

PESTICIDE REPORTS

Division of Agricultural Sciences and Natural Resources • Oklahoma State University
<http://pested.okstate.edu>



March, 2019

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APRIL TEST HELP DATES

The OSU Pesticide Safety Education Program will conduct the next test help workshops for 2019 in April. The workshops will be held April 9th in Oklahoma City and April 17th in Tulsa.

The Oklahoma City Test help session will at the Oklahoma County Extension Office 2500 NE 63rd. The Tulsa session will be at the Tulsa County Extension Office at 4116 E. 15th.

The help sessions will focus on information covered in the core and service tech tests. OSU PSEP will answer any questions over other category tests during this session.

Applicators should acquire and study the manuals before coming to the help session for optimum success. Study manuals can be purchased by using the manual order form available at our website <http://pested.okstate.edu/pdf/order.pdf> or by calling University Mailing at 405-744-9037.

ODAFF Testing fees are not included in the registration fee and must be paid separately.

Register online at the Pesticide Safety Education Program (PSEP) website at <http://pested.okstate.edu/html/practical.htm>. Registration forms can also be downloaded from the website.

DICAMBA DATA DOWNLOAD

Registration will start at 8:30 and the program will run from 8:45 am to 12:30 pm at both locations. Testing will begin at 1:30 pm at both locations.

NO CEU's will be given for this program!

Please check our website below for future test help dates.

<http://pested.okstate.edu/html/practical.htm>

NEW WPS POSTER AVAILABLE

With the new WPS requirements in agriculture establishments that fall under WPS requirements should make sure they have updated their training material and posting information.

All training materials must be EPA approved to meet training standards under WPS.

Training material can be found at the Pesticide Educational Resource Collaborative website <http://pesticideresources.org/>. Updated training materials such as training literature and training videos can be found here. All material at this website is EPA approved.

Growers should also make sure their central posting areas are in compliance and have the new WPS poster or information posted that meets the new requirements.

The Okstate Pesticide Safety Education Programs has updated posters available to Oklahoma growers needing to replace the old poster. Contact Charles Luper at (405) 744-5808 or charles.luper@okstate.edu to request a new poster or for WPS assistance. (OSU PSEP)

One specific herbicide haunted the halls of the Weed Science Society of America's annual meeting in a New Orleans hotel this week.

"The elephant in the room is dicamba off-target movement," Chad Brabham, a post-doctoral researcher from the University of Arkansas, told a room of scientists gathered to hear the newest research on dicamba injury. "And as academics, we're interested in trying to mitigate the risks of off-target movement."

But first, scientists need to understand how and why dicamba is moving off-target -- a topic that many weed scientists in the Midwest and South have spent the past two to three years studying.

Weed scientists' efforts are slowly uncovering why new formulations of dicamba, XtendiMax, FeXapan and Engenia, have moved beyond treated fields to injure millions of acres of non-tolerant soybeans and other vegetation for two consecutive years -- and why some regions seem so much more affected than others. WSSA devoted an entire symposium to the topic of dicamba off-target movement at its annual meeting, where several major conclusions emerged.

First, most academic scientists believe volatility of the herbicides is happening and was a major contributor to off-target damage in 2017 and 2018. Second, they are closing in on key environmental factors that make volatility more likely to occur and cause off-target damage. Those factors include warm, humid weather, temperature inversions and low pH of a dicamba tank mix, often the result of adding glyphosate.

Finally, some scientists are also raising concerns about the possibility of "atmospheric loading" of dicamba in certain geographic regions where high quantities of the herbicide are sprayed in a short period of time in the heat of the summer.

To add to these challenges ahead in the 2019 spray season, the new federal labels for Engenia, FeXapan and XtendiMax have become so complicated and

difficult to follow that even some academic and company scientists were unable to spray on label when conducting their field and small plot trials.

VOLATILITY AND ITS EFFECTS

Air samplers have become a popular tool among industry and academic scientists seeking to measure how much dicamba leaves a field hours and days after an application. Scientists from both the University of Arkansas and Missouri have consistently measured significant concentrations of dicamba coming off treated soybean fields as long as 96 hours following an application.

