since the introduction of GE crops. Take a look at this chart put together by Andrew Kniss in the blog post quoted above:
HerbicideResistanceOverTime

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As you can see, we went from 13.1 cases of HR weeds before 1996 (the first year with RR crops) to 11.4 cases since. So, even as the number of resistant weeds has increased since the introduction of GE herbicide resistant crops, the rate of resistance has slowed. With the wide adoption of crops that have been "bred to withstand being drenched in herbicide", as they have been mischaracterized over and over, how can this be? Simple. RoundUp replaced other herbicides which were not only less environmentally benign, but also more prone to weeds evolving resistance. Compare the raw numbers and rate of resistance between atrazine (triazines) and imazaquin (ALS inhibitors) to glyphosate (glycines). Glyphosate (RoundUp) is the herbicide paired with the most widely adopted trait in GE crops, the RoundUp Ready (RR) trait, which makes the crops immune to glyphosate’s mode of action.

As you can see, herbicide resistant weeds are hardly unique to glyphosate and considering the fact that glyphosate is planted on a massive amount of acres compared to other herbicides, the low rate is all the more impressive and it seems to be leveling off as farmers have addressed the potential for problems. In fact the move to glyphosate has actually improved the situation with herbicide resistant weeds by decreasing the use of atrazine which was the most popular herbicide before RR crops came along.

Why was atrazine so popular? Because corn is naturally resistant to atrazine. Nature had made it's own
Atrazine Ready crop. So GE crops aren't the only herbicide resistant crops. In fact, BASF has a seed/herbicide program called the Clearfield system which pairs non-GE rice, wheat, and sunflowers with the herbicide imazethapyr, ALS inhibitor. Clearfield crops are widely used and have their own resistant weed problems.

Here's the rub, the crux, the one thing almost no one seems to realize in all this: If imazethapyr was a more effective herbicide than glyphosate, then imazethapyr would be over-relied upon on a mass scale and non-GE Clearfield crops would be the elephant in the room and not RoundUp Ready crops. If that were the case, I'm not sure that we'd be having this conversation outside of the ag press and the email alerts of a handful of environmental groups. But, glyphosate is a too good to be true combination of environmentally benign and devastatingly effective on weeds herbicide. It really is too effective for it's own good and farmers will tell you that. The problem of glyphosate resistant weeds is real, but it needs to be understood in the context of other herbicides. It should also be recognized that farmers have already started to adjust and as you can see in the chart, the number of NEW weeds becoming resistant slowed down beginning in 2010, but you can see an uptick in this last year. But take GE herbicide resistant crops out of the picture and it’s not clear that the resistance issue would see any improvement, nor is it clear at all that we would have been better without them. Air sample analysis done in 1995 and 2007 clearly shows that the profile of herbicide use has improved.
It should be clear, that the issue should be framed around all herbicide resistant crops, GE, non-GE and naturally occurring, because the politicized narrative around “superweeds and GMOs” distracts from the more complex issue. The real issue is the lack of integrated pest management (using multiple modes that also accomplish other goals) and best practices, and an over-reliance on whatever pest control strategy happens to be working at the time. It’s such a distraction, that both pieces failed to mention what farmers should be doing, even as they did a decent job of laying out the issue (GMO distraction aside) and what’s at stake. That's what they got right. The current challenge of herbicide resistant weeds and the increasing use of herbicides is a real issue, but we need practical solutions, not just hand-wringing, or worse, hand-waving:

“We don’t need pesticide-resistant GMOs to control weeds. There are natural ways to fight them,” said Bill Freese, a science policy expert at the Center for Food Safety. “The GMO industry likes to put a warm fuzzy glow on GMOs but we don’t see much use for them at all,”
he argued.

John Kempf, a farmer and CEO of Advancing Eco Agriculture, a soil nutrition consulting firm, said GMOs fail to match their claims. “They don’t increase crop yields and they increase the resistance of weeds to herbicides,” he said. “We should use the science of nutrition for the soil instead of the science of GMOs.”

