



A perspective on the extension of research-based information to orchard management decision-makers: Lessons learned and potential future directions



Angela N. Gadino^a, Jay F. Brunner^a, Ute Chambers^{a,*}, Wendy E. Jones^a, Steve Castagnoli^b, Vincent P. Jones^a

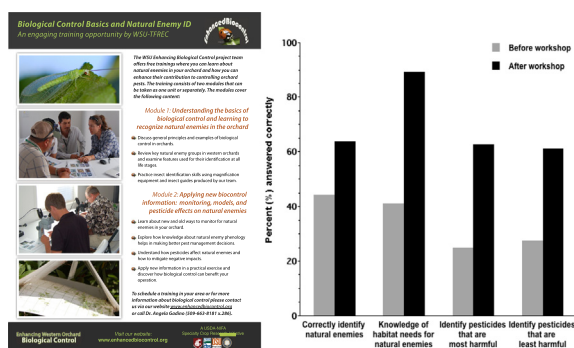
^a Department of Entomology, Tree Fruit Research and Extension Center, Washington State University, 1100 N. Western Ave., Wenatchee, WA 98801, United States

^b Department of Horticulture, Mid-Columbia Agriculture Research and Extension Center, Oregon State University, 3005 Experiment Station Dr., Hood River, OR 97031, United States

HIGHLIGHTS

- Extension of newly generated information was a major element of this project.
- A goal was to have a legacy of information for pest management decision-makers.
- Successes included engaging educational opportunities and a dynamic website.
- Limiting factors of funds and support led to challenges in program implementation.
- Future directions and strategies to address limiting factors are discussed.

GRAPHICAL ABSTRACT



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ABSTRACT

A central element of the Specialty Crop Research Initiative (SCRI) on 'enhancing biological control in western orchards' was to disseminate research-based information generated by the project for adoption and implementation by decision-makers. As the landscape of publicly supported extension and outreach has been changing, our goal was to employ effective and timely strategies that would provide a legacy of project information at relatively low costs. We used various approaches to develop a regional outreach program spanning three states, four institutions, and three crops. Guided by an advisory panel of stakeholders and scientists, our approaches included a simulcast short course, interactive workshops, online media, as well as presentations and print articles. Inevitably, we had to overcome certain challenges and here we share our perspective on the successes, constraints and lessons learned during development and implementation of the project's outreach program. Finally, we consider future directions and strategies that will aid Cooperative Extension in continuing to meet the needs of western tree fruit and nut industries while optimizing available resources.

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1. Introduction

A major component of the Specialty Crop Research Initiative (SCRI) project "Enhancing biological control in western orchards"

was to ensure that research-based knowledge generated by the project was readily available to decision makers in the western US nut and tree fruit industries. This project was conceived and funded during a period when management programs for direct

* Corresponding author.

E-mail addresses: angela.gadino@wsu.edu (A.N. Gadino), uchambers@wsu.edu (U. Chambers).

pests, such as codling moth (*Cydia pomonella*), were transitioning from over 50 years of use of organophosphate insecticides (OPs) to “reduced risk” alternatives and mating disruption (MD). This transition coincided with a period characterized as having increased secondary pest outbreaks and created many new challenges for integrated pest management (IPM) programs (Jones et al., 2009, 2010a).

In an overview of the problem, Jones et al. (2009) suggested that there was a knowledge gap for both researchers and IPM practitioners concerning natural enemies and their function in these systems. The research goals of this project were thus focused on broadening our understanding of natural enemy phenology and biology in western orchards, as well as evaluating the effect of newer pesticide chemistries on a select group of natural enemies. The final objective was to synthesize and transfer both existing and new information, with the hope that decision makers would adopt more practices to conserve natural enemies and re-stabilize pest management programs. With over 625,000 acres of apple, pear and walnut planted in the western US and a combined production value of about \$5 billion (ERS USDA Fruit and Tree Nut Yearbook, November 2013, <http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1377>), there was strong justification to increase practices that enhance biological control in commercial orchards on a large scale.

