PROCEED WITH CAUTION: HERBICIDE RESISTANCE

THE CATALYST OF THE GROWING PROBLEM

By Allison Arp

Herbicide resistance is a growing problem in agriculture, and experts and farmers agree on the reason why.

“I would attribute it to perpetual use of the same chemistry,” says Brad Buchanan, Iowa Soybean Association (ISA) member, farmer and crop consultant near Cedar Rapids. “Anytime you use something year after year on both corn and soybeans you’re bound to see issues arise.”

One of the largest resistance problems for farmers in Iowa is waterhemp. Mike Owen, Ph.D., Iowa State University weed specialist, and his team analyzed more than 900 samples of waterhemp from across Iowa, as part of a study funded by ISA. The group found that essentially all the fields in Iowa have resistant waterhemp with an astounding 5 to 7 percent having detectable resistance to five groups of herbicides.

If resistance is so bad in certain fields, why aren’t farmers doing anything about it? According to Owen, the current infestations aren’t at the threshold of causing problems — yet.

“Until it begins impacting combining or another task, farmers won’t take action,” Owen says. “They’re familiar with seeing late weed escapes. Combining over a weed is a great way to spread the seed far and wide quickly.”

One plant can do a multitude of damage. A single waterhemp plant, for example, has 21,000 seeds. If there is one plant every 15 rows, that means there are 25 million waterhemp seeds per acre.

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"HERBICIDES WILL FAIL WITHOUT DIVERSITY. THE SILVER BULLET ISN’T HAPPENING. FARMERS NEED TO THINK ABOUT ALTERNATIVE STRATEGIES."

— Mike Owen, Iowa State University

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“If you see waterhemp in August or September there is a more than 95 percent chance it is resistant to one or more herbicides,” Owen says. “In addition, multiple resistance is the norm, not the exception.”

Buchanan tries to help his customers address the issue before it goes too far. He advises his customers to start the season with a pre-emergent herbicide that combines multiple modes of action.

Owen also recommends a preseason treatment, but says farmers need to know about previous herbicide resistance problems in fields. They need to apply an effective pretreatment and a timely post treatment. Even with all the new technology and chemistries available, both Owen and Buchanan say scouting throughout the season is imperative.

“You may be spraying two different products with different names, but that doesn’t mean two different modes of action,” says Buchanan. “Farmers and certified crop advisers are being encouraged to know the different classes of herbicides so they can avoid using two in the same class.”

In addition to the class of herbicide, farmers should follow label instructions to see if the product can be mixed or combined with additives, what nozzles to use, the minimum gallons per acre needed and the maximum application speed.

Buffer calculations, tank cleaning recommendations, wind speed rules and boom requirements are also important to take under consideration when applying a herbicide. Especially with the new options on the market.

Recent additions to the herbicide market require an even closer examination of the label, and overall a better understanding of how herbicides effect the environment.

“What’s exciting about the new chemistries is that you can spray weeds at an earlier stage and have contact and residual control,” Buchanan says. “But that has to be weighed against risks like improper tank cleaning, buffer zones, drift onto neighboring fields and specialty crops and other liability concerns.”

Owen agrees the best strategy a farmer can take is having a multi-year herbicide plan with an emphasis on diversification of herbicide groups.

Even though farmers have new weapons against the ever-growing weed problem, they need to be careful when using them, and not expect a catch-all herbicide.


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IN THE WEEDS WITH CHEMISTRY AND TRAIT STEWARDSHIP

By Matthew Wilde

This isn’t the first weed rodeo for crop protection companies and farmers.
Both have been trying to corral and kill waterhemp, giant ragweed, marestail and other yield-robbing weeds for decades.

When Monsanto’s Roundup Ready® soybeans — genetically modified to tolerate Roundup® and other glyphosate-based herbicides — broke out of the chute in 1997, weeds that developed resistance to other herbicides didn’t stand a chance. One or two over-the-top passes of the broad spectrum chemical was all it took.
Glyphosate was a cheap, effective way to grow weed-free beans. Farmers eagerly adopted biotech seeds and heavily relied on what many call the world’s greatest herbicide.

