ORG Project Details

Award Year 2013

5 Research Projects

PROJECT INDEX

1. Ban Pests: Biodiversity and Natural Pest Suppression Grant No: 2013-51106-20910

2. Organic Management of Fire Blight in a Post-antibiotic Era: Developing, Evaluating, & Delivering Options for Apples Grown in Humid Climates Grant No: 2013-51106-20944

3. Improvement and Implementation of Organic Pecan Systems in the Southeastern Us Grant No: 2013-51106-21234

4. Subtropical Organic Agriculture Research (soar) Program: a Participatory Academic Program to Fill Knowledge Gaps for Organic Farmers Grant No: 2013-51106-20970

5. Principles for Transitioning to Organic Farming: E-learning Materials and Decision Case Studies for Educators Grant No: 2013-51106-21005

Ban Pests: Biodiversity and Natural Pest Suppression

Accession No.	1000201
Subfile	CRIS
Project No.	WNP06339
Agency	NIFA WN.P
Project Type	OTHER GRANTS
Project Status	NEW
Contract / Grant No.	2013-51106-20910
Proposal No.	2013-03950
Start Date	01 SEP 2013
Term Date	31 AUG 2016
Grant Amount	$749,661
Grant Year	2013
Investigator(s)	Snyder, W. E.; Reganold, JO.; Harwood, JA.; Stone, AL, G.
Performing Institution	Entymology, WASHINGTON STATE UNIVERSITY, PULLMAN, WASHINGTON 99164

NON-TECHNICAL SUMMARY

We will examine whether, through time, the adoption of organic farming improves natural pest control. Mixed-vegetable farmers have reported to us that since adopting organic methods, they see fewer aphids and caterpillars on their farm each year. Growers generally attributed this to the gradual buildup of insect-killing predators, parasitoids and pathogens. Improving soil quality, and thus healthier and more insect-resistant plants, could also explain this pattern. Understanding what makes a farm pest-suppressive could ease future farmers\' organic transition. Our project will explore the emergence of natural pest control following the conversion to organic farming, by comparing recent adopters to farms that have been organic for decades. Our project includes three integrated research and extension components. The First Component will measure on-farm biodiversity among natural enemies, while searching for management practices associated with species-rich and evenly-balanced assemblages. The Second Component will directly quantify how many pests the natural enemies kill on each farm, in part by searching for pest DNA within predators\' stomachs. The Third Component will compare plants\' ability to fight-off pests on \"new\" versus \"old\" organic farms, in part by measuring the activity of insect-fighting plant genes. Our results and recommendations will be disseminated through an innovative extension program that emphasizes hands-on learning and on-farm demonstration, in addition to innovative web, instruction and publication outlets. The project directly addresses ORG program goals by exploring and understanding the role of biodiversity in organic agriculture systems, to reveal the importance of biodiversity as a benefit of organic agriculture, production, and sustainability.

OBJECTIVES

To provide growers with practical tools to achieve greater natural enemy biodiversity and thus stronger pest control, our project includes three integrated research and extension components. First, we will develop a multi-state network for measuring the biodiversity of natural enemies - insect-killing predators, parasitoids, and pathogens - on farms that range from recent to long-time adopters of organic agriculture. We will consider not just the number of species (species richness), but also their relative abundances (species evenness); both components of biodiversity are thought to be important for effective pest control (Finke and Snyder 2008, Crowder et al. 2010). Second, we will carefully quantify just how many pests these natural enemies are eating on

each farm, in part by searching the stomachs of predators for the presence of pest DNA. On all farms we will document the use of flowering plants and other predator conservation techniques, along with a wide range of other farming practices that might encourage natural enemies. This will allow us to examine how particular farming practices shape natural enemy biodiversity, and in turn the number of pests killed. Third, we will measure the relationship between soil quality on the farms of different \"ages\" and the ability of plants to fight-off pests. This will be done not only by measuring the ability of aphid and caterpillars pests to survive on brassica plants, but also by measuring the activity of plant genes associated with the plants\' \"immune system\". Altogether, our project will allow us to examine interrelations among soil and other management practices, natural enemy biodiversity, and pest suppression.

APPROACH

Objective 1: Characterize each farm and its natural enemies The lynchpin of our project is a rigorously detailed study of natural enemy biodiversity on each of a large group of organic mixed-vegetable farms across MT, ID, WA, northern CA and OR. These farms will vary in their time from organic transition, allowing us to document how natural enemy biodiversity develops through time; we will also characterize the practices and physical layout of each farm, to examine how these factors further speed the development of enemy biodiversity. The Integrated Extension Component will focus on a \"natural enemy sampling short-course\", which will be piloted through a series of \"farm walk\" field days featuring hands-on learning in how to sample pests, predatory insects and spiders, parasitoid wasps, and insect-killing pathogens. These field days will be recorded on video, allowing us to develop the short course into eOrganic web content available to anyone. Thus, we will provide practical tools and know-how for growers to quantify natural pest control on their own farms. Objective 2: Quantify how many pests the natural enemies are killing on each farm The field sampling described under Objective 1 will provide a detailed characterization of the natural enemy communities on each farm. This is interesting, but what a farmer really needs to know is \"how many dead pests can I expect?\" Indeed, a key limitation in the literature on predator conservation methods is that while we now know many ways to make predator densities go up on a farm, we almost never know for sure how many more pests those predators are killing (Heimpel and Jervis 2005). This is because it is so difficult to track tiny, fast-moving predators under real-world conditions. Here we will overcome this obstacle by directly measuring predation rates on farms, in part by identifying pest DNA within the stomachs of their predators. We propose to create a \"CSI: ORGANIC\" video segment for eOrganic that describes the use of molecular gut-content analysis to track predation in the field. Objective 3. Does increasing soil quality lead to healthier, pest-resistant plants? Our final objective first measures soil quality on each of our cooperator\'s farms, and then examines whether pest development and the activity of anti-herbivore plant-defense genes correlate to soil-quality. Here, we propose to construct two separate video pieces for eOrganic. The first will talk about soil attributes relevant to crop production, how to take a soil sample, and what soil analyses are most useful. The second will present a short course on just how a plant\'s \"immune system\" works to fight off insect pests, and how the defenses can be quite different for chewing versus sucking pests. Evaluation. Our advisory board includes both long-time, very experienced growers, and 3 growers that are managing land that is less than 5 years from organic transition. Advisory board members span the states of ID, WA, OR, and (northern) CA. Members of the grower-advisory board will participate in project planning meetings by conference call in years 1 and 3 of the meeting. In the critical year 2 of the meeting, we have budgeted sufficient funds for all scientists and members of the grower-advisory board to meet in person. Of course, because our research will be conducted entirely on the farms of a much larger group of cooperating growers, we will have an open source for constant feedback from growers.

PROGRESS

2013/09 TO 2017/08 Target Audience:The goal of the BANPestS project is to describe how management strategies vary among new and experienced organic farmers, and further, how these strategies predict suppression of crop pests. Using broccoli as a model crop, we quantified numerous biotic and abiotic factors across 53 organic farms to predict the occurrence of several damaging pests including cabbageworm (Pieris rapae), diamondback moth (Plutella xylostella), cabbage aphid (Brevicoryne brassicae) and green peach aphid (Myzus persicae). This broad, correlative dataset will provide important insights about tactics that lead to stable pest/predator communities, which will be invaluable to growers throughout the Northwest. These data will be important to both basic and applied ecologists because they will fuel future experiments as well as provide in-field validation of existing evidence regarding ecological interactions in agricultural systems. Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided?Project postdoc Carmen Blubaugh has received valuable experience mentoring graduate students on this project, including PhD students Joseph Taylor and Karol Krey. Both of these students presented results related to this