BASF also presented field tests results on Engenia, done in conjunction with university scientists in Arkansas, Indiana, Mississippi and Kansas, which found measurable amounts of dicamba in the air outside treated areas up to 48 hours following applications.

Moreover, these volatilized amounts appear able to cause significant injury to sensitive soybeans and other vegetation, University of Arkansas weed scientist Jason Norsworthy said.

"With dicamba concentrations in the air as low as even 1 nanogram per cubic meter, we're seeing more than 10% injury to soybeans," he said.

VOLATILITY RISK FACTORS

Over the past two years, some academic weed scientists have singled out certain environmental factors that are contributing to the volatilization and off-target movement of dicamba. Their research is slowly uncovering the causes of one of the most confounding parts of the dicamba injury crisis -- why some states and regions see so much more damage than other states with similar or more soybean acreage.

One primary culprit appears to be temperature inversions, which occur when cool, dense air traps physical herbicide particles or volatilized herbicide vapors in the air above a treated field, allowing them to move off target when the inversion disperses. At the University of Missouri, weed scientists have collaborated closely with state

climate experts to learn that temperature inversions are occurring frequently in Missouri, Illinois, Tennessee, Arkansas, and Indiana, in the spring and summer months when dicamba is sprayed. They are also learning inversions are affected by a number of conditions beyond weather, including topography and land cover, such as trees -- which can contribute to regional differences in inversions within a state or a county.

Most critically, the Missouri scientists found that when dicamba was applied during inversion conditions, higher amounts of dicamba were detected in the air in the hours following application compared to applications made during non-inversion conditions. Although it is illegal to apply dicamba during an inversion, detecting one underway can be challenging for applicators in the field.

Meanwhile, a growing number of studies from Mississippi State University and the Universities of Arkansas and Tennessee indicate that when the pH of a tank mix is lowered, dicamba volatility increases. The chief culprit behind these lower pH levels appears to be glyphosate, a popular tank mix ingredient that farmers used extensively in the past spraying seasons. Likewise, University of Missouri scientists found that when glyphosate was included in the dicamba tank mix, they detected more dicamba in the air after application.

"Until 2018, I didn't realize how significant the impact of glyphosate was on volatility of dicamba," said Dan Reynolds, a Mississippi State University weed scientist. "And I think pH is the driver behind what we're seeing here." Missouri scientists have also found soil pH might be a factor in dicamba movement.

Warm weather and high humidity were also pinpointed as risk factors by Arkansas and Tennessee scientists, who analyzed weather conditions while using air samplers to measure volatilized dicamba. Dicamba air concentrations increased on days with temperatures higher than 70 degrees and more than 50% relative humidity, Brabham said. In contrast, rain events significantly decreased the amount of dicamba coming off a treated field in the study, however.

ATMOSPHERIC LOADING CONCERNS

Given the new dicamba formulations' apparent volatility, and the expectation that 60 million acres of dicamba-tolerant crops will be planted in 2019, some weed scientists have been raising the specter of "atmospheric loading."

Norsworthy likens the effect to smog in Los Angeles. "When you look at Los Angeles, it's not just one vehicle adding emissions or causing the problem," he said. "It's the fact that you have thousands upon thousands of vehicles within a very small area contributing to this issue and as a result, everyone in the region is impacted. I see this not really being any different from what we're observing in areas where we have heavy use of dicamba and the volatility that is ultimately occurring."

That effect would explain the widespread injury found in certain regions where a lot of dicamba spraying occurred, such as northeast Arkansas and southeast Missouri in the past two years, both Norsworthy and University of Missouri weed scientist Kevin Bradley told DTN. In many of these injury investigations, the dicamba injury to vegetation was clear but no individual culprit could be identified, because dicamba was used so extensively in the area, Norsworthy and Bradley noted.

