

Insight into Some Non-conventional Weed Management Tools for Use in Our Conventionally-minded Ag Systems



Dr. Kevin Bradley, University of Missouri

Why would we look at these “weird” weed control options?

- We have been conditioned to think of herbicides as our only real method of weed management (herbicide-centric)
- Most expect herbicides/traits to “solve” this problem of resistant weeds (techno-optimism)
- Waterhemp = resistance to 7 different herbicide site of action groups; Palmer = resistance to 9 groups (depressing)



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Dicamba-Resistant Pigweed

Dicamba-Resistant Palmer Amaranth Confirmed in Tennessee

7/28/2020 | 2:49 PM CDT

By Emily Unglesbee, DTN Staff Reporter
Connect with Emily:
@Emily_Unglesbee

ROCKVILLE, Md. (DTN) -- Weed scientists are officially confirming the presence of dicamba-resistant Palmer amaranth in Tennessee, where the dicamba-tolerant Xtend trait has dominated cotton and soybean acreage for several years.

Scientists at the University of Tennessee, the University of Arkansas and Texas Tech University have finished greenhouse trials and replicated field trials on Palmer amaranth populations collected from fields in several Tennessee counties, including Crockett, Gibson, Madison, Shelby and Warren.

"It's official," said University of Tennessee Extension weed scientist Larry Steckel. "We have resistance to dicamba, and some preliminary results suggest tolerance to 2,4-D is tagging along, too."

These findings aren't the first case of dicamba-resistant Palmer amaranth. That distinction belongs to a long-term

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Glufosinate-Resistant Pigweed

Glufosinate-Resistant Palmer Amaranth Confirmed in Arkansas

2/17/2021 | 4:31 PM CST

By Emily Unglesbee, DTN Staff Reporter
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ROCKVILLE, Md. (DTN) -- Scientists in Arkansas have confirmed the presence of glufosinate-resistant Palmer amaranth populations in two northeastern counties of the state.

The populations were collected from two fields in Mississippi County in 2020 and one field in Crittenden County in 2019, said Tom Barber, a University of Arkansas Extension weed scientist. The Crittenden County weeds were found to be 3.5 times more resistant to glufosinate than susceptible weeds, and the Mississippi County weeds appear at least 15 times more resistant than susceptible weeds, Barber explained in a university blog posted Wednesday.

The Arkansas scientists are testing the three pigweed populations for resistance to other modes of action, as well. For now, the glufosinate-resistant weeds do not seem widespread, Barber said.

"Currently, this problem does not appear to be widespread

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Waterhemp Scores Again

Illinois Scientists Find New Resistance in Waterhemp

2/8/2019 | 4:22 PM CST

By Pamela Smith, Crops Technology Editor
Connect with Pamela:
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DECATUR, Ill. (DTN) -- Waterhemp has just thumbed its nose at another group of herbicides.

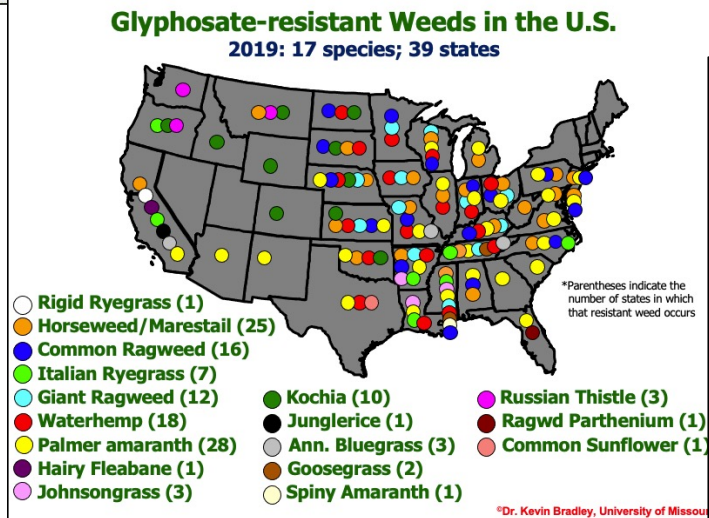
Waterhemp resistant to Group 15 herbicides (very long chain fatty acid inhibitors) has officially been found in Illinois research plots. It is the first dicot (broadleaf) weed in the world to outmaneuver herbicides within the Group 15 chemical family. While scientists aren't sure how widespread the issue is, University of Illinois weed scientist Aaron Hager said the discovery is yet another warning to change weed management behaviors now.

"Waterhemp has now shown the ability to resist seven different herbicide sites of action," Hager said. "Farmers have been leaning heavily on the Group 15 herbicides across all crops as they battle resistant weeds. This is another example of how important it is to diversify weed control approaches to keep the effectiveness of this tool," Hager said.

Syngenta has been collaborating with Illinois scientists on their findings and providing important background information, confirmed Dane Bowers, Syngenta's technical lead for herbicides, and Gordon Vail, Syngenta's technical product lead on S-metolachlor, one of the Group 15 herbicides.

S-metolachlor is the active ingredient commonly sold by Syngenta under the trade name Dual Magnum. It is also found as a component in many popular herbicide premixes.

"We feel it is important as a manufacturer to alert farmers to these findings and work alongside weed scientists to keep these herbicides effective as long as possible," said Vail. "The reality is not any one product or class of chemistry by itself is good enough. We need them all."