project at the Entomological Society of America meeting, providing them with important training as science communicators. Carmen will soon begin a faculty position at Clemson University, and Karol recently started a postdoctoral position at the University of Florida. Joseph Taylor has received an NSF predoctoral fellowship. How have the results been disseminated to communities of interest?Carmen Blubaugh Entomology 2017: Denver, CO (11/2017) Tri-trophic interactions over microbial and nutritional gradients (Invited symposium) Entomology 2017: Denver, CO (11/2017) What promotes predator community evenness in agroecosystems? (Invited symposium) Ecology 2017: Portland, OR, (8/2017) Competing herbivores disrupt predator-prey interactions at a regional scale. Gordon Research Symposium: Ventura, CA (2/2017) Dual-guild herbivory disrupts predator-prey interactions at a regional scale\" (Invited symposium talk) Tilth Alliance Conference: Wenatchee, WA (11/2016) \"Managing Soils to Promote Biological Control of Pests\" (Invited symposium talk) Tilth Producers Conference: Wenatchee, WA (11/2016) Soil: What\'s it Worth?Research Symposium \"Managing Soils to Promote Biological Control of Insect Pests and Pathogens\" Tilth Producers Conference: Wenatchee, WA (11/2016) Beginning grower workshop: \"Management of Pests and Beneficial Insects on Vegetable Crops\" International Congress of Entomology: Orlando, FL (9/2016) Co-occurring herbivore guilds compromise aphid biocontrol: evidence from natural and true field experiments\" (Invited symposium talk) Insect-Plant Interactions (University of Idaho ENT 549) Fall 2016 Invited guest lecture on natural enemies and plant volatiles Organic Farm and Garden Management (WSU SOIL SCI 479) Summer 2016 Guest lecture on integrated pest management and field lab activity on pest/predator identification Eggert Organic Farm Tour (8/2016) Led a group of local growers and students on a pest/predator field identification exercise Newaukum Valley Farm Walk (8/2016) Invited by Tilth Producers, WA to serve as an expert consultant fielding pest management questions Karol Krey International Congress of Entomology: Orlando, FL (9/2016) Comparing the effects of organic and conventional soil management on plant gene expression and insect development Joseph Taylor International Congress of Entomology: Orlando, FL (9/2016) Habitat complexity mediates intraguild antagonism among predatory carabids\" What do you plan to do during the next reporting period to accomplish the goals? Nothing Reported

2014/09 TO 2015/08 Target Audience:The goal of the BANPestS project is to describe how management strategies vary among new and experienced organic farmers, and further, how these strategies predict suppression of crop pests. Using broccoli as a model crop, we quantified numerous biotic and abiotic factors across 53 organic farms to predict the occurrence of several damaging pests including Cabbageworm (Pieris rapae), Diamondback Moth (Plutella xylostella), Cabbage Aphid (Brevicoryne brassicae) and Green Peach Aphid (Myzus persicae). This broad, correlative dataset will provide important insights about tactics that lead to stable pest/predator communities, which will be invaluable to growers throughout the Northwest. These data will be important to both basic and applied ecologists because they will fuel future experiments as well as provide in-field validation of existing evidence regarding ecological interactions in agricultural systems. Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided?Several graduate students have been trained on this project (Jacob Asplund, Karol Krey, Joseph Taylor). Karol Krey is integrating data collected on this project into bioinformatics training; she is currently developing skills to evaluate differential gene expression by plants in response to herbivore attack. Joseph Taylor is using carabids collected in our study to develop skills with stable isotope analysis, enabling him to determine the trophic position of generalist predators in our system. These students will present their results at the Entomological Society of America meeting in 2016, providing them with important training as science communicators. In addition, several undergraduate students are being trained as they assist with this project. Samantha Beck has learned molecular lab techniques (DNA extraction, gel electrophoresis) while processing foliar samples defense-associated gene expression. Sabrina Judson is an undergraduate developing an independent research project focusing on the epigeal community of predators and decomposers from our farm survey. How have the results been disseminated to communities of interest?We have had the good fortune to have many engaged grower-collaborators on this project. At the end of each field season, we shared preliminary findings on the resident pest/predator communities of each farm, as well as results from our soil tests. Several research talks have also been given, and one grower-focused field day has been organized (\"Good bugs and bad bugs at Wilson Banner Ranch\"). Carmen Blubaugh W3185 (Biological Control in the Western US) Annual meeting, Livingston, Montana \"Biodiversity/biocontrol relationships from the soil to sky\" Guest lecture WSU ENTOM 343 General Entomology \"Integrated Pest Management\" Jacob Asplund Entomological Society of America 2014, Portland OR, \"Coccinellids in diverse communities: Which niche fits?\" eOrganic webinar \"Systems organic management suppresses cabbageworm outbreaks: evidence from 4 long term organic farms\" Guest lecture WSU SOILS 479 Organic Farm and Garden Field Management Entomological Society of America \"Biodiversity and Natural Pest Suppression\" What do you plan to do during the next reporting period to accomplish the goals?Objective 1) Processing of field samples should be complete by early 2016; we will complete initial analyses subsequently, and prepare manuscripts related to the pest/predator survey results. Over the next year, we will characterize the surrounding landscapes of each farm, and determine the relative impact of local and landscape factors on pest and predator communities across our farm survey. Objective 2) Gut content analysis on natural enemies

collected at each farm will be processed in 2016. Additionally, a recently recruited graduate student (Joseph Taylor) will use ground beetles as a model to examine the incidence of intraguild predation between generalist predators on farms, and how structural complexity provided by weed growth may mitigate the negative effects of intraguild predators. We expect to have preliminary results prepared by late 2016. Objective 3) Carmen Blubaugh will repeat her on-farm herbivory experiment in 2016, and prepare those results for publication alongside relevant results from the field survey. She and postdoc Daisy Fu will process plant tissue samples collected from this experiment in spring 2016; they will use molecular techniques to examine expression of many defense-associated plant genes to determine a molecular mechanism for results observed. We will also initiate a common garden experiment in spring 2016 using soil from 40 farms, where we will use high-throughput sequencing to characterize each farm\'s unique microbial community and quantify the nutritional and microbial contributions to plant defense against herbivores (following herbivore growth assays). Using information about soil amendments and tillage frequency, we hope to identify management strategies that suppress pest growth rates by enhancing anti-herbivore defenses by plants. Extension activities: Postdocs Carmen Blubaugh and Daisy Fu will also prepare an eOrganic webinar/youtube video in spring 2016, where we will describe scouting techniques for brassica crops, identify common pests and predators, and summarize every published action threshold available for each pest. Carmen Blubaugh will also organize a symposium of applied talks related to this project at a regional grower\'s meeting (Washington Tilth) in 2016.

2013/09 TO 2014/08 Target Audience: Our work is being conducted entirely on the farms of our cooperating growers, including in-field measurements of predators\' pest-killing abilities. We focus on brassica pests because of: (1) the ubiquity of these crops on mixed-vegetable farms, (2) their importance in providing season-long produce for sale, and (3) the intriguing pattern reported by several growers that some, although not all, brassica pests decline through time after organic farming is adopted. Our field work is limited to the western US. However, within this region summers range from hot and dry (ID, eastern WA, central CA) to cool and wet (western OR and WA, coastal CA). Thus, we are considering a relatively broad range of environmental conditions that should make our results relevant to growers farming in a broad range of climates. Our work addresses fundamental questions in predator-prey interactions, and so is also of interest to academic ecologists. Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided? Thus far, this project has provided professional training for 3 undergraduate researchers, a doctoral student in Entomology, and a postdoctoral researcher. Each of these team members is participating in both research and outreach objectives of this project. How have the results been disseminated to communities of interest? Because this is the first year of our project, we do not yet have specific results to transmit to our target audience of growers, extension personnel, and researchers. Nonetheless, we are developing a series of outreach materials that discuss general principles of pest management in organic brassica crops. These include an upcoming eOrganic webinar scheduled for January 2015, titled \"Evidence of successes and challenges for pest control in organic mixed-vegetables.\" We also are preparing the following eOrganic fact sheets, for on-line publication in 2015: 1. Pieris rapae as a pest of Brassica oleracea; expected March 2015 2. Plutella xylostella as a pest of Brassica oleracea; expected May 2015 3. Trichoplusia ni as a pest of Brassica oleracea; expected June 2015 What do you plan to do during the next reporting period to accomplish the goals? As briefly reviewed above, in the 2015 field season we will revisit each of the 53 farms sampled in the first field season. We also plan to increase our sampling effort in California, assuming that the drought there eases allowing increased production of brassica crops. We will continue to analyze insect, plant, and farm-practices data for samples collected in 2014, and use these data to further hone our sampling regime and farm coverage for the upcoming field season. We anticipate a dramatic scaling-up of our outreach efforts in 2015, with the specific direction of these efforts shaped by the results of our analysis of the 2014 data.