"With atmospheric loading of volatile herbicides such as we have observed in northeast Arkansas, the Bootheel of Missouri and west Tennessee, you will have landscape damage with no obvious source of where the damage came from," Norsworthy said.

See more details on presentations at WSSA this week here: <http://wssa.net/...>

(Progressive Farmer, February 15, 2018)
<https://www.dtnpf.com/agriculture/web/ag/news/crops/article/2019/02/15/scientists-illuminate-causes-target-2ps/article/2019/02/15/scientists-illuminate-causes-target-2>

MOSQUITOES SHOW RESISTANCE TO COMMON INSECTICIDE, USDA STUDY SHOWS

Florida mosquitoes that can carry Zika virus and other diseases are showing resistance to pyrethroid—a common group of insecticides used to treat them—according to a new study by U.S. Department of Agriculture (USDA) scientists and their collaborators.

The mosquito *Aedes aegypti*, the main carrier of dengue, Zika virus and yellow fever worldwide, is becoming more common in Florida. Limited Florida outbreaks of dengue in 2009-2010 and Zika in 2016 involved *Ae. aegypti* as the major disease carrier, according to James Becnel, an entomologist in the Mosquito and Fly Research Unit with the USDA Agricultural Research Service (ARS) Center for Medical, Agricultural, and Veterinary Entomology (CMAVE).

During public health emergencies, multiple strategies are used to control mosquitoes, including application of pesticide sprays by truck or aircraft. Understanding the magnitude of insecticide resistance is critical to an effective control program, Becnel said.

A collaborative group from USDA-ARS, the Navy Entomology Center of Excellence, Florida Department of Agriculture and Consumer Services and Florida mosquito control districts published the first statewide study measuring the scope of pyrethroid insecticide resistance in *Ae. aegypti* and *Aedes albopictus*, another local species that is a known carrier of chikungunya virus. Pyrethroid insecticide resistance is common in *Ae. aegypti* in many locations worldwide and can adversely affect mosquito control operations, Becnel said. However, the resistance status of *Aedes* in Florida has largely gone unreported until now.

The four-year study, published in PLOS Neglected Tropical Diseases, shows that resistance to permethrin—an insecticide in the pyrethroid family—was present in all 20 *Ae. aegypti* strains

collected from around the state. Importantly, permethrin doses up to 60 times above susceptible levels were required to effectively control some resistant populations, according to Becnel. In contrast, *Ae. albopictus* strains collected did not show permethrin resistance.

The study found a strong correlation between the actual resistance status of adult *Ae. aegypti* (determined by topical application) and the mosquito genotype. This data can be used to rapidly predict pyrethroid-resistance in mosquitoes within 24 hours by detecting certain genetic mutations. This information, Becnel said, can then inform control districts as to whether they need to try other control strategies, such as using larvicides to target immature aquatic mosquito life stages before they become adults.

These findings also allow scientists and control districts to be more thoughtful in selecting effective control methods for mosquito populations that are resistant to pyrethroids. The research also emphasizes the need for resistance testing in any effective mosquito management program.

Full text of the publication can be found [here](https://www.pctonline.com/article/mosquitoes-permethrin-resistance-usda-study/). (PCT Online, February 14, 2019)
<https://www.pctonline.com/article/mosquitoes-permethrin-resistance-usda-study/>

US JUDGE GREENLIGHTS GLYPHOSATE CANCER TRIAL

A federal judge in the US state of California has rejected Bayer legacy company Monsanto's latest bid to derail hundreds of lawsuits filed by cancer victims who allege that exposure to the company's glyphosate-based herbicides caused their illnesses.

US District Judge Vince Chhabria echoed previous scepticism of the plaintiffs' claims, but concluded that they have provided sufficient evidence to allow the first of three bellwether trials to proceed.

All told, Judge Chhabria is overseeing some 620 complaints brought by cancer victims who have alleged that exposure to Monsanto's glyphosate-based herbicides had caused them to develop Non-Hodgkin's Lymphoma (NHL), a type of blood cancer. The lawsuits argue that the company had known of the cancer risks from its herbicides and had failed to warn consumers in violation of California consumer protection law.