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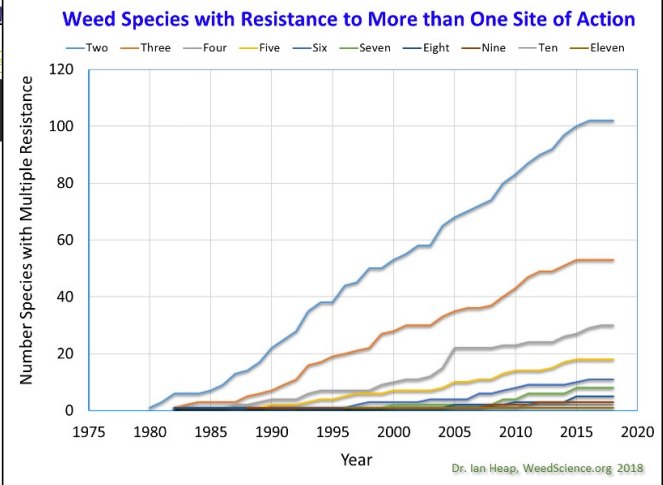
NEWS

MU ON SIGNS OF POTENTIAL WATERHEMP RESISTANCE

July 9, 2021 By Julie Harker Filed Under: Crops, Missouri, News

There are signs of potential waterhemp herbicide resistance in Missouri.

University of Missouri weed scientist Kevin Bradley told participants at the MU Pest



How the Weed Zapper™ Works:

- Copper boom attached to front of tractor which electrocutes any plant that it contacts
- <110,000 watt generator attached to back of tractor
- Up to 15,000 volts translocating through plants contacted





What if we could do something about waterhemp escapes once there are no longer any herbicide options?



Initial Impressions of Electrocuting as a Weed Control Tactic

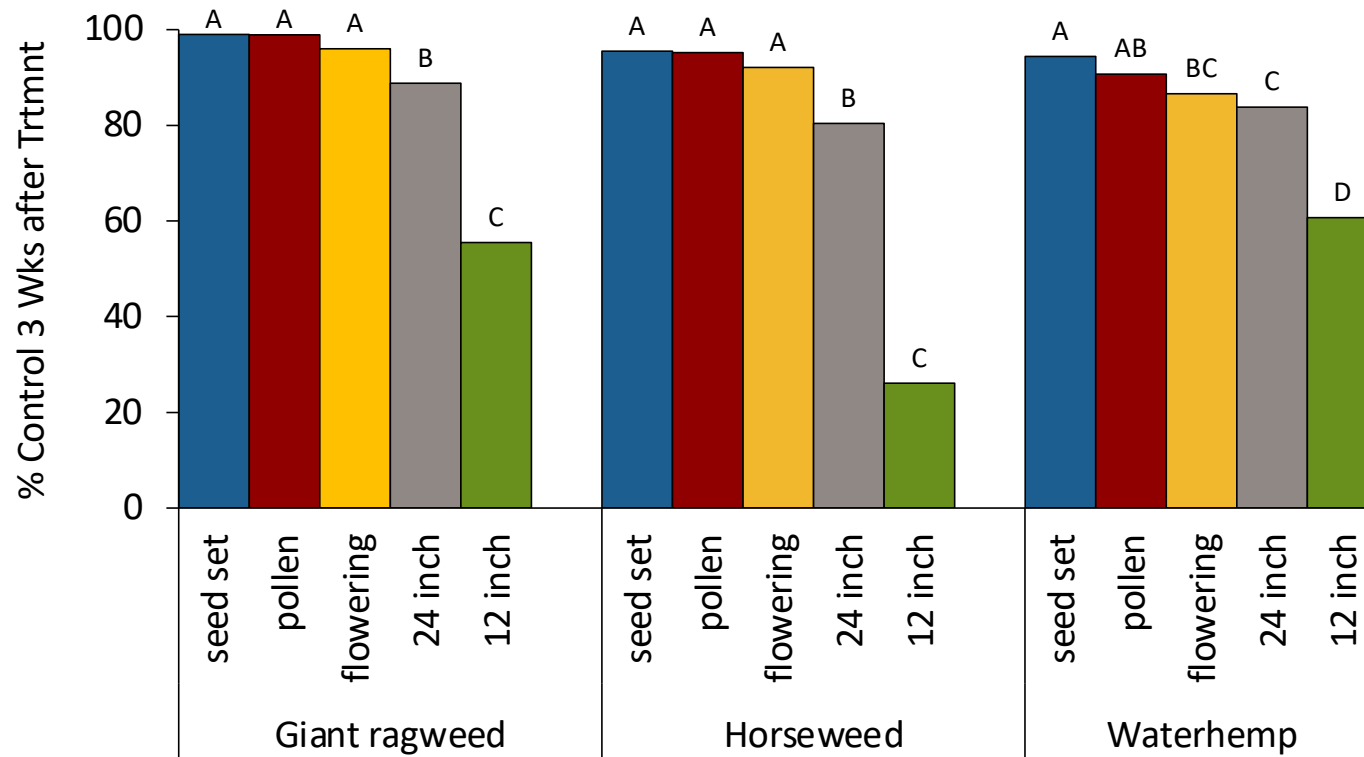
1. #1 disadvantage – it can be dangerous!