IMPACT

2013/09 TO 2017/08 What was accomplished under these goals? Objective 1: Characterize each farm and its natural enemies After two field seasons (2014 and 2015) surveying farms throughout the Pacific Northwest, we have completed family-level identifications of pest and predator samples collected in pitfall traps and vacuum samples. We focused finer-scale taxonomy on particularly important, functionally diverse predator groups like spiders and carabids. Using these 30,000 specimens, three major findings have emerged. The first focuses on pest diversity, particularly how herbivore guild co-occurrence alters parasitoid/prey interactions via herbivore induced plant volatiles. We found that aphid parasitoids tracked aphid densities at farms with few caterpillars (low densities: \<0.5/plant), but not where caterpillars and aphids co-occur (high densities: \>0.5/plant). Chewing herbivores, like caterpillars, may profoundly alter the host-plant volatile signals that are critical for host-location by parasitoids. This pattern in the field led us to perform three subsequent experiments on-farm and in the

greenhouse to clarify trends and identify mechanisms. We found that co-occurring caterpillars indeed reduce aphid parasitism by at least 30%, and reduce foliar concentrations of Gluconapin, a secondary metabolite whose volatile products serve as an important, specific cue for parasitoids. These results have been presented at several academic meetings (see below), and are currently in revision at Ecology. The second major finding relates to predator community evenness and natural pest suppression. Pest suppression may be strongest when natural enemy communities are species rich (high richness) with similar abundances among those species (high evenness). While conservation biological control has focused on encouraging greater species richness, it is less clear how to promote greater natural enemy evenness. Working on over 50 mixed-vegetable farms across three US states, we used structural equation models to examine relationships between evenness of ground-active generalist predators and the availability of two resources - non-pest prey and refuge habitats - thought to encourage greater natural enemy biodiversity. We found that higher densities of detritus-feeding springtails, important non-pest prey, correlated with increasing predator evenness. However, increasing densities of the invasive ground beetle Pterostichus melanarius correlated with reduced evenness among native predators, counterbalancing any benefit of springtails. Structural complexity and alternative food provided by non-crop plants encouraged higher densities of P. melanarius, reinforcing the harm of the invaders to predator evenness. Altogether, these results suggest that the presence of a non-native ground beetle complicates any effort to conserve evenness among native ground-foraging natural enemies. Indeed, negative effects of P. melanarius appeared sufficiently strong to overwhelm efforts to promote greater predator evenness by enhancing prey diversity, food plants, or shelter. These results have also been presented at academic meetings, and will be submitted for publication in early 2018. Third, we examined effects of floral resource supplementation and insecticide use on herbivores, predators, parasitoids, and hyperparasitoids across our survey sites. Floral resource supplementation may improve the compatibility of biological control and pesticide applications by providing untreated refuge space for natural enemies in crop systems, and also by providing non-prey food resources, like pollen and nectar, for omnivorous predators. While non-crop plants may buffer negative effects of farm management on beneficial insects, these resources may also be exploited by pests and hyperparasitoids (wasps that consume primary parasitoids), which can compromise biological control. In a survey of focal crop plants on more than 50 organic farms in the northwestern United States, we examined farm-scale impacts of both floral resources and use of certified-organic pesticides on the food web associated with aphids, a persistent crucifer pest. We found no evidence that non-crop insectary plantings buffer beneficial insects against effects of periodic insecticide use in our system. However, floral resources did appear to buffer hyperparasitoids from effects of insecticides, which may indirectly reduce rates of biological control by primary parasitoids. Surprisingly, periodic insecticide use had contrasting effects on generalist predators (negative) and primary aphid parasitoids (positive). Aphid densities were also higher on farms that employed insecticides, and the positive effect of insecticide use on specialist parasitoids may be due to the fact that they are tightly linked in time and space with their prey. Altogether, we saw evidence of non-target effects of both insecticides and floral resources that may relax natural pest suppression in our system. Insecticide use reduced densities of generalist predators and increased densities of aphids, while floral resources reduced the impact of pesticides on hyperparasitoids without significantly increasing densities of parasitoids and predators. Future work should consider both costs and benefits of insectary plantings, as well as the local and landscape variables that determine them. Objective 2: Quantify how many pests the natural enemies are killing on each farm Progress on this objective has been somewhat delayed due to a co-PI\'s career change. PhD student Joseph Taylor completed preliminary stable isotope analyses on practice specimens early in the year, and will proceed to use the survey dataset to examine how plant and prey diversity support predator communities using both stable isotope and DNA-based gut-content analysis techniques. Objective 3: Measure the relationship between soil quality and herbivore resistance Chemical defenses against herbivores are costly for plants to produce, and are differentially induced over resource gradients. At the same time, co-occurring herbivores and soil microbes can alter host plant quality, as well as prime, induce, or even suppress plant defenses, both direct and indirect. Because microbial communities are difficult to manipulate, most of this knowledge comes from experiments in simple, controlled communities that do not reflect natural gradients of soil nutrition or microbial activity. Therefore, we took an observational approach to test established patterns of microbially-mediated defense induction in naturally-diverse soil communities. We performed common garden experiments in the field and the greenhouse using soil collected from 20 organic farms that varied considerably in microbial and nutritional profiles, and used multi-model inference to identify the strongest predictors of herbivore growth and parasitism. Interestingly, we found that Bacillus spp., known plant-growth promoting rhizobacteria (PGPR) negatively correlated with aphid suppression by specialist parasitoids. Pseudomonas spp., which include both beneficial and pathogenic bacteria, was the strongest predictor of aphid performance, and positively correlated with aphid growth in the field. This suggests that while beneficial rhizobacteria may support plant growth and strengthen defenses against some herbivores, they may actually induce susceptibility to aphids, via both direct and indirect pathways. These results are currently in preparation for a special issue of Frontiers in Plant Science. **PUBLICATIONS (not previously reported):** 2013/09 TO 2017/08 1. Type: Journal Articles Status: Submitted Year Published: 2018 Citation: Blubaugh, CK, JS Asplund, H Atthowe,

SD Eigenbrode, MJ Morra, CR Phillips, I Popova, JP Reganold, AG Stone, and WE Snyder. In revision. Dual-guild herbivory disrupts predator-prey interactions. Ecology. 2. Type: Websites Status: Published Year Published: 2017 Citation: Postdoc Carmen Blubaugh worked with eOrganic to produce two short webinar/youtube videos; the first describes scouting techniques for brassica crops, and the second video helps growers identify predatory syrphid fly larvae, which are important biological control agents of aphids in vegetable systems. They are easily confused with caterpillars, and distinguishing pests and predators is critical for pest management decisions. Scouting video: https://www.youtube.com/watch?v=N-g-1Qyrk2I Syrphid larva identification: <https://www.youtube.com/watch?v=IkixPtTTXyA&t=243s>. Progress 09/01/15 to 08/31/16 Outputs Target Audience:The goal of the BANPestS project is to describe how management strategies vary among new and experienced organic farmers, and further, how these strategies predict suppression of crop pests. Using broccoli as a model crop, we quantified numerous biotic and abiotic factors across 53 organic farms to predict the occurrence of several damaging pests including cabbageworm (Pieris rapae), diamondback moth (Plutella xylostella), cabbage aphid (Brevicoryne brassicae) and green peach aphid (Myzus persicae). This broad, correlative dataset will provide important insights about tactics that lead to stable pest/predator communities, which will be invaluable to growers throughout the Northwest. These data will be important to both basic and applied ecologists because they will fuel future experiments as well as provide in-field validation of existing evidence regarding ecological interactions in agricultural systems. Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided?Project postdoc Carmen Blubaugh has received valuable experience mentoring graduate students on this project, including PhD students Joseph Taylor and Karol Krey. Both of these students presented results related to this project at the Entomological Society of America meeting in 2016, providing them with important training as science communicators. Two undergraduate researchers, both supervised by Carmen Blubaugh, have initiated independent research projects using data from this work. Sabrina Judson is focusing on the soil-dwelling community of predators and decomposers from our farm survey, examining how prey diversity may support stable predator communities, and control problematic pests like flea beetles, which go through egg, larval, and pupal stadia at or beneath the soil surface. Elizabeth Magill is studying parasitoid oviposition behavior. She is examining how thrips damage, which frequently occurs on seedlings in greenhouses before they\'re transplanted outdoors, alters subsequent predation and parasitism of pests on broccoli plants. How have the results been disseminated to communities of interest?Carmen Blubaugh Tilth Producers Conference: Wenatchee, WA (11/2016 scheduled) Soil: What\'s it Worth?Research Symposium \"Managing Soils to Promote Biological Control of Insect Pests and Pathogens\" Tilth Producers Conference: Wenatchee, WA (11/2016 scheduled) Beginning grower workshop: \"Management of Pests and Beneficial Insects on Vegetable Crops\" International Congress of Entomology: Orlando, FL (9/2016) Co-occurring herbivore guilds compromise aphid biocontrol: evidence from natural and true field experiments\" (Invited symposium talk) Insect-Plant Interactions (University of Idaho ENT 549) Fall 2016 Invited guest lecture on natural enemies and plant volatiles Organic Farm and Garden Management (WSU SOIL SCI 479) Summer 2016 Guest lecture on integrated pest management and field lab activity on pest/predator identification Eggert Organic Farm Tour (8/2016) Led a group of local growers and students on a pest/predator field identification exercise Newaukum Valley Farm Walk (8/2016) Invited by Tilth Producers, WA to serve as an expert consultant fielding pest management questions Karol Krey International Congress of Entomology: Orlando, FL (9/2016) Comparing the effects of organic and conventional soil management on plant gene expression and insect development Joseph Taylor International Congress of Entomology: Orlando, FL (9/2016) Habitat complexity mediates intraguild antagonism among predatory carabids\" What do you plan to do during the next reporting period to accomplish the goals?Objective 1) Characterize each farm and its natural enemies In 2017, we will use the numerous local- and landscape-level data collected to identify important drivers of predator community structure and ultimately, pest suppression. At each farm we were given access to records documenting a variety of management practices. These included planting date, farm size, farm age, insectary plantings, crop varieties, weed control methods, and pest control methods (including chemical applications). We plan to use structural equation modeling to identify critical factors and ecological interactions that predict natural pest control using this framework. This approach will be a powerful, multivariate tool to integrate landscape structure and management strategies to elucidate the complex, interactive drivers of pest suppression. Objective 2) Quantify how many pests the natural enemies are killing on each farm Joseph Taylor will continue to use DNA-based and stable isotope techniques to examine prey diversity and predator/prey interactions on-farm, using the dataset and samples collected in 2014 and 2015. Objective 3) Carmen Blubaugh complete a multivariate analysis of how soil nutritional quality and microbial community composition together influence induced plant defenses. Soil microbial sequences should be ready to analyze by late 2016, and will be used to identify fertility amendments that provide the strongest pests resistance. Impacts What was accomplished under these goals? Objective 1: Characterize each farm and its natural enemies After two field seasons (2014 and 2015) surveying farms throughout the Pacific Northwest, we have completed family-level identifications of pest and predator samples collected in pitfall traps and vacuum samples. We focused finer-scale taxonomy on particularly important, functionally diverse predator groups like spiders and carabids. Using