Easier said, than done. And it’s not clear what they are advocating for. That was the second major flaw in these two pieces. They were long on criticism, short on solutions. One of the “natural” ways to control weeds is tillage, turning the soil. This isn’t necessarily better for the environment. Andrew McGuire a professor at Washington State University’s Center for Sustaining Agriculture and Natural Resources explains: a visit with an organic farmer who had grown perennial grass to improve his soil before switching it over to vegetable production. The farmer was then trying to come up with the best way to transition from the grass to vegetables. McGuire saw two options:

The first is to till the grass crop in order to kill it. This would most likely require disking the soil three times or plowing and then disking, to kill the grass and break up the sod that is turned up by the first tillage pass.

The other option would be to spray out the grass crop with an herbicide. One pass through the field and the grass would be killed completely if done right.

If the goal of growing the grass was to build up the soil, which is the best option? Tillage, we know from research, would break up the physical soil habitat built up over the two years, disturbing the microorganisms living there.

In terms of the goal of building soil, the second option is plainly better than the first.

Tillage also reverse the carbon sequestration that we’d like to see from well practiced agriculture and releases carbon instead.
GE herbicide resistant crops have facilitated the adoption of conservation tillage. Graph: USDA

Clearly we need better integrated pest management when it comes to weeds in this country. Breeding crops to pair with the herbicides 2,4 D and dicamba puts another tool in the toolbox, mostly to defend glyphosate from becoming obsolete.

I don’t have an illusions that we could or should do away with herbicides altogether, but we do need to step up our game. However, the path to getting there is not particularly easy and that may be why these pieces were short on specifics as to what needs to happen. In June Nathanael Johnson, food blogger for the environmental magazine Grist delved into possible solutions with experts. He didn’t find any easy answers:

“It’s hard to imagine a herbicide resistance plan that would work for more than one farm, or even more than one field,” said Kniss. “Let alone a whole country.”

If we want a healthier environment, it doesn’t necessarily make sense to force farmers to use
less herbicide, Mallory-Smith said. “Part of why we are so focused on herbicides has to do with environmental concerns,” Mallory-Smith said. We’ve asked farmers to do less plowing and to stop burning their fields, and so they have turned to herbicides.

Many people have a deep aversion to the idea of spraying chemicals on the fields, but Steckel said that herbicides are often the most environmentally friendly solution. “Herbicides to me are kind of like medicine. If used correctly they are not a danger to people or the environment,” he said. In contrast, he says, killing the weeds by plowing has proved to be an environmental disaster in his part of the world. “These soils just won’t hold it,” Steckel said. “When tillage was commonplace, all our soil was headed to New Orleans.”

That’s not to say that herbicides are harmless, but they have to be weighed against the alternatives. It would make the most sense to mix it up, varying by the dirt, the weather, and what the farmer did the previous year. Centralized control would surely force farmers to make some dumb decisions that were actually worse for the environment.

Monsanto has developed the RoundUp Ready Plus platform that does integrate some of these ideas. They went to academics and other weed control experts and asked what an ideal approach would look like. Then they created a program of paying farmers incentives to adopt those best practices even when it meant farmers using their competitor’s products. This is a new program and it hasn’t been widely reported on outside of a few reprinted press release style puff pieces in the ag press, so I can’t say how it’s working, but what I do know of it, it’s an impressive undertaking for the company.

At the 10,000 foot level, the lack of integrated pest management flow from the state of our food and fiber system and what we demand from farmers. One thing that would help is greater use of cover crops. That is happening and it’s a culture shift as farmers test the waters and have success with that. We should figure out if their are smart policies that could help move that along. Restoring funding to extension services would be a great place to start. Another of the things that would help would be more diverse rotations of crops. As Andrew Kniss pointed out in Grist, “This really is a symptom of the larger problem, of not enough diversity in our cropping systems.”

Greater use of extension services would be helpful here as well, but if this is something we want as a society however, that means re-examining things like the ethanol subsidies that have incentivized farmers to plant corn on corn. It means shifting our diets away from corn and soy (sugar, oil and meat) and towards other crops like oats, barley, and beans. It also means peeling away layers for regulatory hoops on genetically engineered crops so that we can get a broader mix of crops that can compete for farmers attention the insane productivity of corn and soy. One of the reason that wheat has fallen out of rotations is that the yields have not kept up with corn and soy as investment in wheat breeding fell behind after the decision growers balked at GE versions.

Now we’ve come full circle. GE crops could be part of the solution to “superweeds” to the same degree that they are implicated.
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