Iowa Soybean Research Center Progress Report for Year 2
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Year 2 Funding period: Oct 1, 2017 - Sep 30, 2018; Project Period Oct 1, 2016 – Sep 30, 2019
Report date: September 30, 2018
Funding amount: $25,000 for year 2; $75,000 over three years
Project Title: IMPLEMENTATION OF THE IOWA PEST RESISTANCE MANAGEMENT PLAN

Progress of Work (Project Summary):
The proposal titled, "Implementation of the Iowa Pest Resistance Management Plan" was awarded funding on May 8, 2017. This three-year project, which was back dated to October 1, 2016, supports the management, coordination and accountability to implement community-based pest resistance management as described in the Iowa Pest Resistance Management Plan (IPRMP). Progress during the second half of Year 2 is consistent with the Progress Report submitted on October 24, 2017 and the approved three-year proposal. Over the course of the three-year project, the Iowa Corn Growers Association and the Iowa Farm Bureau Federation are each providing $75,000 ($150,000 combined). We continue to work with the pest management technology providers through the Insecticide Resistance Action Committee, Herbicide Resistance Action Committee and the Agriculture Biotechnology Stewardship Technical Committee with the intention of securing funds to match the support provided by ISA, ICGA and IFBF. Thus far they have contributed $77,500. We also received a grant of $50,000 from the North Central IPM Center.

Since the October 24, 2017 progress report, the following milestones have been met (milestones since March 2018 in **bold**):

- Team leads, program manager, and project participants for the four pilot projects– Palmer amaranth and herbicide resistant weeds in Harrison County; herbicide resistant waterhemp in central Iowa; soybean aphid resistance to pyrethroids in northern Iowa; and western corn rootworm resistance to Bt in northeast Iowa– held meetings to gain knowledge and participation, assess current practices, and brainstorm strategies.
    - Palmer amaranth and herbicide resistant weeds in Harrison County- Five meetings were held during this reporting period with project participants from Iowa Corn Growers Association, Iowa Farm Bureau Federation, Midstates Bank, Farm Credit Services of America, Heartland Coop, ISU Extension and Outreach, Agriland FS, Monsanto, USDA FSA, BASF, and local farmers. Farmer cooperators were recruited for field demonstration trials, which will involve three soybean sites (two tilled, one no-till) and one corn site. Replicated trials will demonstrate effect of row width and comprehensive herbicide programs on weed management in tilled soybeans and corn and no-tillage soybeans. Herbicide treatments will be applied by a hired custom applicator. Two field days are planned to publicize the trials and project and further increase visibility. A flyer (attached) was created to highlight the Harrison County Pilot Project and the Iowa Pest Resistance Management Program for local distribution. The Harrison County pilot project is the most mature and robust of the projects at this point in time. This can be attributed to the presence of a motivated, dedicated local champion in addition to the fact that this project had a comprehensive team in place since spring 2017, earlier than any of the other projects.

Since March 2018, six meetings have been held with project participants from stakeholder organizations. Replicated trials were implemented with cooperators at four sites- three soybean sites (two no-till and one tilled) and one corn site. Ten comprehensive herbicide programs were applied by a custom applicator (DM Crop Research). Two field days were held: one at the corn site on June 18th, the other at one of the no-till soybean sites on July 13th. Attendance at the first field day was modest. Thirty-five people attended the second field day, an increase we attribute to increased promotion of the event and hiring the Iowa Cattlemen to grill. Funds to hire the Iowa Cattlemen were generously provided by Midstates Bank and FCSA. In addition to the field demonstrations, attendees received tutorials on Palmer amaranth identification, and results of weed screenings for herbicide resistance. A video was produced to document the soybean field day to be used for project promotion and can be viewed at https://www.youtube.com/watch?v=ydTzOFrZREY&t=7s. On August 2nd, we had the opportunity to brief US EPA and USDA representatives about the Iowa Pest Resistance Management Program and the Harrison County pilot. The Harrison County pilot team presented results of the field trials and promoted the project at a Pre-Harvest Crop Fair in Dunlap on September 18th as well.

- Herbicide resistant waterhemp- Seven meetings have been held with participants from DuPont Pioneer, Dow Agrosciences, Syngenta, Monsanto, Key Coop, Heartland Coop, ISU Extension and Outreach, and Hertz Farm Management. Farmer cooperators are being recruited for field trials to demonstrate effectiveness of herbicide resistant management strategies. A flyer was created and provided to Iowa Farm Bureau for use at the IFBF Young Farmer conference to increase visibility and gain participation with this key farmer demographic.