these 30,000 specimens, two major findings have emerged. The first focuses on pest diversity, particularly how herbivore guild co-occurrence alters parasitoid/prey interactions via herbivore induced plant volatiles. We found that aphid parasitoids tracked aphid densities at farms with few caterpillars (low densities: \<0.5/plant), but not where caterpillars and aphids co-occur (high densities: \>0.5/plant). Chewing herbivores, like caterpillars, may profoundly alter the host-plant volatile signals that are critical for host-location by parasitoids. This pattern in the field led us to perform three subsequent experiments on-farm and in the greenhouse to clarify trends and identify mechanisms. We found that co-occurring caterpillars indeed reduce aphid parasitism by at least 30%, and reduce foliar concentrations of Gluconapin, a secondary metabolite whose volatile products serve as an important, specific cue for parasitoids. These results have been presented at several academic meetings (see below), and are being prepared for submission to peer-reviewed journals by the end of 2016. The second major finding, resulting from natural enemy surveys at 50 farms, relates to predator interference and structural habitat complexity. Habitat structure has been shown to reduce antagonism between diverse predator groups, and weeds provide structurally complex habitat resources within crop areas on farms. Using predaceous carabids (ground beetles) as a model system, we examined whether weedy habitat tempered effects of a dominant, invasive predator, Pterostichus melanarius, that is common on mixed-vegetable crop systems in the Pacific Northwest. We predicted that weediness would increase richness and evenness of carabid communities; however, no we found no effect of weeds on carabid community structure. We did, however, discover that weeds reversed a negative relationship between the large, invasive, dominant predator and smaller, more efficient carabid predators. In a follow-up mesocosm experiment, we manipulated weedy habitat and the presence of large and small carabid predators, and measured subsequent rates of predation of fly pupae. Again, we predicted that weed cover would minimize antagonistic interactions between large and small predators, but instead found that rates of pupa consumption were lower in mesocosms where large and small predators existed together, regardless of weed cover; ostensibly because large predators preyed on small beetles instead of fly pupae. Predation rates were highest in mesocosms that contained weeds and P.melanarius alone, suggesting that weeds may reduce interference between conspecifics, even if they don\'t protect smaller predators from active-hunting intraguild predators. Together, these results suggest that alternative prey associated with weed cover, rather than structural complexity, may buffer antagonistic effects of multiple predators in agroecosystems. These results have also been presented at academic meetings, and will be submitted for publication in early 2017. Objective 2: Quantify how many pests the natural enemies are killing on each farm Progress on this objective has been somewhat delayed due to a co-PI\'s career change. PhD student Joseph Taylor completed preliminary stable isotope analyses on practice specimens early in the year, and will proceed to use the survey dataset to examine how plant and prey diversity support predator communities using both stable isotope and DNA-based gut-content analysis techniques. Objective 3: Measure the relationship between soil quality and herbivore resistance Soil samples from each farm in the survey were analyzed for micronutrients, macronutrients, texture, and microbial activity. Together with information we collected about fertility inputs and tillage frequency at each farm, we are beginning to examine how soil management affects microbial activity, and how this in turn affects herbivore resistance and biological control. In May 2016, Postdoc Carmen Blubaugh collected soil from 20 different collaborating farms and performed simultaneous experiments in the greenhouse as well as in a common garden, to examine nutritional and microbial components of induced plant defense, as well as volatile-mediated biological control by parasitoids. Chemical and physical analyses have been performed on the 20 soil samples, and bacterial DNA are currently being sequenced to evaluate how various fertility inputs contribute to microbial community richness, and how that, in turn, interacts with chemical signaling within plants. Leaf tissue has been collected and freeze-dried for chemical analyses, which are ongoing. RNA sequencing has been performed on leaf tissue from a preliminary experiment, and we will use these results to inform efforts to quantify how soil health affects defense gene expression (to be completed in early 2017), using leaf tissue collected this year. Also in the coming year, we will integrate information about soil quality, host plant quality, and pest densities observed in the field with those we measured in common garden experiments, and identify soil management strategies that promote both bottom-up and top-down control of pests. Publications

2014/09 TO 2015/08 What was accomplished under these goals? Objective 1: Characterize each farm and its natural enemies Before the 2014 field season, PhD student Jacob Asplund and postdoc Christopher Phillips recruited 53 mixed vegetable growers in Washington, Idaho, Oregon. Each of these farms was visited once in 2014 and twice in 2015. Pests (aphids and caterpillars) were visually surveyed by scouting 10 plants/site; and predators in plant foliage were surveyed using a D-vac on 10 plants/site; and predators on the ground were surveyed using 5 pitfall traps/site. Weed cover was evaluated using photo transects. Identification of the D-Vac samples was accomplished by PhD student Jacob Asplund with assistance from Dr. William Turner (Washington State University \WSU\, Emeritus Professor of Entomology). Identification of the pitfall samples was accomplished by undergraduate Sabrina Judson (WSU) under the supervision of PhD student Jacob Asplund and postdoc Carmen Blubaugh. So far, over 30,000 specimens have been collected and identified to family. All 2014 and 2015 pitfall samples have been processed, as well as all but half of the 2015 D-Vac samples. At each

farm we were given access to records documenting a variety of management practices. These included planting date, farm size, farm age, insectary plantings, crop varieties, weed control methods, and pest control methods (including chemical applications). We have begun preliminary analyses to determine which practices lead to the greatest suppression of pests and enhancement of natural enemies. Objective 2: Quantify how many pests the natural enemies are killing on each farm We manually collected predators for 15 minutes at each site in 2014, and these specimens are currently stored for molecular gut content analysis, where in the next year the predators will be assayed for pest consumption. In 2015, we set dry pitfall traps overnight to increase capture, and have frozen these samples for stable isotope analysis (see future plans for 2016). Objective 3: Measure the relationship between soil quality and herbivore resistance Soil samples from each farm were analyzed for micronutrients, macronutrients, texture, and microbial activity. Together with information we collected about tillage frequency at each farm, we are beginning to examine how soil inputs and disturbance drive microbial activity, and how these in turn affect tri-trophic interactions between crops, herbivores and predators. A smaller experiment was conducted by postdoc Carmen Blubaugh in September/October 2015 on a subset of four farms, where she examined how soil health and herbivore co-occurrence affect volatile-mediated attraction of predators and parasitoids. She manipulated herbivory of caterpillars and aphids on sentinel broccoli plants at each farm, and measured subsequent aphid growth and parasitism rates. Preliminary analyses show that co-occurrence of caterpillars and aphids reduced aphid parasitism rates by almost 50% compared with plants where aphids occurred in isolation from chewing herbivores. Postdoc Daisy Fu and undergraduate Patricia Hawbaker are examining entomopathogenic nematodes and fungi across our farm survey, to identify soil management practices that promote natural enemy communities belowground. Very few nematodes were detected in samples, and work is proceeding focusing exclusively on the fungal community. They have extracted entomopathogenic fungi from all soil samples by using sentinel waxworm larvae. Fungi that attacked the larvae are stored in culture at 4 degrees C for molecular characterization and analysis later this year. **PUBLICATIONS (not previously reported):** 2014/09 TO 2015/08 No publications reported this period.