But repeated use of a particular chemical(s) allows weeds to select for resistance, a basic function of evolution. It’s been happening ever since herbicides were invented. Now glyphosate is no longer as effective like atrazine and other herbicides.

“Mother Nature always finds a way,” says Mindy Whittle, Monsanto soybean industry affairs lead.

Having a clean field is once again not cheap or easy. But Ed Anderson, Ph.D, Iowa Soybean Association senior director of research, says the weed war is far from lost.

Many herbicides are still effective, including glyphosate. New chemistries and biotech traits continue to be developed, such as soybeans tolerant to reformulated dicamba and 2,4-D.

“It’s certainly early enough in the game that if farmers develop and implement integrated management systems and practices, including responsibly using new traits and chemistries, they should be able to produce weed-free, healthy soybeans,” Anderson says.

Though companies may have competing products and slightly different approaches to battle weeds, a common theme is clear.

Industry experts say trait and chemistry stewardship — reading and following labels, using multiple modes of action, residuals, pre-emergent and post-emergent herbicides, among other things — will be essential to curb and reverse the growing herbicide-resistance problem. Protecting livelihoods, they say, depends on it.

“Industry, academics and farmers need to work together,” Whittle says. “We need to learn from the past and adapt our practices so current and new chemistries and technology can be effective as long as possible.”

Xtend

Monsanto has a new thoroughbred in its crop protection stable for soybeans called the Roundup Ready Xtend Crop System. It’s geared to provide farmers more consistent, flexible control of weeds, especially glyphosate-resistant ones.

The company’s Roundup Ready 2 Xtend soybeans are genetically engineered to tolerate XtendiMax™ with VaporGrip™, an enhanced dicamba herbicide for pre- and post-emergent use.

More than 10 years in the making, the Xtend soybean system will be fully rolled out this spring. XtendiMax with VaporGrip was approved by the Environmental Protection Agency (EPA) and given a 2-year conditional registration for over-the-top use in early November. Roundup Ready 2 Xtend soybeans received U.S. Department of Agriculture and import approval from China and other countries in 2015.

Ty Witten, Ph.D., Monsanto soybean, cotton, specialty crop and seed treatment systems lead, estimates

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18 to 25 million acres of Xtend soybeans will likely to be planted nationwide this year.

He believes the Xtend system will help soybean farmers control weeds and maximize yield potential, but warns proper stewardship is critical.

“Dicamba will look really good in a lot of places when you spray it,” Witten says. “There will likely be situations where farmers say that’s all I need. That is something we want to head off at the pass.

“This is a tool and not the only one farmers should be using,” he adds. “To be a good steward means you have a diverse weed management program with multiple chemistries.”

Getting back to reading and following labels and talking with neighbors about crop and herbicide use to minimize potential damage is important, Witten says. Farmers have got away from doing both partly because glyphosate was so easy and safe to use.

Even though XtendiMax with VaporGrip has a low-volatile formulation of dicamba, drift damage to non-target plants and threatened and endangered species is a concern. Movement via rain, wind and temperature inversion can occur.

“You need to think about what happens to any herbicide once it’s sprayed,” Witten says. “When it comes to on-target application, it’s the responsibility of the applicator.”

Here’s several XtendiMax with VaporGrip application requirements intended to minimize the potential of off-target movement:

- Ammonium sulfate and ammonium-based additives in applications are prohibited.
- Apply .5 pounds per acre for any single, in-crop application.
- Apply a minimum of 10 gallons per acre.
- Don’t apply aerially or if rain is expected within 24 hours, which could result in water runoff from soils.
- Only use approved nozzles and approved tank-mix partners (see www.xtendimaxapplicationsrequirements.com).
- Spray boom height not to exceed 24 inches above target crop.
- Apply only when wind speed is 3-10 mph.
- Do not exceed 15 mph ground speed during application.
- Don’t apply when wind is blowing toward susceptible crops and maintain the required label buffer to protect sensitive areas.
- Use triple-rinse cleanout procedure.