2. The bigger the weed(s), the better! And results are immediate.



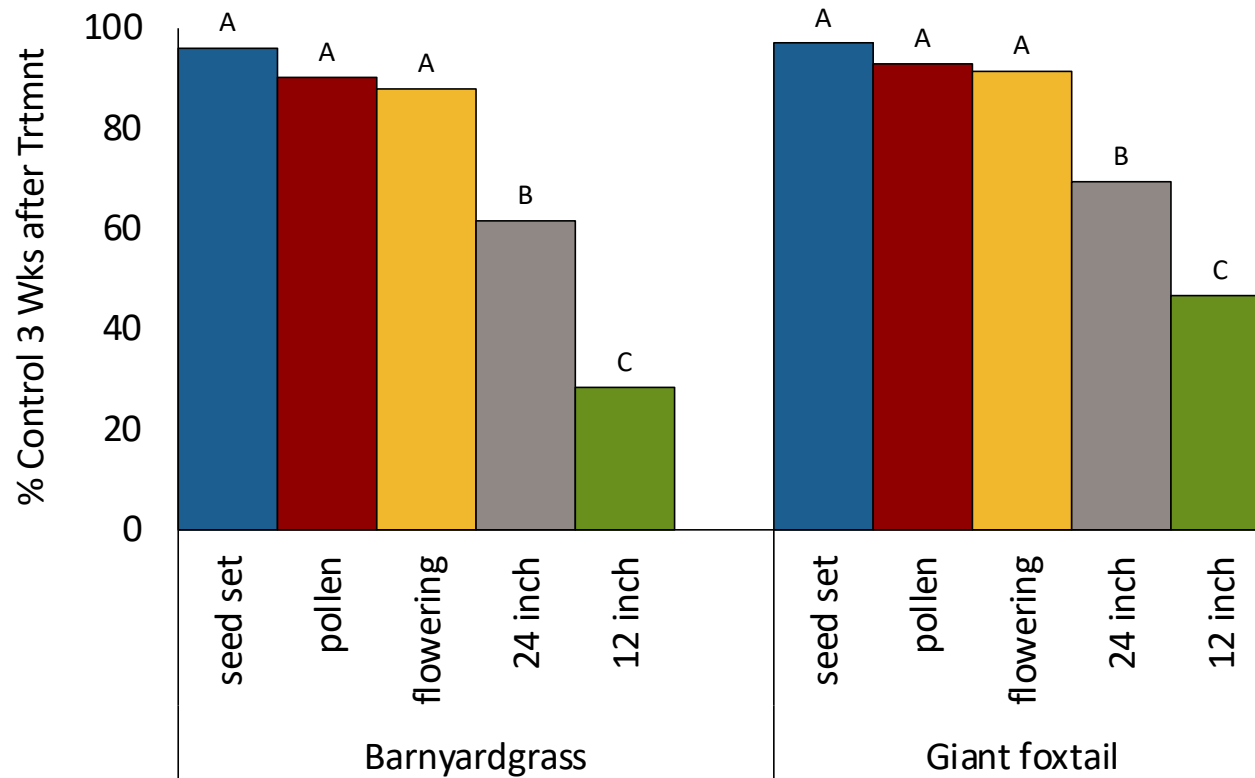
Influence of Growth Stage at the Time of Electrocution on Broadleaf Weed Control



*Bars followed by the same letter within the same species are not statistically different



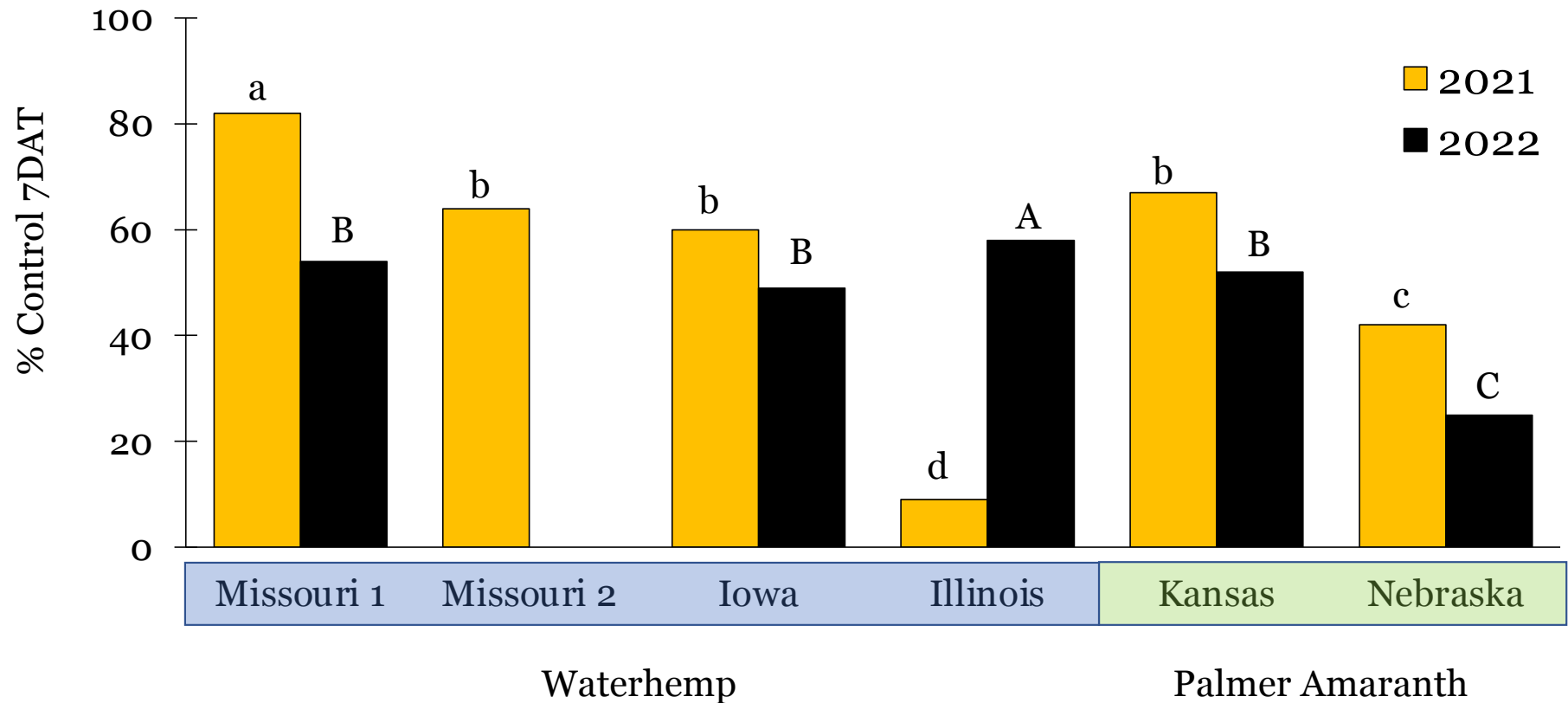
Influence of Growth Stage at the Time of Electrocutation on Grass Weed Control



