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National and Regional Weed Science Societies Comment on EPA's Proposed Herbicide Resistance Management Plan

The Weed Science Society of America (WSSA), Aquatic Plant Management Society (APMS), Northeastern Weed Science Society (NEWSS), North Central Weed Science Society (NCWSS), Southern Weed Science Society (SWSS), and Western Society of Weed Science (WSWS) submitted comments on EPA's proposed herbicide resistance management plan, which was first proposed as part of the dicamba-tolerant cotton and soybean registrations. EPA's proposal presents a significant change in how resistance is monitored, mitigated and communicated to weed management stakeholders. One of our concerns was that this proposal was included as part of the proposed dicamba registration and not as a separate Pesticide Registration (PR) Notice by itself. However, just as the dicamba registration comment period was closing, EPA issued a separate PR Notice for the Resistance Management Plan (see next story below).

While the National and Regional Weed Science Societies complimented EPA on these proactive resistance management measures, we provided many suggestions and recommendations on how to improve the plan. It will be important for EPA to communicate to the weed management community what their expectations are for the plan, how much it will cost to implement, and how will success (and failure) be measured. In addition, we consider the plan a first iteration that will need adaptation and evolution with our experience with it. The comments are at: http://wssa.net/wp-content/uploads/Weed-Science-Societies-Comments-on-EPA-11-element-Resistance-Mgmt-Plan.pdf

EPA's Issues Draft Guidance on Managing Pesticide Resistance

On June 2, EPA made available for a 60-day comment period two draft Pesticide Registration Notices (PR Notices) that are aimed at combating pesticide resistance. The first PR Notice (PR Notice 2016-X) is titled "Draft Guidance for Pesticide Registrants on Pesticide Resistance Management Labeling" and the second PR Notice (PR Notice 2016-XX) is titled "Draft Guidance for Herbicide Resistance Management Labeling, Education, Training, and Stewardship."

To address the growing issue of resistance and preserve the useful life of pesticides, EPA is beginning to embark on a more widespread effort that is aimed at combating and slowing the development of pesticide resistance. The release of these two PR Notices will allow EPA to communicate and seek comment on potential strategies to combat pesticide resistance.

Draft PR Notice 2016-X, which revises and updates PR Notice 2001-5, applies to all conventional agricultural pesticides (*i.e*., herbicides, fungicides, bactericides, insecticides and acaricides). The updates in PR Notice 2016-X focus on pesticides labels and are aimed at improving information about how pesticide users can minimize and manage pest resistance. Updates fall into the following three categories: (1) additional guidance to registrants and a recommended format for resistance-management statements or information to place on labels; (2) references to external technical resources for guidance on resistance management; and (3) instructions on how to submit changes to existing labels in order to enhance resistance-management language.

Draft PR Notice 2016-XX, which only applies to herbicides, communicates EPA's current thinking and approach to address herbicide-resistant weeds by providing guidance on labeling, education, training, and stewardship for herbicides undergoing registration review or registration (*i.e*., new herbicide actives, new uses proposed for use on herbicide-resistant crops, or other case-specific registration

actions). It is part of a more holistic, proactive approach to slow the development and spread of herbicide-resistant weeds and prolong the useful lifespan of herbicides and related technology.

To view and provide comments on these draft Pesticide Registration Notices and any supporting material, please visit EPA-HQ-OPP-2016-0242 for PRN 2016-X and EPA-HQ-OPP-2016-0226 for PRN 2016-XX. **The comment period for each closes on August 2, 2016**. In the future, EPA plans to evaluate other types of pesticides (*e.g.*, fungicides, bactericides, insecticides, and acaricides) to determine whether and what guidance may be appropriate for these types of pesticides.

Weed Science Societies' Opposed to EPA's Proposed Tank Mix Prohibitions

The National and Regional Weed Science Societies also commented on the tank mix prohibitions proposed by EPA for two new herbicide registrations: 1) dicamba-tolerant cotton and soybean; and 2) halauxifen-methyl. The comment period for both those registrations closed at the end of May. EPA is considering whether they will continue to propose tank mix prohibitions on all new registrations and re-registrations going forward due to uncertainty about potential tank mix synergism effects on non-target organisms.

