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Agricultural, and Environmental Issues

Stewardship Challenges for New Pest Management Technologies in Agriculture

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Is there one group from the list of stakeholders that is the most disruptive to the adoption of new technologies/practices?

- No one group can be identified as the most disruptive. There have been individuals *within* groups. See: Davis, A. S., and Frisvold, G. B. 2017. Are herbicides a once in a century method of weed control? *Pest Management Science* 73 (11): 2209–2220.
- There is evidence that greater contact with and reliance on Cooperative Extension has a positive impact on adoption of more sustainable practices.
- Based on theory, the people who are likely to be most disruptive to the adoption of new technologies are those who perceive costs from detrimental side effects or losses from shifting away from the old technologies, or who are averse to taking financial or other risks associated with the new technologies.

To what extent did "area-wide" programs, mapping pest locations and population levels, and modeling of effective responses come up in your discussions with stakeholders?

- Area-wide programs were of great interest in many of the regions, especially when participants were aware of successful programs. Since the listening sessions were not focused on specifics such as mapping or modeling, those topics did not come up.

What are best practices and ideas to address techno-optimism and create a sense of urgency to protect technologies before effectiveness is already critically threatened?

- Research is ongoing, first to look at who are the techno-optimists and second, who do they rely on for information. People “information shop,” that is, they gravitate toward narratives that they want to hear. The idea that a “silver bullet” product is right around the corner so that more fundamental changes in farming practices aren’t needed, is very attractive. If a grower is hearing 10 sources say, “You really need to fundamentally change what you are doing” while the 11th says, “this new product will solve your problem,” that 11th voice has an outsized effect.
- One of the complications in addressing techno-optimism is reconciling the variety of often conflicting messages aimed at farmers and others using pest management technologies. We heard in the listening sessions that this plethora of messages from the



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input supply chain can be confusing and contribute to unrealistic expectations among potential adopters (Schroeder et al. 2017). All the more reason to elevate the role of Extension professionals as purveyors of “objective” information about the technologies.

- As part of a discussion involving multiple stakeholders, an educational element that involves learning about the limits of technology might be useful. Some of us have written about “technological determinism.” Many scientists and engineers unwittingly contribute to a deterministic perspective of technology when they present their discoveries. While understandable, this does contribute to deterministic thinking which in turn can be a foundation for techno-optimism.
- Weeds have evolved to cope with machine weeding, hand weeding, and crop rotations. Insects have shown similar adaptive capacity. With any new technology, one needs to consider what type of selection pressure it is creating.

What are the catalysts for initiating an area wide stewardship program like you described?

- There are negative and positive catalysts. On the negative side, there has been insect or weed resistance that was leading to large yield losses and economic costs. The standard chemistries and farm-by-farm approaches were ceasing to be economically viable. The positive catalyst was a high degree of cooperation between input suppliers, pest control advisors, Cooperative Extension, land grant researchers, the USDA, and the EPA. Each of these groups played essential roles in the success of the case studies. A strong scientific basis was needed to address grower concerns whether recommendations would work. Science was also crucial in convincing the EPA that some innovative approaches were indeed consistent with their environmental objectives.
- At the most basic level, the catalyst to pursue areawide stewardship is the recognition that individual uncoordinated efforts will not succeed. The geographical migration of pests across the landscape forces the acknowledgment that negative externalities can and do occur. This recognition comes grudgingly for farmers who pride themselves on taking individual action to solve their problems. But when actions by their neighbors and other community members cause significant negative effects on their farms, there comes a point where the benefits of cooperation outweigh its costs.
- It is important to have interest—buy-in as it were—from stakeholder groups. There is no easy path to doing this, but it could be useful to have some “point persons” whose role would be to communicate with stakeholders and gauge interest.

It seems the findings are largely very pessimistic. Are there any tangible reasons for optimism?

- If you look at the two case studies, these were both great economic and environmental successes. They both demonstrate how resistance *can* be managed and how new technologies can be integrated into more sustainable pest control. The new technologies were not “stand alone” silver bullets, but one of several tools that were needed. The message of the case studies is that (quite impressive) success is (a) possible and (b)



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replicable in different farming systems. It takes a long time and lots of coordination, but payoffs can be large.

- The record of stewarding the new generation of pest management technologies for agriculture has been uneven at best and inadequate in many cases according to recent NRC panel assessments (NRC 2010; NRC 2016). This is not pessimism, but an objective interpretation of facts. Nonetheless, a robust body of science suggests that such deficiencies due to a lack of collaboration have been surmounted in cases around the world, including those documented in this report that lends optimism going forward (Ostrom 2009). Such successes require difficult behavioral change and will take time and resources, but are feasible and in the end more sustainable than hoping for a new silver bullet.
- With respect to insect pests in particular, there is good reason to be optimistic about new technologies on the horizon that can provide safer and more targeted pest management options. However, as with the adoption of all new agricultural technologies, they should not be considered silver bullets, and their sustainability over time will be inevitably be affected by good stewardship practices.
- Being overly “optimistic” (all we need is a vaccine and the coronavirus problem will disappear) or “pessimistic” (nothing we try will work) are both “deterministic” ways of thinking. We need a more balanced approach to problem solving. One that recognizes that there is no single solution or permanent answer.