Last year, Judge Chhabria rejected a Monsanto motion that had called for summary judgment on the general causation question of whether exposure to glyphosate could have caused NHL at realistic exposure levels, but said that the opinions of the plaintiffs' experts were "shaky but admissible". Monsanto's latest motion challenges the specific causation of the three plaintiffs, arguing that there is no evidence that exposure to glyphosate caused the individuals to develop NHL.

To defeat the motion, the plaintiffs needed to present at "least one admissible expert opinion" to support their specific causation argument, Judge Chhabria explained in his February 24th order.

"It is again a close question, but the plaintiffs have barely inched over the line," he concluded.

Judge Chhabria added that he remains "sceptical of their conclusions" -- particularly the assumptions about the strength of the epidemiological evidence linking glyphosate to NHL.

"But their core opinions -- that the plaintiffs had no other significant risk factors and were exposed to enough glyphosate to conclude that it was a substantial factor in causing their NHL -- are admissible," he wrote in the nine-page order.

The ruling came on the eve of the start of the first-phase of a jury trial for Edwin Hardeman, a 70-year old California resident who claims that exposure to Monsanto's Roundup caused him to develop NHL in 2015.

In a ruling favourable to Monsanto in December 2018, Judge Chhabria agreed to split the three bellwether trials into two phases and restrict the evidence that the plaintiffs' attorneys can use to try

and convince the jury that the company attempted to unduly influence regulators and sway public opinion about the cancer risks from the herbicides.

The first phase of the trial will instead focus on the causation question and consider whether the plaintiffs can prove that exposure to Monsanto's glyphosate-based products caused their cancers. If that causation hurdle is cleared, the trial will move to a second phase to address all remaining liability and damage issues. During that phase the plaintiffs will be able to introduce evidence of the company's alleged attempts to manipulate regulators and the public.

Monsanto is also facing some 8,000 similar complaints in state courts and contesting a decision by a California jury to award a plaintiff \$79 million jury after determining that his NHL was caused by exposure to the company's glyphosate products. A second state case is set to begin next month -- the California judge overseeing that lawsuit recently denied Monsanto's bid to bifurcate the trial.

California Superior Court Judge Winifred Y Smith said that the issue of "specific causation" cannot readily be separated from other issues in the case.

"The court is concerned that trying to separate issues of specific causation from the other issues in the case would result in a stage one trial where counsel would be continuously distracted by the effort to draw the line between stage one and stage two," Judge Smith wrote in a February 19th order.

"In most product liability trials the jury hears all the evidence and then determines issues of causation and injury," the judge added. "The court is confident that the jury will be able to do so here as well." (Pesticide & Chemical Policy/AGROW, February 26, 2019)

NEW RESEARCH GIVES INSIGHT INTO WARDING OFF INSECT PESTS BY WAY OF NEMATODE ODORS

A recent study revealed insect-killing nematodes also produce distinctive chemical cues that enhance plant defenses and deter Colorado potato beetles.

Entomologists from Texas A&M University, including Dr. Anjel Helms, who led the study, and Penn State University took a look at whether Colorado potato beetles and potato plants responded to the presence of entomopathogenic nematodes, EPNs, or insect-killing nematodes.

The study, "Chemical cues linked to risk: cues from below-ground natural enemies enhance plant defenses and influence herbivore behavior and performance," focused on how organisms communicate using signals and cues, specifically how organisms eavesdrop on each other as part of their survival strategies, said Helms.

"For this study, we wanted to flip things around and determine whether plants and insect herbivores can eavesdrop on chemical cues produced by a predator," she said.

Throughout the study, Helms found that these insect-killing nematodes do produce distinctive chemical cues that both the plant and insect herbivores respond to. While the female Colorado potato beetles laid fewer eggs when the cues were present, the potato plant also increased its defenses.

This was especially important since the Colorado potato beetle is notorious for developing insecticide resistance, making them an especially devastating pest, she said.