The National and Regional Weed Science Societies are opposed to the proposed tank mix prohibitions because the benefits of tank mixing outweigh any "uncertainty" about potential tank mix synergism effects on non-target organisms. EPA recognizes the benefits from tank mixes and states: "*The practice of tank mixing can result in **significant economic benefits to the grower** by allowing control of a wider variety of pests in a single application without incurring the expense of sequential applications. Additionally, by reducing the number of visits to the agricultural field, the grower is also **reducing fossil fuel use** and emissions from large agricultural equipment, **as well as the potential exposure to pesticides** that can result from multiple visits to the same area being treated. It is also widely accepted that the practice of **mixing products with different modes of action is essential to the management of weed resistance**. Because weed resistance is known to have a very costly impact to overall crop yields, which in turn negatively impacts growers' harvests and the price of commodities to the consumer, tools that aid in the prevention of resistance are considered to be a very important benefit to agriculture*".

Yet, despite these recognized benefits, EPA has proposed a tank mix prohibitions for both dicamba and halauxifen-methyl. In addition, EPA's "uncertainty" about the effects of herbicide synergism on non-target organisms is a divergence from the 2013 National Academy of Sciences (NAS) report: "Assessing Risks to Endangered and Threatened Species from Pesticides". The NAS report is the gold standard for how EPA and the Fish and Wildlife Service are supposed to make endangered species assessments. The NAS report recognizes that "*The toxicity of a chemical mixture probably will not be known, and it is not feasible to measure the toxicity of all pesticide formulations, tank mixtures, and environmental mixtures. Therefore, combined effects must be predicted on the basis of models that reflect known principles of the combined toxic action of chemicals*". The 2013 NRC report emphasizes that the complexity of assessing the risk posed by chemical mixture (i.e. tank mixing herbicides) "**should not paralyze the process**".

The National and Regional Weed Science Societies comments are at: http://wssa.net/wp-content/uploads/Weed-Science-Societies-comments-on-dicamba.pdf and http://wssa.net/wp-content/uploads/Weed-Science-Societies-comments-on-Halauxifen-methyl.pdf

Supreme Court Says Landowners Can Challenge Feds in CWA Permit Determinations

On May 30, the Supreme Court ruled unanimously against the government in a case deciding when landowners can challenge certain decisions about water permits in court. The case, *Army Corps of*

Engineers v. Hawkes Co. Inc., centers on a North Dakota peat mining company that wants to challenge a government determination that its mining plans would require costly Clean Water Act permits.

The broader issue in the case was whether the Army Corps of Engineers' "jurisdictional determinations" about whether permits are required represents "final agency actions" that can be challenged in court. Property rights advocates and industry contend that landowners should be able to contest those decisions in court; the government disagrees.

Chief Justice John Roberts wrote the court's opinion, finding that a jurisdictional determination approved by the corps is indeed a "final agency action" that is subject to judicial review. The justices seemed skeptical of the government's position when they heard oral arguments in the case in March.

It's the latest wetlands case the Obama administration has lost in recent years. In 2012, the high court ruled 9-0 against the government in another important case where property owners sought to challenge EPA enforcement actions in court. Click here to read the Supreme Court opinion.

"NPDES Fix" Bill Passes House, But Stripped Out of Zika Response Conference Agreement

On May 24, the House passed H.R. 897, the Zika Vector Control Act (formerly the Reducing Regulatory Burdens Act- a.k.a. the "NPDES Fix" bill) by a vote of 258-156. This is the 3rd time in five years the House has passed this bill. This version of H.R. 897 contains the same language as the original legislation, but included a 2 year sunset provision that we oppose. The Zika Vector Control Act (H.R. 897) was rolled into H.R. 2577, which also includes the Military Construction and Veterans Affairs Appropriations Bill as well as the Zika Response Funding bills.

The National and Regional Weed Societies joined over 100 other organizations to urge House and Senate Conferees to support the inclusion of H.R. 897 in the final conference agreement for H.R. 2577 and to remove the sunset provision. The good news is that part of the NPDES fix language made it into the House – Senate Conference Agreement that includes a $1.1 billion Zika virus response package and the fiscal 2017 Military Construction-VA appropriations bill. The bad news is that there is only a waiver from NPDES permits for mosquito control, not aquatic weeds. Plus the waiver is only for 180 days, and then sunsets. The House did pass the conference agreement (H.R. 2577), but then it blew up in the Senate, plus the president promised to veto it. In other words, it's back to the drawing board.

FY 2017 Ag Appropriations

The House and Senate Agriculture Appropriations Subcommittees released their proposed budgets for FY 2017. In both budgets, many of the USDA agencies that receive funding for weed research and management were proposed to receive modest increases compared to FY 2016. Agencies with proposed increases include: APHIS, ARS, NIFA, and NRCS. Within NIFA, the AFRI Competitive Grants program, both the House and Senate recommended an increase of $25 million over the FY 2016 appropriation of $350 million. However, most of the other NIFA line items relevant to weed science were held constant to the FY 2016 levels. This included Hatch Act, McIntire-Stennis, Smith Lever b & c, IR-4, SARE, and Crop Protection and Pest Management.