  Since March 2018, six meetings were held with team members and local stakeholders. The project was promoted at an Extension Herbicide Resistance field day in June. Numerous discussions were carried out with local cooperators concerning on farm field trials, but due to a late Spring and other concerns all cooperators declined involvement. Additional progress for this project has been hampered by retirements of key area leaders, lack of commitment by technology providers, and unsuccessful attempts to obtain commitment and local leadership.

- Soybean aphid resistance to pyrethroids- Discussions have been carried out involving Iowa Soybean Association (ISA) directors April Hemmes, Suzanne Shirbroun, and Brent Renner and former ISA President Wayne Fredericks. Among the topics of discussion were the interaction between fungicide applications and the prophylactic application of insecticides, as well as a perception held by some farmers of an interaction between the stresses induced by soybean cyst nematode and soybean aphid. Discussions have also been held with University of Minnesota Extension and research personnel on potential collaboration.

Discussion and contact with Iowa Soybean Association directors as indicated above has continued. Discussions with growers and agronomists have indicated that soybean aphid resistance is fairly low on the hierarchy of concerns for growers, well below such issues as weed management and trade issues. Increasing grower awareness and recognition of the risk poses by pyrethroid resistance in soybean aphid remains a challenge.

- Western corn rootworm resistance to Bt traits- Five meetings have been held since late summer 2017 involving representatives from DuPont Pioneer, Iowa Corn Growers Association, ISU Extension, Schneider's Milling, SilverEdge Coop, Innovative Ag Services, independent crop consultants, and local farmers. A survey of current management practices and awareness of Bt resistance is currently being finalized for distribution. Educational materials were produced and disseminated at the Hawkeye Farm Show and the NE Iowa Research Farm annual meeting. Educational materials were also developed and provided to Terry Basol, ISU Extension agronomist for Region 4, and Kristine Schaefer, ISU for inclusion in Pesticide Applicator Training sessions. Approval was sought and received from the Agriculture Biotechnology Stewardship Technical Committee (ABSTC), and the specific companies that are members of ABSTC, to share information with farmers, crop advisors and other partners that the value of future RNAi technology is dependent upon the stewardship of current Bt traits. This 'information push' was initiated based on discussions with farmers and crop advisors who indicated this issue was not widely known and that it raises the stakes for implementing effective corn rootworm resistance management to existing Bt traits.

  Efforts to identify the best location and team for this project continue. A meeting was set up in Fayette County to discuss Bt resistance and the potential of a project in Delaware or surrounding counties. Delaware is being targeted due to its high frequency of continuous corn, history of Bt resistance, and reported unexpected damage cases concerning cry 34/35. A statewide grower survey of management practices and awareness of Bt resistance was conducted to inform future project directions and is currently under evaluation.

- Outreach and communication from October 2017 to March 2018 included:

  Five presentations

  - The Iowa Pest Resistance Management Plan: A community-based approach to address pest resistance in Iowa. Iowa State University Integrated Crop Management Conference. Ames, IA. November 29-30, 2017.
  - Iowa Pest Resistance Management Program. Iowa Soybean Association Board Member Event. Ames, IA. January 31, 2017.
  - Iowa Pest Resistance Management Program. American Society of Farm Managers and Rural Appraisers- Iowa Chapter 2018 Annual Meeting. Ames, IA. February 1, 2018.
  - Iowa Pest Resistance Management Program and the Resistance Management Specialty (RMS): Opportunities for CCAs. Agribusiness Association of Iowa Annual Showcase. February 13-14, 2018.

- Iowa Pest Resistance Management Program. Iowa State Sustainable Agriculture Colloquium. March 28, 2018.

One organizational meeting

- Roundtable Discussion: Managing Pesticide Resistance in Iowa. Iowa Institute for Cooperatives Office, Ames, IA. January 26, 2018.

One newspaper article

- Iowa State University leads Harrison County Project to Combat Weeds Resistant to Herbicides. Missouri Valley Times, March 13, 2018.