2013/09 TO 2014/08 What was accomplished under these goals? Our sampling regime on each farm includes intensive examination of: (1) pest and beneficial insect populations and biodiversity, (2) farm characteristics including a census of crop and non-crop vegetation, (3) soil characteristics and quality, (4) measurement of plant defenses, and (5) grower management practices and farming philosophy. Thus far we are working with 53 cooperating mixed-vegetable growers across WA, OR, ID, and CA. These growers manage farms ranging in age from \< 1 year to \> 30 years of operation under organic practices, and ranging in size from 1 to 75 acres. This diversity allows us to capture a broad swath of farming practices. On each farm we took soil samples for physical and nutrient properties, captured overhead photographs of a quadrat along transects for foliar coverage measurement, collected leaf tissue samples for analysis of RNA expression, visually counted pest insects (aphid and lepidopteran larvae), vacuum-sampled a broad range of pest and beneficial insects, used pitfall traps to capture ground-active predators, and hand-collected predators for molecular gut-content analysis. We currently are sorting, processing, identifying, and analyzing these many thousands of plant and insect samples. For example, altogether we estimate that we collected over 100,000 insects that must be identified and tabulated. We will again revisit each of these farms in the 2015 field season, shaped by what we learn from the many samples already in-hand, while adding additional farms in California (the ongoing California drought limited our ability to work in this state in 2014). **PUBLICATIONS (not previously reported):** 2013/09 TO 2014/08

↑ Return to Index

Organic Management of Fire Blight in a Post-antibiotic Era: Developing, Evaluating, & Delivering Options for Apples Grown in Humid Climates

Accession No.	1000292
Subfile	CRIS
Project No.	MICL05075
Agency	NIFA MICL
Project Type	OTHER GRANTS
Project Status	NEW
Contract / Grant No.	2013-51106-20944
Proposal No.	2013-03968
Start Date	01 SEP 2013
Term Date	31 AUG 2016
Grant Amount	$464,482
Grant Year	2013
Investigator(s)	Sundin, G.; Grieshop, MA.
Performing Institution	Plant, Soil, and Microbial Sci, MICHIGAN STATE UNIV, EAST LANSING, MICHIGAN 48824

NON-TECHNICAL SUMMARY

Organic apple production east of the Mississippi river is nearing a significant crossroad \-- faced with the near-term removal of antibiotics from organic production, growers need novel solutions that they can rely on or production will neither be economically nor biologically feasible due to fire blight disease. This project directly addresses one of the four ORG FY 2013 Priorities - to develop alternatives to antibiotics for fire blight control in organic crops. In a post-antibiotic era, we will evaluate all available NOSB-approved materials to reduce flower infection and improve efficacy. We will take a microbial ecology approach to increasing the colonization potential of two fire blight antagonists, the bacterium Pantoea agglomerans (Bloomtime Biological) and the yeast Aureobasidium pullulans (Blossom Protect). We will use a contact sterilant as a niche-clearing agent on flowers prior to inoculation of antagonists. Two promising new low copper formulation materials, Previsto and Cueva, will also be evaluated. Various combinations of antagonists, copper, and other materials will be tested for compatibility, and optimized integrated treatment programs will be developed, and examined at farm scale. The long-term goals of this project are to develop sound, sustainable, efficacious organic disease-control programs for the management of fire blight in organic apple orchards in humid environments, and to deliver these new management programs to growers through innovative and comprehensive Extension programs. Extension activities will include a yearly on-farm field day with demonstration plots available to growers, production and dissemination of scripted videos outlining project research results, regular grower presentations, and site visits.

OBJECTIVES

The major long-term goals of this project are to develop sound, sustainable, efficacious organic disease-control programs for the management of fire blight in organic apple orchards in humid environments, and to deliver these new management programs to growers through innovative and comprehensive Extension programs.

APPROACH

1. We propose to examine the effects of the indigenous apple flower microflora on colonization of P. agglomerans and A. pullulans by examining colonization (% incidence and population size) of flowers that were either non-treated or treated with OxiDate 2.0 (Biosafe Systems; East Hartford, CT) at the labeled rate of 128 fl. oz per 100 gallons of water. OxiDate is OMRI-approved and is a hydrogen dioxide product that functions as a contact sterilant. OxiDate has essentially no residual activity; there is a 0 hr re-entry interval on the label following its use. Our plan is to use this material as a niche-clearing treatment of the apple flower and stigma and to determine the effect of this pre-sterilization step on subsequent colonization by P. agglomerans or A. pullulans. Experiments under Objective 1 will be conducted in small plot treatments using a randomized complete block design and at least 5 single-tree replicates. These small size experiments are typically utilized in efficacy studies and provide sufficient replication to yield robust results. Treatments yielding positive results will be examined at farm scale under Objective 4. 2. Copper efficacy trials testing Previsto and Cueva will be conducted at the MSU Plant Pathology farm using trees inoculated with the fire blight pathogen Erwinia amylovora. Disease ratings will yield stastically-analyzed efficacy data for blossom blight and shoot blight symptoms. 3. Use timing of application studies will be conducted to determine the potential compatibility of Blossom Protect and Bloomtime Biological with the copper compounds Previsto and Cueva. 4. Research results from the various efficacy experiments and integration experiments will yield optimized treatments that will then be examined at farm scale. Three certified organic grower cooperators in Michigan will test optimized programs in large scale plots on their farms. These experiments will be of sufficient scale that positive results would be expected to be directly applicable to other organic growers.

PROGRESS

2013/09 TO 2017/08 Target Audience:The target audience for this work is the grower community (apple, cherry, peach), extension agents, representatives for chemical companies and disease scouting consultants, mainly in Michigan but in other states as well, especially those east of the Mississippi river. Additional target audience is the research community of plant pathologists that work on bacterial diseases of tree fruit and bacterial pathogens as well as the microbiology research community that works on bacterial pathogenesis. Extension presentations covering work from this project were given in Michigan, Ohio, and Virginia. Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided?Training opportunities include mentoring of two M.S. graduate students, Samantha Gebben and Emma Sweeney, and a Ph.D. graduate student, Suzanne Slack. How have the results been disseminated to communities of interest?Results have been disseminated to grower audiences, especially organic apple growers, through presentations at grower meetings, in particular the Great Lakes Fruit and Vegetable EXPO in December 2014 and 2016. Results have also been disseminated to extension agents, tree fruit extension specialists, and industry personnel through a talk presented at the Cumberland-Shenandoah Fruit Workers meeting in Winchester, VA in Dec. 2016. Sundin also discussed biological alternatives for fire blight management in 34 fire blight presentations in Michigan, Minnesota, Ohio, and Ontario and Nova Scotia in Canada between 2014 and 2018. What do you plan to do during the next reporting period to accomplish the goals? Nothing Reported

2013/09 TO 2014/08 Target Audience: The target audience for this work is the grower community (apple, cherry, peach), extension agents, representatives for chemical companies and disease scouting consultants, mainly in Michigan but in other states as well. Additional target audience is the research community of plant pathologists that work on bacterial diseases of tree fruit and bacterial pathogens as well as the microbiology research community that works on bacterial pathogenesis. Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided? Training opportunities include mentoring of a PhD graduate student Kim Lesniak. How have the results been disseminated to communities of interest? Results have been disseminated to grower audiences, especially organic apple growers, through presentations at grower meetings, in particular the Great Lakes Fruit and Vegetable EXPO Organic Tree Fruit session in December 2013. What do you plan to do during the next reporting period to accomplish the goals? Continued studies will be done in attempts to optimize the use of Blossom Protect for fire blight management under Michigan conditions. We also will be examining comaptibility with copper and other fungicides. Copper would be used to increase the overall level of fire blight control and other fungicides will be used as needed for apple scab control.