Do systems exist at the local level to bring all the stakeholders together to meet the inclusivity necessary to solve problems? Or as in your tumbleweed example, do these groups spawn ad-hoc when the situation becomes out of control?

- From a grower perspective, things tend to spring up in an ad hoc way, based on the local problem. What *is* in place is Cooperative Extension and USDA staff and expertise. In the two case studies in the report, expertise from the land grant universities and Cooperative Extension were critical in building up trust and cohesion over time. Technical and financial assistance from the USDA was also critical.
- A significant factor documented in successfully coalescing diverse stakeholders is the presence of a local champion who enjoys the trust and respect of the community (Ostrom 2009). We saw an example of this in Iowa with the fledging Harrison County project where the local leader had assembled a diverse group of stakeholders due to their trust in his leadership. The history of building effective community- based collaborations makes clear the importance of a knowledgeable and sometimes inspirational leader.
- They tend to emerge ah-hoc. That said, there are techniques that can be used to aid these processes.

Any thoughts on how to incent folks to make proactive changes to avoid the development of resistance before it is already a large, financial problem?



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- I've often posed the question "isn't avoiding going out of business an economic incentive?"
- In every case to date that we've examined, a major catastrophe was either impending or already present, or the potential for catastrophe was very clearly articulated. Change is difficult to incentivize unless the threat is clearly understood, and the magnitude is catastrophic.
- In terms of positive incentives, Maryland and Delaware have state cost-share programs to encourage cover crop adoption and adoption in those two states are much higher than the national average. So, there might be more that could be done with USDA's EQIP program to provide cost sharing for resistance management practices.
- The science literature for other industries makes clear that the tangible threat of regulation is a powerful incentive to proactive environmental management by firms (e.g., Ervin et al 2013). Ideally the threat does not have to become real to stimulate enough voluntary action that negates the need for regulation. Under such preemptive action, firms have an incentive to reach environmental targets that might otherwise only be feasible with government regulation.

Do we need more research on how to get behavioral change so you can get all the stakeholders to agree and work towards a common purpose?

- Yes, indeed! What our team has clearly identified is that trans-disciplinary research that crosses the physical, biological, and social sciences will be required if we sufficiently address these wicked issues.
- Efforts to promote "behavioral change" (I am connecting here to where this idea is connected to the notion of "social marketing") are both scientifically and ethically dubious. It is impossible to promote any kind of specific – or "desired" – behavior(s). That said, one can seek to promote change that responds to social problems. As noted during the webinar, such efforts are more likely to succeed if they involve a bottom-up approach that incorporates various stakeholders and perspectives.

Are there lessons that can be learned about cooperative action that has been implemented for sharing information and coordination to address impacts on pollinators and protection from pesticide sprays?

- See: Ervin, D.E., and G.B. Frisvold. 2016 Community-based approaches to herbicide-resistant weed management: lessons from science and practice. *Weed Science* 64.SP1 (2016): 609-626. A point in this article is that there are institutions and a history of successful cooperative action. So, one doesn't have to reinvent the wheel to develop programs. We drew on historical experiences of pest eradication programs, USDA-ARS areawide programs (which I think is a great framework) and various invasive plant control programs. I am not aware of programs addressing pollinator impacts from these, but many of the lessons and methods should apply.



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For Dr. Shaw: How we need to better train new generation agricultural producers to sustain the diversity of beneficial species (pollinators, decomposers, parasitoids and predators, etc.) for better agriculture production, environment and human health.

- The challenge of diversifying agriculture to foster more resilient socio-ecological systems is real and deserves high priority in educational and Extension programs. Farmers face real constraints in achieving diversification, including government payment and assistance programs that reward a narrow set of agricultural enterprises that spawn less diversity. A strong body of science supports the need for diversity in ecological systems to foster resilience and overcome unexpected shocks to those systems. The corollary for social systems likely holds as well. Training a new generation of agricultural producers and other professionals in these system dynamics should be a very high priority.

Did they see that beginning farmers tend to see stewardship differently than those who are more established? If so, are there opportunities to encourage practices within the Farm Bill that are directed at beginning farmers?

- Some economic theory has suggested that beginning farmers have longer time horizons and so might be more likely to adopt conservation or resistance management practices.
- Another argument is that, as farmers grow in experience, they become more knowledgeable and confident in farming and so, more comfortable with innovating.
- Aside from theory the empirical evidence about farm experience and adoption of stewardship practices is mixed.
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