"Although Colorado potato beetles feed above ground on plant leaves, they are susceptible to EPNs at all life stages," she said.

While a beetle is not likely to come in contact with EPNs during most stages of life, it is most susceptible to EPNs while on the ground moving

from plant to plant, or when entering the soil to pupate and emerge as an adult beetle.

The study also found that growers can experience additional benefits from using EPNs for biological control of insect pests.

“Not only are the EPNs directly killing insect pests in the soil, they also produce chemical cues that provide additional protection to plants,” Helms said. “They deter herbivores and enhance plant resistance to pests.”

For more information, view the study in the journal “Functional Ecology” [here](#).

(AgriLife Today, February 27, 2019)
<https://today.agrilife.org/2019/02/27/new-research-entomopathogenic-nematodes/>

US SENATE APPROVES PESTICIDE FUNDING BILL

The US Senate last week approved bipartisan legislation to reauthorize a key pesticide funding law widely supported by a broad and unique coalition of industry stakeholders, state officials, environmentalists and farmworker advocates.

The reauthorization of the Pesticide Registration Improvement Act (PRIA) was passed by unanimous consent only a day after it was introduced by Senate Agriculture Committee chairman Pat Roberts and ranking member Debbie Stabenow. The bill extends the law until 2023, giving the EPA the authority to collect some \$31 million in annual maintenance fees from the pesticide industry.

The Senate’s action “provides certainty to farmers, consumers, and many other stakeholders”, Mr. Roberts and Mrs. Stabenow said. “We urge our colleagues in the House to pass this legislation quickly.”

The PRIA technically expired in September 2017 but has been kept alive by short-term spending bills approved by Congress. Stakeholders are keen to see

a permanent fix given the broad support for the PRIA and the importance of the statute to the EPA.

First established in 2003, the law couples the collection of fees from the agrochemical industry with specific decision review periods and has typically provided 20-25% of funds used by the Office of Pesticide Programs. The law is widely credited with helping the EPA create a more predictable and effective framework for making regulatory decisions about pesticides while also improving scientific reviews and funding pesticide safety training.

The measure mirrors legislation approved by the Senate in June 2018 by voice vote and includes language requiring the EPA to fully implement two farmworker safety rules finalized by the Obama administration.

That provision was added to the bill by Senator Tom Udall, a New Mexico Democrat and the ranking member of the Senate Appropriations subcommittee that oversees the EPA. Mr. Udall was vital to the passage of the 2018 version as he had blocked consideration of the PRIA reauthorization bill due to frustration with the Trump administration's effort to consider changes to the Worker Protection Standard (WPS) and the Certified Pesticide Applicator rule.

The legislation addresses a lingering concern about the designated representative provision in the WPS. The provision allows a farmworker to designate an individual to request information about the pesticides used on farm where they are employed. Agricultural industry interests worry that the information might not be adequately protected and pressured the EPA to reconsider the language.

The American Farm Bureau Federation recently dropped its opposition to the PRIA bill after receiving assurances from lawmakers that they would track implementation of the provision to alleviate their concerns. The PRIA bill requires the Government Accountability Office to study the provision and produce a report on its impact.

House Agriculture Committee chairman Collin Peterson sent a letter last week to Farm Bureau

president Zippy Duvall addressing worries about the designated representative provision. “While I do not share your concerns with the included updated Worker Protection Standard, I nevertheless pledge that, should demonstrable abuses of the designated representative (DR) provision occur, the House Agriculture Committee would exercise its oversight responsibility to review the WPS, in particular the DR provision, to assure the protection of both farm worker and producer interests,” said Mr. Peterson, a Minnesota Democrat. (Pesticide & Chemical Policy/AGROW, February 19, 2019)

EPA GRANTED CHLORPYRIFOS REHEARING

The EPA will get another hearing on a federal court's 2018 order to ban all chlorpyrifos registrations, as the U.S. Court of Appeals for the Ninth Circuit granted the agency an en banc hearing in an order handed down on Wednesday in San Francisco.