	FY 2014	FY 2015	FY 2016	FY 2017 House	FY 2017 Senate
USDA AGENCY	---------- $ millions ----------				
ARS	1,122.4	1,132.6	1,143.8	1,151.8	1,177.9
ERS	78.0	85.3	85.3	86.0	86.7
NASS	161.2	172.4	168.4	168.4	169.6

NIFA	1,277.1	1,289.5	1,326.4	1,341.1	1,363.7
APHIS	821.7	871.3	894.4	930.9	939.2
NRCS	812.9	846.4	850.8	855.2	864.4
NIFA Programs					
Research and Education Activities	772.5	786.8	819.6	832.8	851.4
-Hatch Act (Experiment Stations)	243.7	243.7	243.7	243.7	243.7
-Cooperative Forestry Research	33.9	33.9	33.9	33.9	33.9
-AFRI Grants Program	316.4	325.0	350.0	375.0	375.0
-Sustainable Ag Res. & Education	22.6	22.6	24.6	24.6	27.0
-IR-4 Program	11.9	11.9	11.9	11.9	11.9
Extension Activities	469.1	471.6	475.8	477.3	476.2
-Smith-Lever Act, Section (b) & (c)	300.0	300.0	300.0	300.0	300.0
Integrated Activities	35.3	30.9	30.9	30.9	36.0
-Crop Protection & Pest Mang't	17.1	17.2	17.2	17.2	20.0

There are also various instructions and recommendations included in both the House and Senate Ag Appropriations bill related to weed science and pest management in general.

Here are five items that are mentioned in the House Ag Approps bill:

1) **Office of Pest Management Policy**—The Committee commends the Office of Pest Management Policy for its work providing the Department, federal agencies, producers, and other interested stakeholders scientifically sound analysis of pest management issues important to agriculture, especially methyl bromide transition, **pesticide resistance management**, and the development of antimicrobials to combat citrus greening. The Committee encourages the Under Secretary to better utilize this office and directs ARS to continue to support its vital work.

2) **Invasive Species**—The Committee recognizes the threats posed by invasive plant species and the need to protect, restore, and enhance native plants, including those that are endangered or threatened. The Committee encourages ARS, the Natural Resources Conservation Service (NRCS), and NIFA to support the research, education, and conservation of native plants.

3) **Cheat Grass Eradication**—The Committee encourages NRCS to continue to assist farmers and ranchers to eradicate, control, and reduce the fuel loads associated with cheat grass and to collaborate with ARS, as appropriate, on research related to cheat grass.

4) **Herbicide Resistance**—The Committee reminds NRCS of the challenges many producers are facing due to the spread of herbicide-resistant weeds and encourages it to ensure agency staff, partners, and producers are aware of conservation practice standards, conservation activity plans to address herbicide-resistant weeds, and financial assistance available through conservation programs to assist producers in their efforts to control these weeds.

5) Milkweed—The Committee is concerned about the rapid decline in milkweed for monarch butterfly habitat. The Committee encourages NRCS consider the increased benefits of restoring milkweed for monarch habitat in fiscal year 2017.

Here are four items that are mentioned in the Senate Ag Approps bill:

1) **Office of Pest Management Policy** - The Committee recognizes the critical role that the Office of Pest Management Policy plays in fulfilling USDA's statutory role in the interagency consultative process under the Federal Insecticide, Fungicide, and Rodenticide Act. The importance of OPMP's mission has increased commensurately with the increased actions undertaken by EPA, and the Committee provides $3,000,000 for OPMP to fulfill its obligations on behalf of USDA.

2) **Research Assistance** - The Committee encourages the Agricultural Research Service to provide direct, place-based assistance to 1862 Institutions in States that do not have Agricultural Research Service facilities to address the research priorities of such States, such as invasive plant species and insects that cause significant impacts to agriculture, aquaculture, and communities in such States and to assist in the development of specialty and horticultural crops to increase food security and expand marketing opportunities for small farmers.

3) **Sage Steppe Restoration Science** - The Committee includes an increase of $1,000,000 for ARS to advance sagebrush habitat restoration science in the Northern Great Basin including cooperative research, testing and deploying precision restoration methods to restore habitat Impacted by significant disturbance such as wildfire and invasive species.