*Bars followed by the same letter within the same species are not statistically different



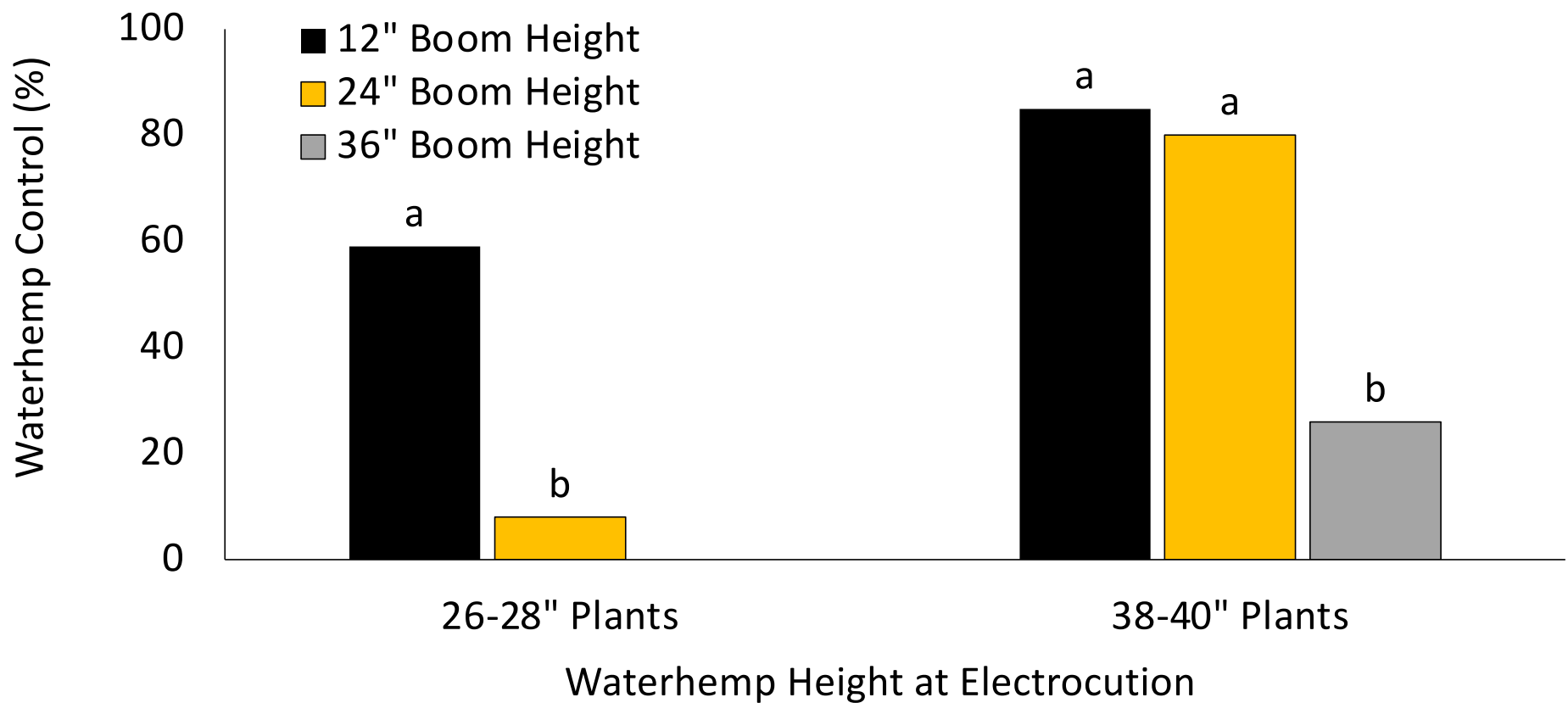
Response of Pigweed Species To Electrocutation