In August 2018, the EPA asked for the hearing that will be before all non-recused judges in the Ninth Circuit on the week of March 25, 2019, in San Francisco.

On Aug. 9, 2018, a three-judge panel on the court ordered EPA to cancel all chlorpyrifos registrations in 60 days. The court ruled the agency was not justified in maintaining the insecticide's registration "in the face of scientific evidence that its residue on food causes neurodevelopmental damage to children."

Chlorpyrifos' registration was set to end on Oct. 9, 2018.

En banc hearings are reserved for cases that are particularly complex. According to the court order, the three judges that issued the 2018 ruling were not part of the vote to allow a rehearing. They are judges Marsha Siegel Berzon, Jay Scott Bybee and Ryan Douglas Nelson.

Chlorpyrifos is the main ingredient in Dow AgroScience's Lorsban insecticide, which targets pests such as soybean aphids, spider mites and corn rootworm.

Attorneys with the U.S. Department of Justice argued in EPA's petition that the law requires the court to allow the EPA to reconsider the insecticide's registration.

The petition argued the court's revocation of the registration was in conflict with cancellation requirements laid out in the Federal Insecticide, Fungicide, and Rodenticide Act, or FIFRA.

The legal pursuit began in 2007 when the Pesticide Action Network North America and the Natural Resources Defense Council petitioned EPA to cancel chlorpyrifos registrations.

The EPA denied a petition filed by environmental groups on March 30, 2017, to ban the pesticide outright. The agency said in a statement at the time that farmers need chlorpyrifos, and an agency that relies on "sound science" when making decisions.

That move was a surprising reversal from the stance of the EPA under the previous administration, which had indicated as recently as fall 2016 that it was prepared to issue a full ban on the pesticide.

The court decided the EPA had been ignoring its own science that showed chlorpyrifos is allegedly a danger to children.

Following the court's August 2018 decision, an EPA spokesman told DTN the decision was based on data that was not accessible to the agency.

A Columbia Center for Children's Environmental Health study has been widely used as support for the ban, despite divergent scientific views among EPA scientific review panels, and former President Barack Obama's administration's USDA questioning the study, and its data.

A 2016 EPA scientific advisory panel indicated some members of that panel said they had difficulty assessing the study, because the raw data from the study was not made available.

On July 30, 2018, the California Department of Pesticide Regulation released a scientific assessment that concluded that chlorpyrifos should be listed as a toxic air contaminant in the state based on evidence of its neurological effects and exposure risks.

Agricultural groups have expressed concern over a ban, arguing that doing away with chlorpyrifos could complicate the battle against insects, especially when growers are being encouraged to rotate chemistries to guard against insect resistance. (Progressive Farmer, February 7, 2019)

<https://www.dtnpf.com/agriculture/web/ag/news/crops/article/2019/02/07/insecticide-registrations-ordered>

WATERHEMP SCORES AGAIN

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."

Go down through the sites of action commonly used in corn and soybean crops today and nearly all have had some level of resistance confirmed, Bowers added. "This is the age we live in. Resistance to a particular AI (active ingredient) or site of action doesn't invalidate or devalue that active. It can still be extremely important across a wide geography to control other weed species," he said.

A CRACK IN ARMOR

What makes this discovery unique is the Group 15 herbicides have been fairly resilient. Worldwide, there are only five cases of grass weeds that have been confirmed resistant to very long chain fatty acid inhibitor (Group 15) herbicides. Most of those cases are in wheat and rice. The only confirmed Group 15 resistance in the United States had been in monocot (grass) in Idaho, Washington and Oregon.

The Illinois discovery is the first confirmed case in the world in a dicot (broadleaf) weed species and the first case of Group 15 resistance known associated with corn and soybean production, according to the International Survey of Herbicide Resistance (www.weedscience.org).

Hager said the resistant populations were found in McLean County and Champaign County. Both populations were already known to be resistant to multiple modes of sites of action -- the McLean County population now resists five sites of action and the Champaign County waterhemp population has six-way resistance.