One webinar

- Iowa Pest Resistance Management Plan. Recorded December 20, 2017. https://www.iowafarmbureau.com/Article/Webinar-Iowa-Pest-Resistance-Management-Plan

One extension publication

- The Iowa Pest Resistance Management Plan: A community-based approach to address pest resistance in Iowa. Proceedings of the 29th Annual Integrated Crop Management Conference. Iowa State University, Ames, IA. November 29-30, 2017.

One press release

- Harrison County Project to Combat Weeds Resistant to Herbicides. February 13, 2018. https://www.cals.iastate.edu/news/releases/harrison-county-project-combat-weeds-resistant-herbicides

One blog post

- EPA Releases Guidance on Slowing Pest Resistance. November 14, 2017 https://www.ipm.iastate.edu/epa-releases-guidance-slowing-pest-resistance

Outreach and communication efforts from March 2018 through September 2018 included:

Six presentations

- **Pre-Harvest Crop Fair. Dunlap, IA. September 18, 2018**
- **Iowa Farm Bureau Federation Field Crops Advisory Committee. Ames, IA. August 7, 2018.**
- **EPA Tour. Logan, IA. August 2, 2018**
- **Iowa Pest Resistance Management Program Update for Iowa Farm Bureau Federation. (Recorded). Ames, IA. July 30, 2018.**
- **Herbicide Resistance Field Day. McCallsburg, IA. June 12, 2018.**
- **Iowa Pest Resistance Management Program. Iowa State Sustainable Agriculture Colloquium. March 28, 2018.**

Seven articles

- **Iowa Corn Roots. Tackling Pest Resistance in Iowa. pg 12-14. September, 2018. https://issuu.com/iowacorn10/docs/final_roots_magazine_b7637fe1904dc3/12**
- **Events in Harrison County Highlight Pest Resistance Management Efforts. Iowa State University Integrated Pest Management. August 30, 2018. https://www.ipm.iastate.edu/events-harrison-county-highlight-pest-resistance-management-efforts**
- **ISU offers July crop clinics, field days. Wallaces Farmer. July 11, 2018. https://www.wallacesfarmer.com/crops/isu-offers-july-crop-clinics-field-days**
- **Weeds Are Winning the War against Herbicide Resistance. (IPRMP mention). Scientific American. June 18, 2018. https://www.scientificamerican.com/article/weeds-are-winning-the-war-against-herbicide-resistance1/**
- **Weed Management Field Day to be Held in Harrison County July 13. Iowa State University Integrated Pest Management. June 20, 2018. https://www.ipm.iastate.edu/weed-management-field-day-be-held-harrison-county-july-13**
- **Weed Management Field Day to be Held in Harrison County June 18. Iowa State University Integrated Pest Management. June 7, 2018. https://www.ipm.iastate.edu/weed-management-field-day-be-held-harrison-county-june-18**
- **Iowa State University leads Harrison County project to combat weeds resistant to herbicides. Missouri Valley Times News. April 29, 2018. http://www.enterprisepub.com/movalley/news/iowa-state-university-leads-harrison-county-project-to-combat-weeds/article_e3ce0aec-4969-11e8-8e1d-e7afcc51a6ce.html**

One video

- **Harrison County Herbicide Resistance Project - 2018 Field Day. Published September 11, 2018. https://www.youtube.com/watch?v=ydTzOFrZREY&t=7s**

Looking forward to year three of the project, the project manager and pilot project leads will continue to meet with local stakeholders and build pilot project teams to include a broad cross section of stakeholders. Project teams will work towards develop and implement work plans for the 2018 season. Outreach efforts will continue to expand visibility of the Iowa Pest Resistance Management Project and pilot efforts. Project manager will continue to seek external funding for program and pilot projects. Communication efforts will be distributed locally and statewide, and will publicize progress made by pilot projects. The IPRMP website, www.ProtectIowaCrop.org, will be updated and expanded with informational resources, updates, and communication pieces regarding program progress. Specific goals for each pilot project for year three include:

- Palmer amaranth and herbicide resistant weeds in Harrison County
  - Assess year two work plan, including successes and areas for improvement
  - Work to expand visibility in county and continue to expand participation
  - Plan and implement 2019 field activities and demonstrations