Crop scouting will be required to use Xtend products. It’s an EPA mandate to monitor herbicide resistance and product performance.

“It will be important to keep good records, get trained on use and follow label instructions,” Witten says.

Monsanto is investing heavily in education to help. The company recently provided approximately 14 universities and/or organizations unrestricted funds to update weed management training tools, 150 field engagement specialists will be hired to work with farmers and dealers and all employees working with Xtend technology and products will be thoroughly trained on use.

“I think we will see this across the board how companies educate about products entering the market,” Witten says.
Enlist

John Chase of Dow AgroSciences couldn’t agree more. He’s the commercial leader for the company’s Enlist™ weed control system.

Enlist soybeans are genetically engineered to tolerate glufosinate, glyphosate and new 2,4-D choline, which are the active ingredients in Enlist Duo® herbicide. Chase expects Enlist corn to be available to U.S. growers this year and Enlist soybeans in 2018.

Herbicide resistance is rampant nationwide, he says. The problem is escalating due to reliance on one mode of action for too long, namely glyphosate.

Chase says Enlist provides farmers new tools to incorporate multiple modes of action to battle problem weeds.

“You won’t hear us talk about the Enlist weed control system without mentioning the program approach,” he says. “We will never promote being reliant on just a post application. We will always recommend a residual along with sound behavior.”

According to Dow AgroSciences, 2,4-D choline is 90 percent less prone to drift (half of that percentage is due to improved spray nozzles) and 96 percent less volatile than a traditional mix of glyphosate and 2,4-D.

Regardless, Chase says following label instructions and proper stewardship is a must. For Enlist, that means:

• Use one of 23 approved nozzles.
• Maximum application wind speed is 15 mph, with recommended wind speed of 3-10 mph.
• Don’t apply when wind is blowing toward susceptible crops and maintain a 30-foot downwind buffer to protect sensitive areas.
• Soybeans and corn are not susceptible crops.

Chase recommends rotating traits and modes of action. Developing new technologies isn’t cheap and doesn’t happen overnight, industry officials say.

“We want and need this technology to last as long as possible,” Chase says. “These are the tools that farmers have for the next several years. We need them to be successful.”

LibertyLink

Matt Keel, MaxYield Cooperative seed solutions specialist based in Britt, says Bayer’s LibertyLink® soybeans are a popular, effective choice among farmers in his region for weed control. LibertyLink beans are engineered to be tolerant of Liberty® herbicide.

According to Bayer, it’s the only nonselective herbicide that is effective on tough-to-control grasses and broadleaves including Palmer amaranth, which is in Iowa. Liberty has no known resistance issues.

“It’s one of my best selling beans,” Keel says. But as a farmer, he knows stewardship is important and he can’t rely on one trait and one herbicide. Most other farmers know it too, he says. After all, it’s not their first weed rodeo.

“I think we’ve learned our lesson,” Keel says. “You have to stick to the label, recommended rates and use multiple modes of action. We can’t just think two to three years down the road, but long term.”

Helpful websites and contacts

Xtendimaxapplicationrequirements.com
Helpful information about dos and don’ts like nozzles, tank mixing, etc.

Roundupreadyxtend.com
Information about the Xtend program, along with online training videos and education materials

1-844-RRXtend
Toll-free number required by the EPA to report herbicide resistance and application problems.

Enlist.com
Information about the Enlist weed control system
cropscience.bayer.us/products/traits/libertylink
Information about LibertyLink product information

EDITOR’S NOTE: This is the first of a series featuring industry perspectives on herbicide and biotech trait stewardship to curb herbicide resistance. Additional stories in the March Iowa Soybean Review will feature farmer and academia perspectives.
Herbicide resistance is a growing problem in Iowa and nationwide that threatens the competitiveness of soybean farmers. Industry and academia are working hard, and often together, to mitigate the problem. This includes developing new soybean traits, technologies and weed control programs to more effectively use existing herbicides.

