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Item No. 1 of 1

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**GRANT AMT:** \$420,636

**INVESTIGATOR:** Doohan, D. J.; Ernst, S.; Wilson, R.; Stinner, D.; Parker, J.; Tucker, M.; Gibson, K.; Smith, R.; Gallandt, E.; Riemens, M.

**PERFORMING INSTITUTION:**

Horticulture and Crop Science  
OHIO STATE UNIVERSITY  
1680 MADISON AVENUE  
WOOSTER, OHIO 44691

***MENTAL MODELS AND PARTICIPATORY RESEARCH TO REDESIGN EXTENSION PROGRAMMING FOR ORGANIC WEED MANAGEMENT.***

**NON-TECHNICAL SUMMARY:** Despite recent USDA and land grant university engagement with organic producers, most still rely on informal farmer-to-farmer networks, the popular literature, and perceived experts for production information. Many organic farmers have not embraced practices known to mitigate ecological imbalances and contribute to long-term farm sustainability. Continued growth of organic farming will depend on efficient delivery and acceptance of research-based information. The long-term goal of our team is to facilitate full integration of scientific knowledge and technology into organic farming practice. We hypothesize that barriers to learning can be overcome through audience-specific educational programs that have been informed by in-depth understanding of what organic farmers' know and believe along with their attitudes and current practices. We will 'lift the rug' obscuring the barriers to effective broad-based knowledge transfer to organic farmers by using a mental models approach to address the relentless problem of weed management. Without better understanding of what and how growers think, increasing scientific knowledge about managing weeds will not efficiently facilitate growth in organic farming. This research fills a critical gap in our comprehension of the knowledge, beliefs, perceptions, values and practices of organic farmers. Understanding how they make decisions will allow us to design educational programs that match the needs of various farmers who may operate under widely divergent philosophical and economic models. Extension educators will be equipped to deliver these programs within a participatory environment that engenders trust and behavioral change. The research will yield biophysical information relating how the farmers' different cognitive processes impact weed management strategies being used, and the outcomes in the field. In lieu of inventing new weed control procedures our goal in this long-term project, for which we request 48 months of funding, is to understand and then dismantle knowledge-based, social, and economic barriers to optimal adoption of ecologically-based practices already known to control weeds. We expect to produce immediate and tangible recommendations on how to broadly promote adoption of optimum weed management practices across diverse communities of organic producers. We anticipate that this knowledge will also be applicable to other disciplines educating organic producers.

**OBJECTIVES:** The projects long-term goal is to understand and then dismantle knowledge-based, social, and economic barriers to optimal adoption of current scientifically validated, ecologically-based practices already known to control weeds. Outreach will occur continuously as the project team engages growers, extension educators, and private crop advisors in participatory mental models and biological research, and development and testing of redesigned extension programming. Focused outreach opportunities will occur

as the team develops and participates in the eOrganic Community of Interest focused on crop rotation, during the iterative design, delivery, and evaluation of redesigned extension programs, and through presentations made at grower organization and scientific meetings. Specific objectives are: 1. Determine the knowledge, beliefs, perceptions, and attitudes that underlie weed management practices and outcomes amongst organic farmers in Ohio, Indiana, California, northern New England, and The Netherlands. The primary expected outcome from this research is comprehensive knowledge about what farmers are doing to control weeds, why they do the things they do, and how effective these practices are. (Years 1 & 2). 2. Establish a learning community of growers, researchers and extension educators within the eOrganic Community of Practice to conduct case-study research on working farms, and outreach on the benefits of crop rotation for weed management. Tools and capacity to increase understanding of the ecological effects of crop rotations on weed communities will be developed through this aim. (Year 2 & 3). 3. Develop, disseminate, and evaluate the impact of differentiated educational programs and communication strategies designed to encourage adoption of scientifically-validated weed management practices for organic farming. The primary expected outcome from this research is deeper knowledge about educational orientations, preferences and behaviors of organic farmers and the development of differentiated educational programs that fulfill the perceived information needs of various grower segments. (Year 3 & 4).

**APPROACH:** 1. Determine the knowledge, beliefs, perceptions, and attitudes that underlie weed management practices and outcomes amongst organic farmers in Ohio, Indiana, California, northern New England, and The Netherlands. Method: Mental models reflecting perspectives on weed control of small, medium and large organic farmers will be prepared. For each cohort we anticipate interviewing 20-30 individuals. Confirmatory surveys will be used to assess quantitatively the frequency of specific beliefs and practices determined through mental modeling. The survey instrument will include items on weed control practice, precise descriptions of actual crop rotations, perceptions of weed biology and weed management, preferred sources and means of receiving information, and attitudinal data related to the strength of such preferences. 2. Establish a learning community of growers, researchers and extension educators within the eOrganic Community of Practice to conduct case-study research on working farms, and outreach on the benefits of crop rotation for weed management. Method: We will establish an online Workspace including participants from the Northeast, Midwest, California and the Netherlands, within eOrganic focused on rotation strategies for managing weeds in organic systems. The Workspace will provide the group with an asynchronous learning community, including opportunities for threaded discussions, drafting of joint documents, and monitoring group progress. Initial efforts will focus on describing current Mental Models and developing survey devices to assess growers' positions along this continuum of understanding. Input variables would include initial weed seed bank estimates (low, moderate, high), tillage, crop sequences, observed periods of weed seedling emergence, and flowering in each sequence, timing of weed control measures and observed efficacy, estimates of weed biomass and seed rain (light, moderate, heavy), crop harvest and residue management. Input of variables from grower case-studies will be supplemented in Year 2 with biophysical data collected from fields managed by farmers across the country and the Netherlands who participated in the mental models data collection. 3. Develop, disseminate, and evaluate the impact of differentiated educational programs and communication strategies designed to encourage adoption of scientifically-validated weed management practices for organic farming. Methods: Characteristics that set organic farmers apart from conventional farmers will be determined through mental models, focus groups and quantitative data collections. Differentiated educational programs will be designed, delivered and evaluated for impact on various grower segments. Evaluation will be conducted with growers and extension personnel. Data will be analyzed for emergent themes from which the researchers will develop differentiated audience profiles. Findings will be used in developing and assessing tailored educational programs and messages in the area of organic weed management.