*Bars followed by the same letter within a year are not different, LSD <0.05

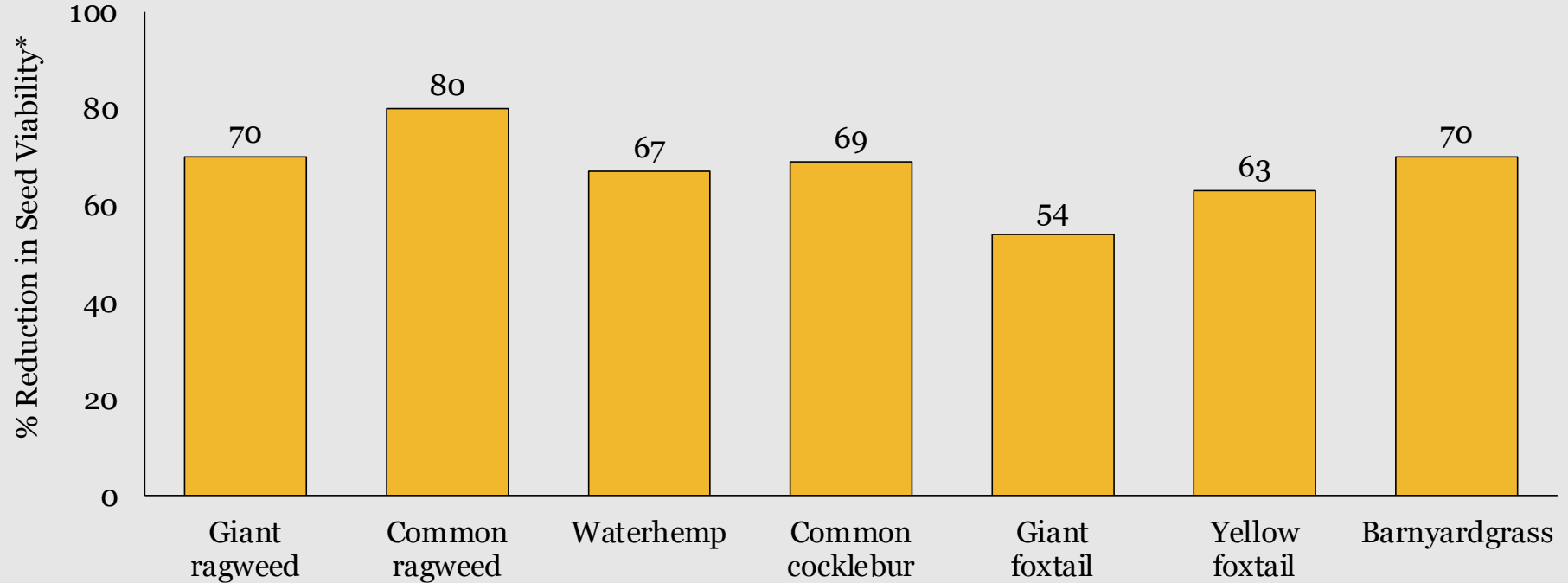
3. The height of the electrocution boom matters.

Influence of Electrocution Boom Height on Waterhemp Control



4. Can result in substantial reductions in weed seed viability.

Influence of Electrocution on Weed Seed Viability



*Based on viability of non-treated seed of that species

Other things we think we've learned and/or are still working on...

- ↑ waterhemp control has been associated with ↓ plant moisture
- No correlations with soil moisture content so far
- No negative effects on earthworms or soybean nodulation so far



**Will On-combine Seed
Destruction Devices
Become “Standard” in
the United States ?**



The concept of impact mills and harvest weed seed destruction has been tried, tested, and adopted in Australia as a result of widescale multiple herbicide resistance in ryegrass.



FEATURE January 16, 2018



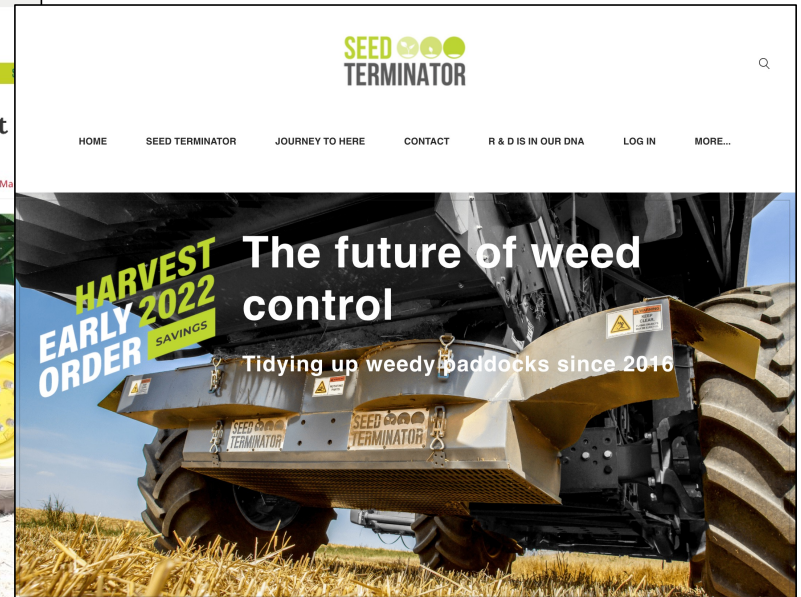
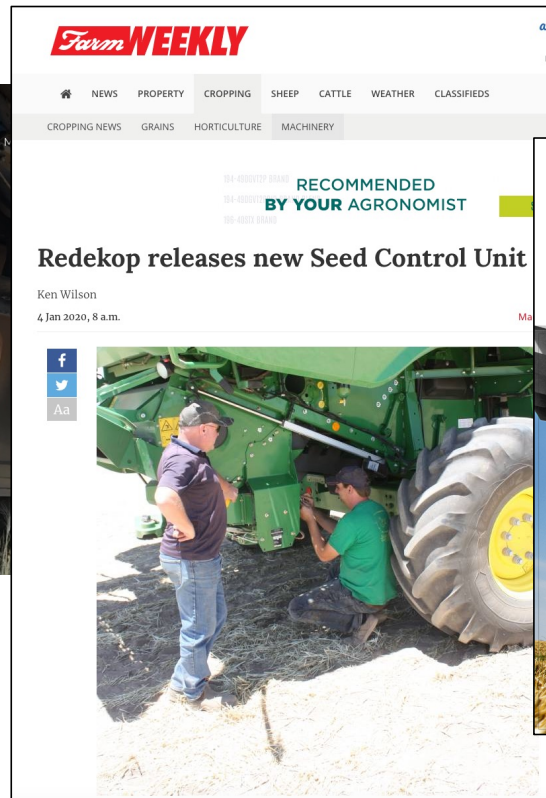
Harrington destructor keeps weeds at bay

Weed destroying innovation put through its paces during the 2017 harvesting season in NSW's Riverina region

Grower Graham Kotzur sourced a Case IH Axial-Flow 9120 header retrofitted with a prototype weed seed destructor produced by the University of South Australia, and has used it across the recent harvest on his Culcairn farm.