IMPACT

2013/09 TO 2017/08 What was accomplished under these goals? We completed field research evaluating the use of a contact sterilant in clearing the apple flower niche of microbes to enable better colonization by the yeast Aureobasidium pullulans. This yeast forms the basis of the commercial product Blossom Protect which is used for biological control of fire blight disease. Colonization of apple flowers by the yeast Aurebasidium pullulans (active ingredient of Blossom Protect) was excellent in treatments using four applications during bloom and also in the treatment using the contact sterilant Oxidate followed by two applications of Blossom Protect. We demonstrated that application of Oxidate resulted in a complete clearing of the flower stigma niche of culturable bacteria and fungi within 4 hr in each of the three years this experiment was conducted. This research provided proof of concept for contact sterilant effects ahead of the intentional introduction of microbes for biological control. Furthermore, all treatments with Blossom Protect provided excellent fire blight control with no significant difference between them in the level of control. Ultimately, we demonstrated that effective flower colonization by A. pullulans and excellent blossom blight control can be achieved with two applications of Blossom Protect. Blossom Protect has proven to be a usable material for fire blight control in organic situations in humid climates when cultivars with resistance or tolerance to apple scab are grown. Additional experimental treatments involved using various copper compounds including Previsto and Cueva and other biological control materials such as Serenade Opti for blossom blight control. While excellent control was achieved with copper in a few cases, the use of copper was typically followed by fruit russeting. In humid climates, russeting of fruit due to copper use is difficult to avoid. Reducing the copper rates utilized by at least 50% resulted in less russeting but more inconsistent fire blight control. Nevertheless, successful integration of blossom blight spray programs containing the copper Cueva and Serenade Opti or Cueva and Blossom Protect was achieved. These integrated programs give organic growers more choices in materials usable for fire blight management. Finally, application of a bacterial inducer of host resistance, LifeGard, also showed promise in achieving commercially viable levels of blossom blight control. During this grant program, PI Sundin delivered extension presentations on biological management of fire blight specifically covering Blossom Protect and the use of contact sterilants and integrated disease management programs at the organic session of the Great Lakes Fruit and Vegetable EXPO in Grand Rapids, MI in 2014 and 2016. Sundin also discussed biological alternatives for fire blight management in 34 fire blight presentations in Michigan, Minnesota, Ohio, and Ontario and Nova Scotia in Canada between 2014 and 2018. **PUBLICATIONS (not previously reported):** 2013/09 TO 2017/08 1. Type: Other Status: Published Year Published: 2017 Citation: Outwater, C.O., and Sundin, G.W. 2017. Evaluation of Cueva, Nu-Cop HB, Nu-Cop 30HB, Oxidate, and Actigard for resistance management and control of fire blight on JOnathan apples, 2016. Plant Dis. Mgmt. Rep. 11:PF002. 2. Type: Journal Articles Status: Other Year Published: 2018 Citation: Slack, S.M., Begley, B., Gebben, S., Outwater, C.O., and Sundin, G.W. Effect of a contact sterilant on apple flower microbial populations and impacts on biological control of fire blight by Aureobasidium pullulans. (submitted for publication). Progress 09/01/15 to 08/31/16 Outputs Target Audience:The target audience for this work is the grower community (apple, cherry, peach), extension agents, representatives for chemical companies and disease scouting consultants, mainly in Michigan but in other states as well, especially those east of the Mississippi river. Additional target audience is the research community of plant pathologists that work on bacterial diseases of tree fruit and bacterial pathogens as well as the microbiology research community that works on bacterial pathogenesis. Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided?Training opportunities include mentoring of two M.S. graduate students, Samantha Gebben and Emma Sweeney. How have the results been disseminated to communities of interest?Results have been disseminated to grower audiences, especially organic apple growers, through presentations at grower meetings, in particular the Great Lakes Fruit and Vegetable EXPO in December 2015. Results have also been disseminated to extension agents, tree fruit extension specialists, and industry personnel through a talk presented at the Cumberland- Shenandoah Fruit Workers meeting in Winchester, VA in Dec. 2015. What do you plan to do during the next reporting period to accomplish the goals?Continued studies will be done in attempts to optimize the use of Blossom Protect for fire blight management under Michigan conditions. We also will be examining compatibility with copper and other fungicides under different spray timings. On-farm tests using the optimized Blossom Protect protocols will be conducted on two organic farms in Michigan in 2017. Impacts What was accomplished under these goals? We conducted research aimed at determining the best use practices for application of the yeast biological control agent Blossom Protect for fire blight management. Control of fire blight by the yeast is predicated upon successful colonization of flowers typically prior to the arrival of the fire blight pathogen Erwinia amylovora. We tested the standard application protocol of four applications, an alternation of Blossom Protect with a bacteriophage material (Fire Quencher), and also tested the use of the contact sterilant Oxidate prior to Blossom Protect applications. The contact sterilant is utilized to clear the flower niche prior to colonization by the biocontrol yeast. We also evaluated the growth of bacteria, fungi, and yeast populations on flowers during the experiment. Colonization of the flowers by the yeast Aurebasidium pullulans (active ingredient of Blossom Protect) was excellent in treatments using four applications during bloom and also in the treatment using Oxidate. These treatments provided excellent fire blight control with no significant difference between them in the level of control. Publications Type: Other Status: Published Year Published: 2016

Citation: Sundin, G.W. and OUtwater, C.A. 2016. Evaluation of Serenade Optimum combinations for control of fire blight on Jonathan apples, 2015. Plant Dis. Manage. Rpt. 10:PF022. Progress 09/01/14 to 08/31/15 Outputs Target Audience:The target audience for this work is the grower community (apple, cherry, peach), extension agents, representatives for chemical companies and disease scouting consultants, mainly in Michigan but in other states as well. Additional target audience is the research community of plant pathologists that work on bacterial diseases of tree fruit and bacterial pathogens as well as the microbiology research community that works on bacterial pathogenesis. Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided?Training opportunities include mentoring of three M.S. graduate students, Smantha Gebben, Suzanne Slack, and Emma Sweeney. How have the results been disseminated to communities of interest?Results have been disseminated to grower audiences, especially organic apple growers, through presentations at grower meetings, in particular the Great Lakes Fruit and Vegetable EXPO in December 2015. Results have also been disseminated to extension agents, tree fruit extension specialists, and industry personnel through a talk presented at the Cumberland-Shenandoah Fruit Workers meeting in Winchester, VA in Dec. 2015. What do you plan to do during the next reporting period to accomplish the goals?Continued studies will be done in attempts to optimize the use of Blossom Protect for fire blight management under Michigan conditions. We also will be examining comaptibility with copper and other fungicides. Copper would be used to increase the overall level of fire blight control and other fungicides will be used as needed for apple scab control. We will also be conducting on-farm tests using Blossom Protect at two organic farm locations in Michigan. Impacts What was accomplished under these goals? We conducted research aimed at determining the best use practices for application of the yeast biological control agent Blossom Protect for fire blight management. Control of fire blight by the yeast is predicated upon successful colonization of flowers typically prior to the arrival of the fire blight pathogen Erwinia amylovora. We tested the standard application protocol of four applications, an alternation of Blossom Protect with a bacteriophage material (Fire Quencher), and also tested the uze of two contact sterilants prior to BLossom Protect applications. The contact sterilants are utilized to clear the flower niche prior to colonization by the biocontrol yeast. Results showed excellent control by Blossom Protect in 2015, the best control we\'ve ever observed with this material. Similar control levels were observed in treatments using the contact sterilant. Yeast populations on flowers were higher in treatments using contact sterilants compared to the four application regime, but control of fire blight was not increased. Publications Type: Conference Papers and Presentations Status: Submitted Year Published: 2015 Citation: Blossom Protect for fire blight control: efforts to increase flower colonization by the yeast Aureobasidium pullulans. Presentation at the Cumberland-Shenandoah Fruit Workers meeting, Dec 3, 2015 (Winchester, VA). Type: Other Status: Submitted Year Published: 2016 Citation: Sundin, G.W. and C.A. Outwater. Evaluation of Blossom Protect, Fire Quencher, BloomTime and Cueva for control of fire blight on McIntosh apples, 2015. Plant Disease Management Reports.