    - Organize two field days to highlight corn and soybean field trials
    - Produce communication pieces to publicize the field trials and their results
- Herbicide resistant waterhemp- Central Iowa
    - Expand project team by continuing to reach out to under-represented local stakeholders.
    - Increase local leadership of pilot project by team members.
    - Implement field trials to demonstrate resistance management practices effective for managing resistant waterhemp.
    - Create news article(s) and press releases to publicize the waterhemp pilot project and IPRMP in local community.
- Soybean aphid resistance to pyrethroids
    - Continue discussions with stakeholders to formulate best tactic for project potentially involving pyrethroid resistance, fungicide use, and SCN.
    - Identify opportunities for collaboration with stakeholders from neighboring states.
- Bt resistance in Western corn rootworm
    - Expand pilot project team in Bremer County to incorporate under-represented stakeholder groups.
    - Continue efforts to initiate project in Delaware County
    - Increase local leadership of pilot project by team members.
    - Identify and take advantage of all opportunities for grower education and raising awareness of Bt resistance and identified knowledge gaps
    - Distribute survey of current management practices and awareness of Bt resistance to obtain an accurate picture of baseline practices and understanding.

The project team also submitted a letter of intent for a USDA grant to assess socio-economic factors that influence the formation of community-based pest resistance management. USDA accepted the letter of intent; a full proposal is due to USDA by October 22, 2018. The letter of intent is appended to the report. The proposal builds from the four pilot projects in the IPRMP. Letters of support in the grant proposal will include those from the Dean of the College of Agriculture and Life Sciences, the Vice President for Extension and Outreach and numerous faculty. In addition, the Iowa Soybean Association, the Iowa Corn Growers Association, the Iowa Farm Bureau Federation, Institute of Iowa Cooperatives, Agribusiness Association of Iowa, Insecticide Resistance Action Committee, Herbicide Resistance Action Committee, and Agricultural Biotechnology Stewardship Technical Committee have provided/are providing letters of support. The proposal will be for $300K over three years.

Key Personnel

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Program Area and Program Area Priority

Crosscutting Programs- Critical Agricultural Research and Extension (CARE)
Agriculture economics and rural communities

Title: Assessment of the Socio-Economic Factors Impacting Adoption of Voluntary Pest Resistance Management by Rural Communities

Rationale: The increasing spread of pesticide-resistant weeds, insects, and pathogens is threatening long-term farm profitability. Pesticide resistance is a "wicked problem" with social, economic, and biological uncertainties contributing to multifaceted barriers for action[1], despite prior investments in basic and applied research. When resistant pests cross farm boundaries, the notion that community-based resistance management programs will succeed is compelling, based on economic theory and a limited number of insect eradication programs[2]. Much has been written on voluntary community-based pest resistance management, but little has been tried in practice[1,2]. Lack of adoption and reports of pest management failures are also leading to increased regulatory oversight[3,4]. We propose an integrated project to assess 'on the ground' community-based, resistance management efforts and transform weed science, entomology, and socio-economic research into practical guidance.

Goal: Inform policy design for community-based, pest resistance management.

Specific Objectives:
1. Quantify socio-economic and agronomic factors that influence adoption of practices.
2. Provide recommendations that facilitate community-based resistance management.

Approach: This integrated project will involve four unique community-based efforts recently initiated under the Iowa Pest Resistance Management Program[5], a collaborative, multi-organizational effort, supported by Iowa State University Extension. The community projects address management practices for resistant waterhemp, Palmer amaranth, western corn rootworm, and soybean aphids in four locations across Iowa. Social factors influencing community building (e.g., individual traits, existing community cohesiveness and history of engagement, structure of farming operations) and perceived economic gains[6] associated with alternative pest management decisions will be assessed as a function of pest mobility[7].

Impact and Outcomes: This project will document pest biology and socio-economic factors influencing adoption of community-based resistance management programs. Working through the North Central IPM Center, results will be shared with University researchers, extension agents, and producers to support additional community efforts. Peer-reviewed articles, extension publications, and farm press will help inform Federal policy makers and producer groups of the economics of voluntary, community-based pest resistance management.

Citations: 1. Gould et al. (2018) Science 360: 728-732; 2. Ervin and Frisvold (2016) Choices 31(4); 3. EPA (2016) EPA-HQ-OPP-2014-0805-0094; 4. EPA (2017) PRN 2017-1,2; 5. The Iowa Pest Resistance Management Plan (2016) www.ipm.iastate.edu/files/iprmp/iprmp.pdf; 6. Rosburg and Menapace (2018) J Agric Res Econ 43: 1-S2; 7. Miranowski and Carlson (1986) National Academy Press, pp. 436-448.