2. Considerations for grant funded outreach

Cooperative Extension, as part of land grant institutions, typically serves as the link between researchers and stakeholders as information is transferred from one to the other. Historically it was assumed that outreach programs originating from research projects would be supported through the traditional Extension system, but today this expectation is seldom realized. SCRI grants are expected to have a significant outreach portion to transfer information and technology. Yet, one major concern is the loss of information once the grant is completed and there are no longer funds to continue outreach programs. Continued education is necessary as adoption of new information and technology by stakeholders takes time. However, in many cases Cooperative Extension is not able to support and sustain these outreach programs due to reductions in state funding (Jones et al., 2009; Jones et al., 2016). Finally, in a multi-state project the development and implementation of the outreach program needs to be cooperative across all participating states, which can be difficult to coordinate. It was important to consider these factors in order to create a robust outreach program for our project.

We also needed to understand how growers make decisions and their perspectives on implementing IPM and biological control. Surveys for pear and walnut growers were devised by a team that included a rural sociologist, researchers, extension personnel, and industry IPM consultants who served on the project's advisory board (Goldberger, 2010, 2011; Goldberger et al., 2016). Since Washington's apple industry was surveyed extensively during the Pest Management Transition Project (Apple IPM Transition Project, 2007–2010; Goldberger et al., 2011), for this project, we employed less formal follow-up surveys at several industry meetings in 2011–2012. For these inquiries, we used a real-time audience response system (Turning Technologies®, Youngstown Ohio, USA) to gain specific information about biological control from growers and crop consultants. These assessments identified knowledge gaps, evaluated decision-makers' perceptions of biological control practices, and revealed how and where respondents received their information. In turn, survey responses helped to guide the development and methods used in this project's outreach program.

3. Successes in outreach implementation

We utilized both traditional and novel approaches in our information and technology transfer efforts. These included articles published in trade journals, presentations of synthesized project information at industry and professional meetings, interactive educational opportunities, participation in on-farm experiences, a project website (<http://www.enhancedbiocontrol.org>) and production of high quality guides and information resources. Most of these methods were effective at starting the information transfer process and received positive reviews from our stakeholders. Here we highlight aspects of the program that were most successful in addressing industry needs and influencing the adoption of new practices.

3.1. A focus on interactive education

Educational opportunities during this project included a comprehensive two-day short course, two hands-on field day workshops and eight half-day training workshops. The two-day short course was held at three Pacific Northwest locations that were simultaneously linked via video-conferencing technology (Annual Report, 2012; <http://www.enhancedbiocontrol.org>). There were seventy-five attendees who represented a significant portion of apple and pear decision makers in Washington and Oregon. The course contained several presentations focused on using biological control, a natural enemy identification activity, and several case study and discussion sessions. Throughout the event participants had the opportunity to interact with topic experts at each location. Course evaluations were overwhelmingly positive with 93% of participants stating it was worth their time and registration fee. When asked how the information would change their current or future management practices, the top two responses were the choice of pesticides used and the timing of pesticide applications (Fig. 1). To reach a larger audience, the content of the short-course (including the workbook and narrated slide presentations) was made available on the project website (Jones et al., 2016). The short course page has been viewed and/or materials downloaded approximately 500 times since 2012, extending the educational outreach almost seven-fold from the original live event.

To offer additional hands-on experience, the short course was followed up with two field day workshops offered in Wenatchee, Washington (1 h) and Hood River, Oregon (half-day) during the summer of 2012. A total of twenty-five participants attended these two events where they were able to practice natural enemy identification and monitoring/scouting techniques in an orchard setting.

Due to various limitations (i.e., fiscal and personnel resources, travel, availability of facilitators and participants) we were not able to repeat the two-day course, thus we developed a shorter, hands-on workshop sourcing components directly related to orchard pest management from the two-day course curriculum. These four-hour workshops were offered at a time and location convenient to the industry groups interested in enhancing their knowledge of biological control. Eight different workshops were delivered to ninety-four attendees in Washington in January to March 2013. Participants completed an online pre-workshop survey that was compared to results from review quizzes taken after workshop attendance, enabling us to assess learning outcomes. The percentage of questions answered correctly after the workshop training nearly doubled for three of the four categories of comparable questions (Fig. 2). These results show a strong knowledge gain about natural enemies and biological control principles from the workshops. Based on this positive feedback we were encouraged to

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