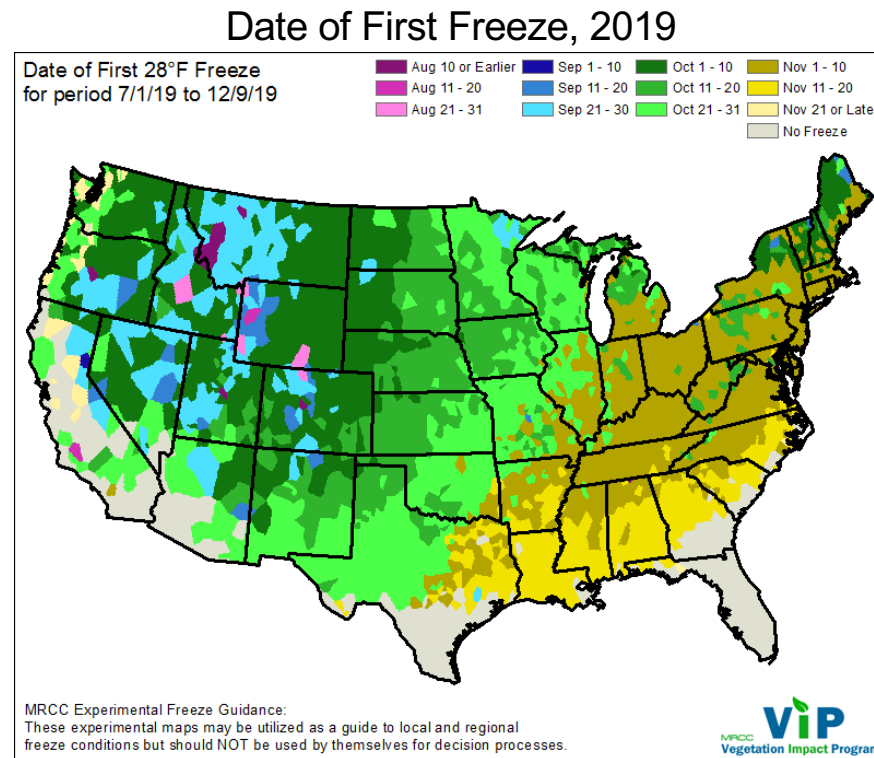


Where will this market go in the United States?





On-combine Impact Mills for use in U.S. Soybean



1. The earlier the frost(s), the better. “Green” weeds with high moisture content have proven difficult.

On-combine Impact Mills for use in U.S. Soybean



2. Some degree of header loss of weed seed is likely to occur (~31% of available waterhemp seed in a field).

On-combine Impact Mills for use in U.S. Soybean



3. The majority of weed seed that enters the combine appears to make it into the seed terminator. Approximately 94% of waterhemp seed that comes out of the Seed Terminator are damaged (= non-viable).

On-combine Impact Mills for use in U.S. Soybean

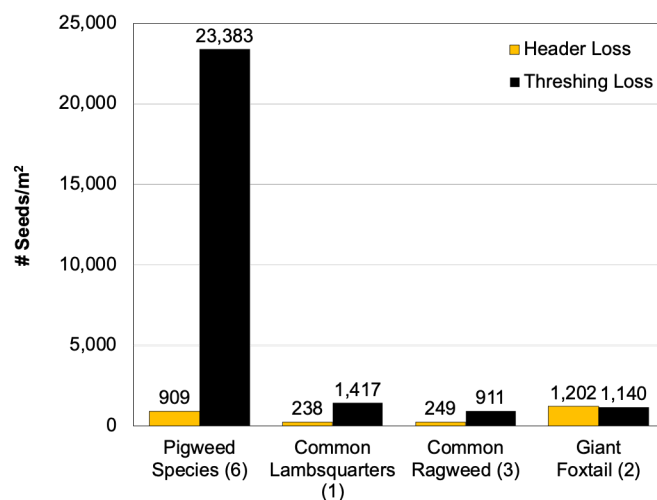


Figure 3. Average header and threshing loss of weed seeds when harvesting soybean. Numbers in parentheses indicate the number of locations that contained a given weed species.

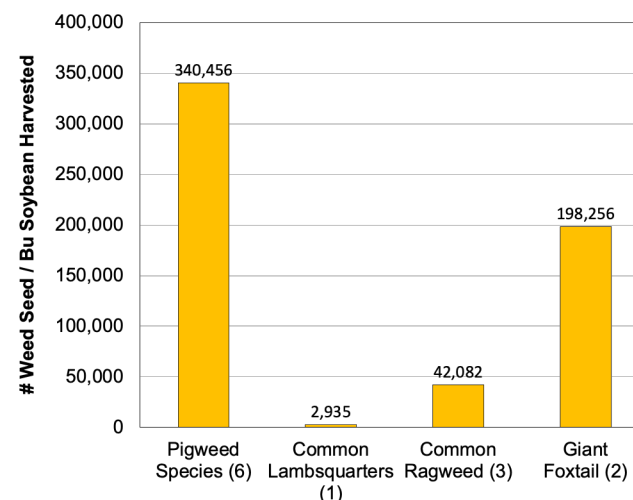


Figure 4. Average grain tank contamination of weed seed when harvesting soybean. Numbers in parentheses indicate the number of locations that contained a given weed species.