4) **Pollinator Health and Monarch Recovery** - The Committee reiterates its concern for the need to address threats posed to pollinator health, and urges the Department to continue to support the Fish and Wildlife Service's Monarch Conservation Strategy. The Committee directs NRCS to leverage resources, relationships and partnerships, including with non-governmental organizations that are perceived positively by the private land and agriculture communities and that possess experience working directly with agricultural producers and other conservation partners. The Committee recommends the Department continue to support monarch conversation on private lands in fiscal year 2017 and expects to see a multi-year recovery effort undertaken, focusing on the deployment of conservation practices.

FY 2017 Aquatic Plant Control Funding

The Senate Energy and Water Appropriations Subcommittee recommendation for aquatic plant control funding in FY 2017 initially included $9 million in their first markup in March, despite the Army Corp of Engineers not requesting any funding once again. Within the $9 million in funding from the Senate, $4 million was for the Aquatic Plant Control Research Program (APCRP), another $4 million was for the watercraft inspection stations, and $1 million was for monitoring and contingency planning associated with watercraft inspection stations.

The House and Senate both passed the Energy and Water Development and Related Agencies Appropriations Act, 2017 (H.R.2028) in May, albeit with several changes to aquatic plant control funding. In the House version of H.R. 2028, there is only $4 million for the watercraft inspection stations. In the Senate version, there is only $4 million for APCRP. Needless to say, the National and Regional Weed Science Societies will support the Senate version over the House version if we had to choose, but we'd rather see both programs receive $4 million like they did in the FY 2016 appropriations.

During the floor debate in the Senate on H.R. 2028, an amendment by Sen. John Hoeven (ND) that would have blocked the EPA and Army Corps of Engineers WOTUS rule was defeated by a 56-42 vote. They needed 60 votes to invoke cloture and pass the amendment. The amendment also would have

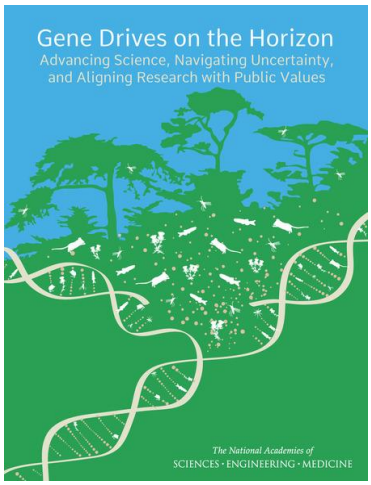
blocked EPA's Interpretive Rule, which narrowed an agricultural exemption for farmers and ranchers under the Clean Water Act.

$286 Million- Cost to Bring a New Crop Protection Product to Market

CropLife America (CLA) recently helped the market research firm, Phillips McDougall, develop a study that shows the overall cost to discover and advance a new crop protection product averages $286 million – up 21% over the previous 5 years. (Link to CLA statement with imbedded report available here: http://www.croplifeamerica.org/cost-of-crop-protection-innovation-increases-to-286-million-per-product/ The biggest driver in that cost increase appears to be regulatory compliance. That statistic demonstrates why it is so important to be sure that US regulatory requirements are assessments of real science and safety advancements, not simply reactions to non-scientific political ideologies.

NAS Gene Drive Report Urges Caution

On June 9, the National Academies of Sciences, Engineering and Medicine (NAS) issued a report titled:



Gene Drives on the Horizon: Advancing Science, Navigating Uncertainty, and Aligning Research with Public Values (2016). The report notes that the technology offers great promise for agriculture, conservation, and public health, but it stresses that the current regulatory system, which includes institutional review boards and environmental impact assessments, is not adequate to address the potentially great risks. It calls for a greater involvement of the public in the early stages of the technology's development and approval for use.

To examine the questions surrounding gene drive research, the report explored seven plausible gene drive case studies that offer practical scenarios on which to base the report's analysis and recommendations. Two of those case studies involved weeds, *Centaurea maculosa* and *Amaranthus palmeri*, both of which I include below.

CASE STUDY 5: Centaurea maculosa - *Plausibility of a Gene Drive Solution*

Spotted knapweed is obligately outcrossing (Harrod and Taylor, 1995), meaning that there is little or no self-fertilization and that gene drives would be able to spread throughout knapweed populations. Another factor that makes it potentially suitable for a gene drive is that the basis for its ability to outcompete native plants is thought to come from the production of a compound called catechin (Thelen et al., 2005), which it exudes from its the roots. Catechin inhibits the germination and growth of native plant species, thereby conferring a competitive advantage to spotted knapweed (Bais et al., 2003).