Hager said both of the resistant populations demonstrate resistance to all Group 15 herbicides tested, which included S-metolachlor (Dual Magnum), dimethenamid-P (Outlook), pyroxasulfone (Zidua) and acetochlor (Harness, Warrant, Degree and others).

"In field trials, we noticed that the level of control with metolachlor was drastically lower than that of acetochlor (Harness, Warrant, Degree and others)," he noted. "It has always been less, but this was dramatically different."

Further field trials and greenhouse studies showed resistance ratios that ranged from 4- to 64-fold among the Group 15 herbicides. However, Hager said that doesn't mean simply switching to another herbicide within this site of action removes the threat of resistance in this weed species.

"This is yet another example of how relying on chemicals alone to control waterhemp isn't working anymore," Hager added. "It also means we expect the length of residual control is going to continue to decline." Group 15 herbicides are also important ingredients in pre-emergence residual programs.

ROADS TO RESISTANCE

Weed scientists have long warned that new herbicide miracles are not sitting in company pipelines. Bowers and Vail point to Syngenta's Resistance Fighter program as an example of efforts to educate about the risk of continuously relying on the same weed-control tactics.

However, they also agree that the message is deceptively simple in a world where nature keeps evolving. "While this particular example of resistance seems to be limited right now, it is evidence that we need to do things different going forward," Vail said.

"We cannot continue to rely totally on herbicides and expect to be sustainable long term," he said. "I think in a lot of cases we're doing the right things, but it is getting more and more difficult for these herbicides to be effective in some of these weed species."

Some key ways to delay herbicide resistance include crop rotation, combining effective herbicides with multiple sites of action and using full rates for all applications in the field. Letting pre-emergence residual products clean up fields early and using postemergence products as a backup, rather than the first line of defense, is also important, Bowers said. Cover crops, tillage and increasing crop competition through narrower row spacings are other tactics to improve odds.

Bowers added that products such as atrazine and HPPD-inhibiting herbicides, for example, have had known resistance for years, but remain important tools. "While the discovery with Group 15 resistance in waterhemp is important, we think that addressing it early and being upfront about it is equally important.

"There's a lot more work to be done to find out how or why this has developed in Illinois," Bowers said. "What we do know is it is critical to use full rates of products and employ multiple tactics to avoid resistance."

SCOUT AND LEARN

Hager said one clue that resistance may be evolving in the field is if you notice the residual control of the product isn't holding up.

Don't assume the sprayer skipped if you see a small weed break. Pull a sample. Have it tested for resistance, he said.

"Resistance doesn't happen overnight," Hager said. "We usually see small weed populations break first. Keeping those weeds from going to seed can go a long way toward helping keep these products useful. And yes, sometimes that means using a hoe."

For a full summary of the weeds and countries that have confirmed resistant to long chain fatty acids: [http://www.weedscience.org/...](http://www.weedscience.org/)

(Progressive Farmer, February 8, 2019)
<https://www.dtnpf.com/agriculture/web/ag/news/crops/article/2019/02/08/illinois-scientists-find-new-2>

L.A. CITY HALL MAY REMOVE ALL CARPETS AMID TYPHUS CONCERNS

All carpets at Los Angeles City Hall may need to be replaced amid a Typhus outbreak that may have infected one city employee while at work, according to a motion filed by Council President Herb Wesson on Wednesday, KTLA reported.

Wesson, who first became aware of a vermin issue in November 2018, contacted pest control experts and removed all his office's carpets, according to the motion.

The motion reported cleanup issues and a noticeable increase in rodents in the area, which could have contributed to the outbreak.

The California Department of Public Health first reported a Typhus outbreak in downtown Los Angeles in October 2018, saying that four people had been infected, and that the number was expected to rise.