2013/09 TO 2014/08 What was accomplished under these goals? We conducted research aimed at determining the best use practices for application of the yeast biological control agent Blossom Protect for fire blight management. We used varying numbers of applications and timings of Blossom Protect, and also examined the effect of using a contact sterilant Oxidate prior to Blossom Protect application. By tracking yeast populations (Aureobasidium pullulans) on flowers, we determined that the use of Oxidate enabled better colonization of flowers by the yeast, and colonization following two applications of Blossom Protect was equivalent to that after four applications. **PUBLICATIONS (not previously reported):** 2013/09 TO 2014/08 No publications reported this period. ** **

↑ Return to Index

Improvement and Implementation of Organic Pecan Systems in the Southeastern Us

Accession No.	1000583
Subfile	CRIS
Project No.	FLA-NFC-005266
Agency	NIFA FLA
Project Type	OTHER GRANTS
Project Status	NEW
Contract / Grant No.	2013-51106-21234
Proposal No.	2013-03971
Start Date	01 SEP 2013
Term Date	31 AUG 2015
Grant Amount	$0
Grant Year	2013
Investigator(s)	Mizell, R. F.
Performing Institution	AG-NFREC-QUINCY, UNIVERSITY OF FLORIDA, G022 MCCARTY HALL

NON-TECHNICAL SUMMARY

Pecan, a highly nutritious commodity, constitutes the most valuable North American native nut crop. Severe insect pest and disease pressure have limited the ability of growers to produce organic pecans, particularly in the Southeastern US. However, advances in organic IPM strategies combined with appropriate whole-farm management systems offer the potential to develop viable organic production in the Southeast. Our goal is to develop sustainable whole-farm systems for organic pecan production in the Southeast. The primary barriers facing organic production will be addressed: i.e., for insect pests, control of pecan weevil and pecan aphids, and for disease control, pecan scab. Methods for insect pest and disease management will include biological control, organic insecticides and fungicides, and resistant cultivars. Orchard floor management impacts tree nutrition and productivity as well as pest and natural enemy population dynamics. Hence IPM approaches will be investigated along with optimization of orchard floor management. Treatment impacts on biodiversity will also be assessed and compared. An advanced systems-based on-farm research approach will be implemented at five locations including three commercial farms. Simultaneously, in-depth optimization of key components will be investigated (e.g., optimization of microbial biological control applications and cultivar resistance). Socio-economic analysis will determine the profitability of selected strategies and measure project outcomes. A multi-faceted outreach and extension program (ipmPIPE, eOrganic) will be implemented to disseminate findings and recommendations facilitating wide-spread adoption. The project addresses several OREI legislative-defined goals including #1 (Facilitating the development of organic agriculture production), #2 (Evaluating economic benefits), and #6 (Conducting advanced on-farm research).

OBJECTIVES

I. To integrate insect pest and disease control with orchard floor management tactics in an organic whole-farm systems approach. II. To conduct additional \"small-plot\" optimization experiments to enhance specific insect pest and disease control strategies. A. Optimize parameters for pecan weevil control. B. Optimize aphid control. C. Test new approaches and optimize existing options for control of pecan diseases (particularly scab). D. Test promising pecan cultivars for resistance to disease. III. To conduct a socio-economic analysis to determine

strategies for improving adoption of organic pecan farming practices while maximizing organic pecan profitability. IV. To compare the relative impact of organic treatments vs each other and vs conventional strategies and tactics on the biodiversity of two arthropod groups: epigeal insects on the orchard floor and aphid-mite predators in the foliage. V. To carry out extension, education, and outreach activities based on the systematic evaluation of farmers\' knowledge and attitudes toward organic farming and their current practices of pecan farming.

APPROACH

Our experimental approach will be two-pronged. First, in a whole-farm systems approach, we will synthesize the most current knowledge and recent research to test a variety of integrated organic methods (Objective I); we anticipate the results/outcome will lead to an improved organic production system that is ready for implementation. At the same time, we will optimize specific tactics known to provide control, and explore new strategies; results/outcomes will lead to enhanced recommendations and incorporation of new strategies in the future (Objective II). This two-pronged approach contributes to the many near-term as well as long-term benefits the project will offer to growers and the general public. All research experiments will be conducted in appropriately replicated plots, arranged in randomized complete block designs, repeated in time (and many of them in space as well), and analyzed for treatment effects according to standard statistical procedures (Steel and Torrie, 1980; SAS, 2002). A major issue requested in the RFA, biodiversity, will also be assessed and described; accepted statistics including ANOVA, diversity indices and others, will be used to analyze treatment differences, and the results will be widely applicable to the future study of organic production ecology. In addition to research experiments, we will conduct an in-depth socio-economic analysis (Objective III), and extensive outreach program (Objective V). Research Locations: The project will involve research at four farms. All the locations are certified organic or in organic transition. Specific information on the locations follows: 1. USDA-ARS, Byron, GA. The USDA-ARS Southeastern Fruit & Tree Nut Research Laboratory contains three pecan blocks in organic transition (no chemical inputs \> 2.5 years) that will be used in the study. One block is approximately 2.5 ha and contains mixed Stuart and Schley cultivars (approximately 70 years old) spaced approximately 18 m apart. The second block is 6 ha and contains cv. Stuart (approximately 70 years old) spaced at 18 m. The third block is approximately 1.5 ha and contains mixed cultivars (Desirable, Stuart, Cheyenne, and Cape Fear) that are 27 years old and spaced at 12 m. The first two blocks will be used in combination (given the trees are analogous in age and cultivar) for experiments addressing Objective I. The smaller third block will be used to address Objective II (experiments will be set up so that cultivar is not a confounding factor). Insect and disease pressure within these blocks has been high over the past ten years (DIS, personal observation). 2. Cleveland Organics, LLC, Fort Valley, GA. Cleveland Organics has 32 ha of pecan acreage in organic transition (3 years of transition completed) for use in this project. One block of eight ha contains cv. Sumner (28 years old) that are spaced at approximately 11 x 22 m. A 2nd block contains cv. Elliot (40-45 years old); half the block is spaced at 13.7 m x 24.4 m, and half is at approximately 18 m x 20 m. The Cleveland Organics farm will be used extensively as a primary site in this project; experiments pertaining to both objectives I and II will be addressed. The Elliot block will be utilized for Objective I, and the Sumner block for Objective II (if necessary, additional space in the Elliot block is available for Objective II). Disease pressure within the Cleveland Organics blocks has been very low (due to resistant cultivars) and insect pressure has been moderate (low weevil pressure, moderate aphid pressure). 3. DGW Farms, Colquitt, GA. DGW farms (Debra Wallace co-PI, grower collaborator) contains approximately eight ha of pecans in organic transition (three years completed). Cultivars include primarily Stuart as well as seedling and Money Maker; the trees are about 80 years old and spaced at 13.7 m. The farm operations are overseen by Debra Wallace and Charles Pickle; Mr. Pickle manages a number of farms and has \~35 years of experience as a pecan orchard manager. The DGW farm will be one of the sites devoted to addressing objective I and IV. Disease and insect pressure has been observed to be moderate to high within these blocks. 4. McDonald Farm, Marshallville, GA. The McDonald farm (Scott and Darlene McDonald, grower cooperators) contains approximately 8.5 hectares of Desirable cultivar pecans in organic transition. The trees (approximately 4 hectares) devoted to use in this project are young bearing trees about 17 years old with spacing 12 m x 12 m. Disease (pecan scab) and insect pressure have been observed to be moderate to high within these orchards. **KEYWORDS:** IPM; aphid; biological control; disease; insecticide; pathogen; pecan; scab; weevil **SUPPLEMENTARY DATA:** **Institution Type:** SAES **Coop States:** FL **Region:** 2 **Process Date:** 2013/08/21 **Program Code:** 112.E

PROGRESS

2013/09 TO 2018/08 Target Audience:Pecan producers, shellers and accumulators, consumers, other scientists, general public, cooperative extension personnel Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided?A demonstration orchard has been planted on

the grounds of the 1890 land grant in Georgia, Fort Valley State University. The planning and development process (planting) have involved minority students and the standing orchard is being used to expose minority students to pecan production and agricultural practices. Students formerly trained: Ms. Tzu-Chin Liu graduated with a Master of Science degree in Entomology from the University of Georgia and her research assistantship was entirely funded by this project. Another student in economics at the University of Georgia is completing her Ph.D (re: the above economic results) with funding from this project. How have the results been disseminated to communities of interest?The website: <https://Pecan.ipmpipe.org> is the go-to source for pecan information in the U.S. Developed at TAMU it is in the process of being turned over for IT management to the Southern Region IPM Program. Items include an overview of Organic Pecan Certification, a searchable list of OMRI products, a searchable Pecan Insect Check List (200+ phytophagous insects), a List of Expert Organic Pecan Scientists, and a seamless interface with the standard Pecan ipmPIPE website resource that includes access to an interactive Make Your Own Pecan budget, and a Make your Own Risk Assessment for pecan nut casebearer. This new information resource is designed to be economically maintained and easily upgraded as new research merits translation for industry application. A number of minority and other students were directly involved in the project in the capacity of seasonal workers, field trips of agricultural classes and other demonstrations by the PIs. Oral presentations: \~20 presentations to pecan grower groups around the Southeast (GA, AL, FL) and Southwest (TX) have been provided that discussed the findings from this project. These included talks at major producer events such as the annual Southeastern Fruit and Vegetable meeting in Savannah, Georgia and the AL,FL, GAand TX annual pecan grower association meetings. These will continue in the coming off-season meetings - post project termination. What do you plan to do during the next reporting period to accomplish the goals? Nothing Reported

2014/09 TO 2015/08 Target Audience:Pecan producers, industry representatives, general public, extension agents, other professional scientists involved in commercial or non-commercial pecan production across the Pecan belt including the states represented in the grant of AL, FL, GA, and TX via scientists contacts and via the web nationally and internationally. Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided?Trainings: the PIs have provided presentations in FL and GA to several hunderd pecan growers and their families. FVSU has developed a demostration orchard for students who have been exposed to pecan production. UGA has both undergraduate and graduate level student funded and working on the project as does the ARS. The pecan ipmpipe website serves as the main extension resource for pecan production of all types for the U.S. and Mexico. How have the results been disseminated to communities of interest?Through PI presentations and through the pecan ipmpipe website. What do you plan to do during the next reporting period to accomplish the goals?Continue objectives with most research being focused on repeat of some experiments, development of economic data, development of the pecan.ipmpipe website, transfer of results to clientele, andperforming experiments that were delayed by delays in funding to several Co PIs.