4. There is also a significant fraction of weed seed that is directed into the grain tank.

On-combine Impact Mills for use in U.S. Corn ?

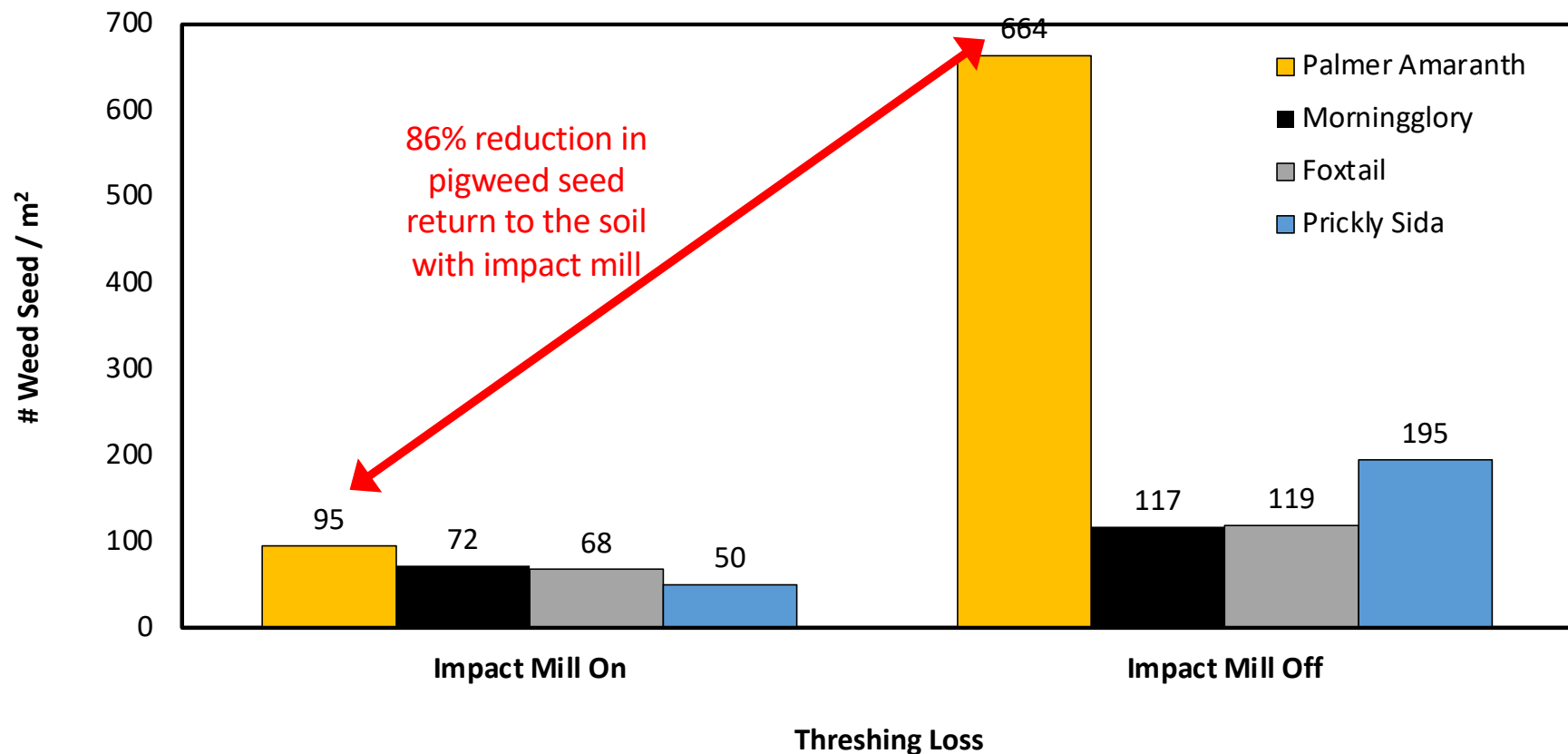


We have observed significant fractions of weed seed loss at the header and grain tank. But...



Influence of an On-combine Impact Mill on Weed Seed Return to the Soil at Corn Harvest

Keiser, Arkansas 2022



On-combine Impact Mills for use in U.S. Soybean

5. Combine Performance

On average across all the locations, fuel consumption was 3 gal/hour greater, engine load was 5.6% higher, but there was no difference in productivity when the Seed Terminator™ was on.

On-combine Impact Mills for use in U.S. Soybean



6. Significant reductions in the waterhemp seed bank were observed in 3 out of 5 locations.

On-combine Impact Mills for use in U.S. Soybean

7. Current costs of these implements are approximately \$60-75k (and falling). We found operating costs to be ~\$5/acre more than operating a conventional combine.