Wesson's motion asks for a report on the scope of vermin and pest control issues at City Hall, and instructs city staff to report back with a cost estimate for removing all carpets in the building and an assessment of all live plants in any city building. (PCT Online, February 7, 2019)

<https://www.pctonline.com/article/la-city-hall-remove-carpets/>

Find us on Twitter at [@OkstatePestEd](https://twitter.com/OkstatePestEd)

CEU Meetings

Date: March 5-6, 2019

Title: 2019 Spring OKVMA Conference & Trade Show

Location: The Grand Spa Hotel & Casino Shawnee, OK

Contact: Kathy Markham (918) 256 -9302

www.okvma.com

CEU's:	Category(s):
5	A
5	3A
4	5
6	6
6	10

Date: March 7, 2019

Title: ABC DFW Swarm School Workshop

Location: ABC Home & Property

Lewisville TX

Contact: Brian Wardwell (704) 361-8493

CEU's:	Category(s):
1	7b

Date: March 14, 2019

Title: BWI Winter Pest Control Seminar 2019

Location: Reed Conference Center

Midwest City, OK

Contact: Tim Ruminer (405) 227-2985

www.bwicompanies.com

CEU's:	Category(s):
2	3A
3	7a
1	7b
2	8
4	10
1	11

Date: April 4, 2019

Title: Target Specialty Products OKC Workshop 2019

Location: Reed Conference Center

Midwest City, OK

Contact: Jennifer Gonzalez (800) 352-3870

www.target-specialty.com

CEU's:	Category(s):
4	7a
1	7b
5	10
1	All

Date: September 11, 2019

Title: General Pest Services (Defined by label/What does this mean to you?)

Location: Hampton Inn Edmond, OK

Contact: Donald Stetler (281) 217-2965

www.ensystem.com www.for-thor.com

CEU's:	Category(s):
4	3A
2	7A
3	7B

Date: September 10, 2019

Title: General Pest Services (Defined by label/What does this mean to you?)

Location: Hampton Inn Tulsa, OK

Contact: Donald Stetler (281) 217-2965

www.ensystem.com www.for-thor.com

CEU's:	Category(s):
4	3A
2	7A
3	7B

Date: September 12, 2019

Title: General Pest Services (Defined by label/What does this mean to you?)

Location: Hampton Inn Durant OK

Contact: Donald Stetler (281) 217-2965

www.ensystem.com www.for-thor.com

CEU's:	Category(s):
4	3A
2	7A
3	7B

ODAFF Approved Online CEU Course Links

Online Pest Control Courses

<https://www.onlinepestcontrolcourses.com/>

PestED.com

<https://www.pested.com/>

Certified Training Institute

<https://www.certifiedtraininginstitute.com/>

WSU URBAN IPM AND PESTICIDE SAFETY EDUCATION PROGRAM

<https://pep.wsu.edu/rct/recertonline/>

CEU University

<http://www.ceuschool.org/>

Technical Learning College

<http://www.abctlc.com/>

All Star Pro Training

www.allstarce.com

Wood Destroying Organism Inspection Course

www.nachi.org/wdocourse.htm

CTN Educational Services Inc

http://ctnedu.com/oklahoma_applicator_enroll.html

Pest Network

<http://www.pestnetwork.com/>

Univar USA

<http://www.pestweb.com/>

AG CEU Online

<https://agceuonline.com/courses/state/37>

For more information and an updated list of CEU meetings, click on this link:

<http://www.kellysolutions.com/OK/applicators/courses/searchCourseTitle.asp>

ODAFF Test Information

Pesticide applicator test sessions dates and locations for March/April are as follows:

March		April	
5	OKC	9	OKC
14	Tulsa	5	Goodwell
19	OKC	10	Lawton
28	Tulsa	11	Tulsa
		25	Tulsa

Enid: Garfield County Extension Office, 316 E. Oxford.

Goodwell: Okla. Panhandle Research & Extension Center, Rt. 1 Box 86M

Lawton: Great Plains Coliseum, 920 S. Sheridan Road., Prairie Bldg

McAlester: Kiamichi Tech Center on Highway 270 W of HWY 69

OKC: ODAFF Building 2800 N Lincoln BLVD Oklahoma City OK

Tulsa: Tulsa County Extension Office 4116 E 15th St. (**New Location**)

Pesticide Safety Education Program