There are two possible gene-drive approaches to help limit the spread of spotted knapweed, which could potentially be employed together. The first option is to engineer a suppression gene drive by targeting sex-specific genes, thereby biasing gender ratios and facilitating a population crash. The second is to modify the population by targeting the catechin biosynthetic pathway, which in theory would negatively affect the knapweed's ability to compete against endemic plants, although this effect is still debated (Perry et al., 2005). In either case, the rate of spread of either of these gene drives is expected to be slow, because spotted knapweed is a perennial plant that lives for approximately nine years (Zouhar, 2001). In addition, the success of a suppression drive is likely to depend critically on the fertility advantages of sex-modified plants compared to hermaphrodites and also on features such as pollen availability and spatial structure (Hodgins et al., 2008).

CASE STUDY 6: Amaranthus palmeri - Plausibility of a Gene Drive Solution

Palmer amaranth is a likely candidate for gene-drive technology, for five reasons. First, it is an annual plant, so it has yearly sexual reproduction and a rapid generation time. Second, Palmer amaranth and some other members of the genus are dioecious (male and female flowers occur on separate plants (Steckel, 2007), which ensures the outcrossing necessary to spread gene drives. Third, it does not have an extensive seed bank; studies suggest that most seeds do not persist in the soil, so that there is unlikely to be a seed repository that is immune to the gene drive. Fourth, an Amaranthus species has been transformed genetically (Pal et al., 2013), suggesting that it will be technologically feasible to insert gene drives into Palmer amaranth. Finally, Palmer amaranth is wind-pollinated, implying that the eradication of species will, at the very least, not harm insect pollinators.

In theory, Palmer amaranth could be subjected to two types of gene drive. In the first, a modification drive would target the genes that confer resistance to glyphosate and reestablish the population's susceptibility to glyphosate herbicides. The potential targets of this gene drive are known, because the glyphosate herbicide acts by interrupting the function of 5-enolpyruvylshikimate-3-phosphate synthase. In Palmer amaranth, this synthase gene has been duplicated extensively, leading to enzyme overexpression and glyphosate resistance (Gaines et al., 2010). Thus, a candidate gene drive would need to target multiple 5-enolpyruvylshikimate-3-phosphate synthase copies that are scattered throughout the genome. If the gene drive succeeded and susceptibility became fixed, glyphosate could then be used again as a tool to limit Palmer amaranth populations. A second approach would be to build a suppression drive. Although the target and content of such a drive is not yet clear, the fact that there are separate male and female plants implies that there are sex-specific genes that are suitable targets for biasing the sex ratio. Under this approach, the goal would be skew sex ratios until the entire population (or species) collapses.

Lack of Milkweed is Unlikely to be Driving Monarch Decline

The *Oikos Journal* published a Cornell study online on April 27 titled "Linking the continental migratory cycle of the monarch butterfly to understand its population decline". **Abstract**: Threats to several of the world's great animal migrations necessitate a research agenda focused on identifying drivers of their population dynamics. The monarch butterfly is an iconic species whose continental migratory population in eastern North America has been declining precipitously. Recent analyses have linked the monarch decline to reduced abundance of milkweed host plants in the USA caused by increased use of genetically modified herbicide-resistant crops. To identify the most sensitive stages in the monarch's annual multi-generational migration, and to test the milkweed limitation hypothesis, we analyzed 22 years of citizen science records from four monitoring programs across North America. We analyzed the relationships between butterfly population indices at successive stages of the annual migratory cycle to assess demographic connections and to address the roles of migrant population size versus temporal trends that reflect changes in habitat or resource quality. We find a sharp annual population decline in the first breeding generation in the southern USA, driven by the progressively smaller numbers of spring migrants from the overwintering grounds in Mexico. Monarch populations then build regionally during the summer generations. **Contrary to the milkweed limitation hypothesis, we did not find statistically significant temporal trends in stage-to-stage population relationships in the mid-western or northeastern USA. In contrast, there are statistically significant negative temporal trends at the overwintering grounds in Mexico**, suggesting that monarch success during the fall migration and re-establishment strongly contributes to the butterfly decline. Lack of milkweed, the only host plant for monarch butterfly caterpillars, is unlikely to be driving the monarch's population decline. Conservation

efforts therefore require additional focus on the later phases in the monarch's annual migratory cycle. We hypothesize that lack of nectar sources, habitat fragmentation, continued degradation at the overwintering sites, or other threats to successful fall migration are critical limiting factors for declining monarchs.

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