Ty Witten, Monsanto soybean, cotton, specialty crop and seed treatment systems lead, and Mike Owen, Iowa State University Extension and Outreach weed specialist and agronomist, provide their thoughts to Iowa Soybean Review (ISR) readers on herbicide resistance and chemistry stewardship.

ISR: How serious of a problem is herbicide resistance in Iowa and nationwide?

Witten: “It depends on where you are. In the southern states, soybean farmers are well aware of herbicide resistance, particularly in Palmer amaranth. In the North, the big herbicide resistant weeds are marestail and waterhemp. Treat every acre like you have herbicide resistant weeds.”

Owen: “It is very serious and affects a majority of growers. In Iowa, most soybean fields have detectable populations of herbicide resistant weeds. However, in most fields the populations are below the ‘grower threshold’ of detection. Given the seed production potential of weeds, particularly waterhemp, the population density of resistance can increase rapidly.”

ISR: Are new herbicides, chemistries and biotech traits like Monsanto’s Roundup Ready® Xtend Crop System for soybeans the answer to weed-free fields again?

Witten: “To me this is an exciting time. You will see amazing results from new chemistries and traits, but they are only a tool and not a silver bullet. We need to watch and monitor herbicide resistance in a robust way to be productive and promote longevity of our tools. We want to do this with dicamba and other products coming on the market, whether they are Monsanto’s or not.”

Owen: “The answer for the future is to diversify weed management beyond herbicides. We will not be able to ‘spray’ our way out of the problem. There are no new herbicides (new mechanisms of action) in the foreseeable future. All ‘new’ herbicides are from existing herbicide groups and most of the groups already have weeds with evolved resistance. New traits will help but are beyond farmer expectations of what the technologies will deliver.”

ISR: What are the benefits and potential pitfalls of new herbicides and technology to combat weeds/herbicide resistance?

Witten: “Dicamba and other chemistries used in-season, across the top against broadleaf weeds will have dynamic results. But Dicamba will hurt Enlist crops and Enlist will harm Xtend crops … and symptomology could show up in other sensitive crops. It comes back to that stewardship component for on-target application. It will be
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Owen: “The use of a different herbicide group on soybeans will help. However, the new traits and herbicide systems will not provide the level or consistency of weed control that farmers have grown to expect until glyphosate resistance evolved. Pitfalls represent the potential off-target injury from these herbicides. While the movement from the volatilization of these herbicides has largely (but not completely) been resolved by new formulations, the potential for injury to sensitive crops from sprayer and nurse tank contamination is high as is the potential for drift during applications.”

ISR: Why is chemistry stewardship and following label instructions such an important component of weed management?

Witten: “To be a good steward means you have a diverse weed management program with multiple chemistries. We need to manage existing traits and crop protection products such as dicamba, 2,4-D and PPO inhibitors (Flexstar, Cobra, Valor, Blazer, etc.). New chemistries and technologies aren’t developed over night. “Roundup Ready and LibertyLink® has been the norm for so many years that people have gotten away from looking at labels. Getting back to this important practice is important, and will continue to be so. On-target application is the responsibility of the applicator.”

Owen: “The agricultural landscape has changed dramatically. The presence of sensitive crops (i.e., grapes) and sensitive areas (i.e., endangered species and pollinator habitat) has increased and applications must be adjusted to protect these areas. Further, more acreages have populated the rural landscape. The labels for these herbicides and application procedures must be followed carefully.”

ISR: How can industry and academia work together to slow herbicide resistance and help soybean farmers?

Witten: “We typically work with academia on product development. Monsanto recently provided 14 universities and/or organizations unrestricted funds to update their weed management training tools, such as presentations and webinar content. The core of this has nothing to do with Xtend. It’s about improving weed management programs and educating growers/applicators to have on-target application and better weed management.”

Owen: “The objectivity and ethics of industry must recognize the problems and marketing must track the science more closely. Academia does not have the presence that we once had and must partner with whomever we can to provide the information farmers need to improve weed management and slow herbicide resistance. However, we must also recognize the economic dilemma that farmers face and help them develop programs that meet economic, environmental and weed management goals. A difficult task, to be sure.”