**Will On-combine Seed
Destruction Devices
Become “Standard” in
the United States ?**



Autonomous Weeding/Use of Robots

Bosch's Giant Robot Can Punch Weeds to Death

By Evan Ackerman
Posted 12 Nov 2015 | 20:00 GMT



Photo: Deepfield Robotics

At IROS last month, researchers from a Bosch startup called Deepfield Robotics presented a paper on "Vision-Based High-Speed Manipulation for Robotic Ultra-Precise Weed Control," which has like four distinct exciting-sounding phrases in it. We wanted to write about it immediately, but Deepfield asked us to hold off a bit until their fancy new website went live, which it now has. This means that we can show you video of their enormous agricultural robot that can autonomously detect and physically obliterate individual weeds in a tenth of a second.

Given the scale of farming today, treating weeds chemically is really the only practical way for humans to keep them under control, because you can use tractors or airplanes to cover large areas in a short amount of time. But all of those necessarily deadly (to weeds) chemicals then get on the plants we don't want to kill (because we want to eat them), as well as getting washed into the soil. The most organic and eco-friendly way of dealing with weeds is the old-fashioned way: physically removing them. "Physical removal" can mean

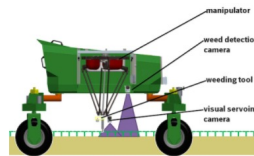


Image: Deepfield Robotics



FarmWise launches autonomous weeding robot

JANUARY 7, 2019 BY SAM FRANCIS



Deere is paying over \$300 million for a start-up that makes 'see-and-spray' robots

- Blue River's robots affix to tractors and can precisely identify and spray herbicides, pesticides or fertilizers to plants in need.
- The start-up had raised about \$31 million in venture funding.

Lora Kolodny | @lorakolodny

Published 8:08 PM ET Wed, 6 Sept 2017 | Updated 10:22 PM ET Wed, 6 Sept 2017

CNBC



Michael Newberg | CNBC

Sam Allen, CEO of John Deere at CONEXPO in Las Vegas on March 7, 2017.

Deere is bringing more robots to the farm.

The maker of John Deere agricultural equipment said on Wednesday that it's acquiring robotics start-up [Blue River Technology](#) for \$305 million. The deal is expected to close in September.



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2021mar02 John Deere Launches See And Spray Select

NEWS RELEASES

MARCH 02, 2021

John Deere launches See & Spray™ Select for 400 and 600 Series Sprayers



See & Spray™ Select can help farmers reduce their herbicide use by 77% on average by targeting and spraying only weeds on fallow ground.

UAV Sprayers



Exploring the use of Sterile Pollen

[Weed Resistance](#)[Our Solution](#)[News](#)[Our Vision](#)[About Us](#)[Contact Us](#)

Exploiting sterility to win the battle against resistant weeds

WeedOUT brings a totally new strategy into the world of weed control by developing a novel biological herbicide to fight off resistant weeds.

WeedOUT's unique **weed pollen** possesses 2 major properties:

- It competes successfully with naturally occurring weed pollen and fertilizes the ovule
- It leads to the formation of **aborted** seeds

Susceptible weeds are destroyed by chemical herbicides. However, escaper resistant weeds that were not affected by the herbicides mature and reproduce. Consequently, their proportion in the total weed population increases rapidly and leads to an evolutionary drift. Our groundbreaking solution is designed to outcompete naturally occurring pollen and accordingly **get evolution back on track**.

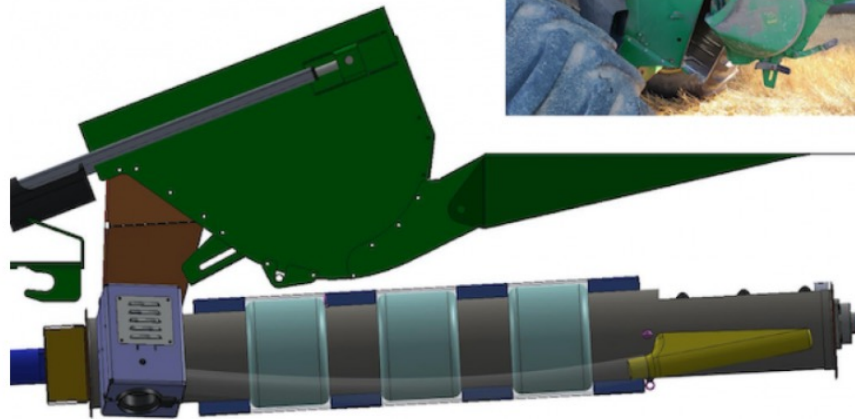
WeedOUT's novel technology is based on the development of a unique proprietary weed pollen, which is applied during weed flowering period via artificial pollination to prevent the generation of viable resistant weed seeds.

- New mechanism of action for weed control that is orthogonal to all currently available solutions
- Green, non-toxic, biologically based solution to outcompete naturally occurring pollen and to inhibit soil seed bank replenishment



SOYBEANS

Agriculture Invention Harnesses LED Light Inside Combine to Kill Weed Seed



"Blue LED light is going to become a regular tool for weed control in farming," says Jon Jackson, the innovator behind the Weed Seed Destroyer. "This type of agriculture technology is developing faster than people know."
(Photo courtesy of Global Neighbor)

By **CHRIS BENNETT** February 7, 2022
<https://www.agweb.com>



Mizzou[®] weed science

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App: ID Weeds (free download)



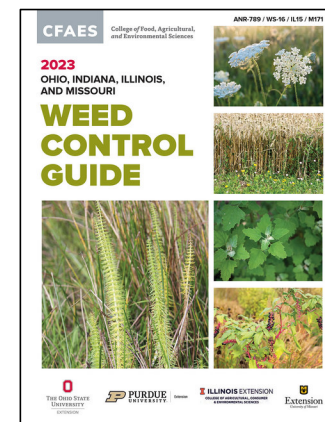
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