**PROGRESS:** 2011/09 TO 2012/08

**OUTPUTS:** During Period 3, mental models and biophysical data collections were completed within all cooperating institutions. The expert model (see OAREI Continuation Application FY 2010) that formed the foundation for farmer mental model interviews (n=92) has been submitted for publication to a peer-reviewed journal, and will be followed by additional manuscripts addressing mental models of 2 farmers in CA, ME and the NL. The next and final phase of the perception research will be a national quantitative survey that will be sent to 5000 organic farmers during autumn/ winter 2012/2013. The survey instrument is currently being developed as an outcome of a May 15/16 workshop in which all PDs reviewed the mental models data

from each region. In turn quantitative survey results will be used to validate and quantify the farmer mental models. Biophysical (soil weed seed bank) data collections and a review of weed control practices corresponding to each farmer who participated in mental model interviews are now also completed (Aim 1). These data will be used to inform the mental models through a combined analysis that will take place during Period 4. Specifically this will answer the question, 'How does grower knowledge, perception and attitude affect farm practice and weed control outcomes'. This analysis will enable development of exemplary farmer illustrations that will be used in future teaching opportunities and on the project website hosted at Purdue University (<http://www.ydae.purdue.edu/oarei/index.html>). Additionally, the biophysical data has opened an effective and ongoing communications channel with the farmers in each state enabling us to form the learning community described in the proposal (Aim 2). This will aid the collection of time and cost data in winter 2012/2013. As we continue to interact and learn with this large international community during Period 4 and beyond we anticipate that some farmers will modify their personal mental model leading to behavioral change; in particular, greater acceptance and utilization of scientific information in their decision making process. Dr. Patrick Lillard joined the team members at Purdue as the project's 'message-design specialist'. Dr. Lillard is coordinating activities under Aim 3 across the cooperating locations. The participatory communication approach emerging from our research is being used to develop the 2013 Indiana Small Farm Conference where our educational materials will be showcased. Specific outcomes in Aim 3 will be guided by a communication strategy that is currently in preparation along with a white paper on the participatory communication approach. Dr. Lillard is also coordinating the presentation of relevant outreach products at the MOSES and OEFFA conferences to be held next year in La Crosse, WI, and Granville, OH.

**PARTICIPANTS:** The Ohio State University: Doug Doohan, Professor and Project Director (PD). Jason Parker, Research Scientist and co-PD. Robyn Wilson, Assistant Professor and co-PD. Stan Ernst, Program Manager and co-PD. Gerri Isaacson, Research Assistant. Andy Glaser, Graduate Research Assistant. Sarah Zwickle, Graduate Research Assistant. Marlon Pagan, Post Graduate Intern. University of Maine: Eric Gallandt, Associate Professor and co-PD. Randa Jabbour, Post Doctoral Associate. Purdue University: Kevin Gibson, Associate Professor and co-PD. Mark Tucker, Professor and co-PD. Partrick Lilliard, Post Doctoral Associate. Jose Garcia, Graduate Research Assistant. University of California: Richard Smith, Farm Advisor and co-PD. Wageningen University: Marlene Reimens, Research Scientist and co-PD.

**TARGET AUDIENCES:** This project is targeted to organic farmers and their crop advisors. **PROJECT MODIFICATIONS:** Nothing significant to report during this reporting period.

**IMPACT: 2011/09 TO 2012/08**

The following specific outcomes and impacts were completed in FY 3 of the project. 1. Expert Model paper submitted to Journal of Sustainable Agriculture. 2. New England farmer mental models paper submitted to Weed Research. 3. Technical report Organic Weed Management in Ohio and Indiana: A Report on the Knowledge, Perceptions, and Experiences of Farmers and Experts, presented at the regional Ohio Ecological Food and Farm Association (OEFFA) annual conference 2012 and Midwest Organic and Sustainable Education Service (MOSES) annual conferences. 4. Invited symposium presentation at the North Central Weed Science Society annual meeting on the subject of OH and IN organic farmer's mental models. 5. Poster presentation of OH and IN farmer and expert mental models presented at OEFFA and MOSES. 6. New England and CA farmer biophysical results were presented at the Northeast Organic Farming Association in Burlington, VT. 7. An invited overview of this project was presented at the Canadian Organic Science Conference, Winnipeg, MB. 8. New England biophysical and mental models overview was presented at the 97th Annual Meeting of the Ecological Society of America, Portland, OR (August 2012). 9. Project results to date were presented at the international workshop Improving the Standard and Utility of Weed and Invasive Plant Research, Emigrant, MT. 10. A paper on the effect of cultural and institutional barriers to symmetrical communication between scientists and organic farmers was presented at the 75th Annual Meeting of the Rural Sociology Society (July 2012). 11. Purdue undergraduate students participated in an independent study with project staff in the spring of 2012 and conducted interviews with organic farmers for the development of educational resources.

**PUBLICATIONS (not previously reported): 2011/09 TO 2012/08**

No publications reported this period

**PROJECT CONTACT:**

Name: Doohan, D. J.  
Phone: 330-202-3593  
Email: doohan.1@osu.edu

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