2013/09 TO 2014/08 Target Audience: Pecan producers, industry representatives, general public, extension agents, other professional scientists involved in commercial ornon-commercialpecan production across the pecan belt including the states represented in the grant of AL, FL, GA, and TX via scientists contacts and via the web nationally and internationally. Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided? Harris-TAMU-pecanipmPIPE website:was on-line again for the 2014 season with a volunteer Cooperator Network of \~40 pecan producers recruited and trained to participate in inputting real time information from across the pecan belt. The project has also begun developing an Organic Pecan component to emphasize this option in pecan management in cooperation with Mizell. The outreach provided by thewebsite will improve program delivery using the internet. How have the results been disseminated to communities of interest? Via the pecan.ipmPIPE website, the primary Beltwide dissemination vehicle; presentations by each of the PIs to their respective state producer organization annual meetings, presentations to other scientists atprofessional meetings anda 1.5 day exchange of ideas and progress at the annual regional pecan project (S-1049)meeting held at the Noble Foundation in Ardmore, OK. What do you plan to do during the next reporting period to accomplish the goals? Auburn University - will continue all pecan scab evaluations in 2015. ARS- will repeat arthropod and disease experiments as warranted and add new treatments as available. University of Georgia: I, IIB: The pecan aphid control experiments will be conducted to determine the efficacy of the integration of 3-5 sprays of organic insecticides to the tree crown with an air-blast sprayer. The first spray will be applied to suffocate aphid eggs at the overwintering sites on the shoots of the tree in February while the trees are dormant. The second and subsequent sprays will applied to control Spring (May) and Summer (late August) pecan aphid populations materials tested for efficacy against foliage-infesting aphids that reach the action thresholds designated by the Georgia Cooperative Extension Service of 50 aphids per leaf in the Spring and Early Summer and 20 aphids per leaf during the late Summer and Fall for yellow pecan aphids and

blackmargined aphids (combined count) and/or 1 aphid per compound leaf for black pecan aphids over the entire season. Two application rates of the following commercial products will be tested: a natural insecticide, Trilogy® (Certris USA L.L.C., Columbia, MD, USA, www.certisusa.com); two oil formulations, Suffoil-X® (Bioworks. Inc., Victor, NY, USA, www.bioworksinc.com), Oroboost™ (Oro Agric, Inc., Trophy Club, TX, USA, www.oroagri.com); and, a soap, Des-X™ (Certris USA L.L.C., Columbia, MD, www.certisusa.com). The treatments will be tested on 25 year-old 'Desirable' pecan trees in a 6 acre (150 trees) orchard block that will be managed by organic production methods. The treatments including a nontreated control will be applied to four single tree replications in a complete randomized block design. Aphid densities will be measure before treatment and then 2 days, 1 wk, 2 wk and 3 wk post-treatment in each replication of each treatment. Data will be analyzed for normality, and then transformed to approximate a normal distribution when necessary; and finally with analysis of variance and mean separation techniques. Efficacy and application costs will be used to support subsequent economic analysis and extension activities. Host plant resistance studies will be conducted in pecan to determine the susceptibility of pecan cultivars to pecan aphids. Aphids will be studied in clip cages on the multi-cultivar pecan trees to determine the population parameters -- time from birth to first reproduction, and number of nymphs produced per adult - so that we can calculated the natural rate of increase for each aphid species on each cultivar. In the clip cage studies a single adult aphid is placed in a small enclosure (clip-cage) on the leaf surface and observed each day until the first nymph is born. The adult is then removed from the cage the entire life cycle of the nymph is observed in the clip-cage at two day intervals until the aphid dies. During the observation period the number of days to the maturity of the aphid and the number of nymphs produced by the aphid are recorded. Five aphids will be observed on each cultivar for each of the three aphid species. Trials coincide with peak activity of each aphid species and are typically run in May and June for yellow pecan aphid; July and August for Blackmargined aphid; and, September and October for black pecan aphid. Biological control will be studied by direct observations after altering orchard floor design and by experimentation. Aphidophagous insects will be monitored at two levels in the orchard -- on the orchard floor and in the tree canopy -- by the following methods: Direct counts on pecan foliage samples; Fan traps in the tree canopy; Sweep net samples ground cover plants; Traps baited with attractants incl. pheromones, host plant volatiles and honeydew mimics. The orchard floor will be managed for the dual purpose of altering the soil organic matter, providing additional nitrogen for the trees, and providing refuge and alternative food for aphidophagous insects by the following scheme: Plant crimson clover and hairy vetch as a cover crop in the Fall after harvest; Apply organic fertilizer to the soil in February and March; Cut the clover-vetch crop and plant iron clay peas with a seed drill in April; Cut the peas and plant buckwheat in June; Cut the buckwheat when aphids begin the increase in the pecan canopy in late August. Control of aphids will be achieved by attracting the aphidophagous insects into the tree canopy with a honeydew mimic -- 1 pt molasses plus 2 oz brewer's yeast, fermented for 2 days in 2 qt of water then added 100 gal of water and applied to the foliage with an airblast sprayer. The effects of these control methods will be determined by comparing direct observations of the pests in the orchard before and after the treatments are applied over the entire orchard. The actual efficacy of the methods individually will be determined in concomitant, small- plot, controlled field experiments. These will be conducted at the Ponder Farm of the Coastal Plain Experiment Station. University of Florida: IV, V: The biodiversity experiment comparing epigeal and aerail arthropod species in an organic vs conventionally managed pecan orchards will be repeated. The results will be prepared for publicationat the end of the season following data collection and analyses. All other objectives and procedures originally proposed will be executed.

IMPACT

2013/09 TO 2018/08 What was accomplished under these goals? Results from consumer surveys and choice experiments indicate that there is demand for organic pecans if supply challenges can be overcome. Analyses found that consumers on average are willing to pay a substantial premium of \$2.53/8oz for organic shelled pecans over conventionally produced pecans, a premium of nearly 30% in the study areas. Organic insecticide tests: The results indicated that Grandevo and Doubletake controlled pecan weevil and Intrepid Edge and Entrust SC did not control pecan weevil. Doubletake, Intrepid Edge and Entrust SC at 10 oz formulation/acre controlled kernel-feeding Hemipterans and Grandevo and Entrust at 6 oz formulation/acre did not control kernel-feeding Hemipterans. Doubletake and Entrust at 10 oz formulation/acre controlled hickory shuckworm and Grandevo, Intrepid Edge and Entrust at 6 oz formulation/acre did not control hickory shuckworm. Entrust and Grandevo results are encouraging for organic pecan growers since these are approved for use in organic production. Entrust at 4 or 6 oz/acre was an ineffective treatment against all three pests. Over all trials, average efficacies for treatments with some potential use for pecan growers for pecan weevil control were: 78% for Entrust SC at 10 oz/acre, 91% for Grandevo at 3 lb/acre, 100% for Intrepid Edge at 6.4 oz/acre, and 80% for Doubletake at 4 oz/acre. Efficacies for kernel-feeding stinkbug control were: 100% for Entrust SC at 10 oz/acre, 0% for Grandevo

at 3 lb/acre, 100% for Intrepid Edge at 6.4 oz/acre and 83% for Doubletake at 4 oz/acre. Efficacies for hickory shuckworm control were: 67% for Entrust SC at 10 oz/acre, 0% for Grandevo at 3 lb/acre, 95% for Intrepid Edge at 6.4 oz/acre and 94 % for Doubletake at 4 oz/acre. New aerial sampling methods for pecan aphids indicated substantial immigration of aphids into orchards heretofore unrecognized as a contributing problem to aphid suppression. Fire ants are important predators in pecan orchards on the ground but become pests by feeding on biological control agents if allowed to forage within the tree canopy. Chlorpyrifos is labeled for use on pecan tree trunks to keep ants out of trees. A comparison of 2 available organic methods - Tanglefoot barrier vs Bird Stop treated tree trunks - indicated that Tanglefoot was effective for two weeks while Bird Stop excluded ants for 4 weeks. Comparisons of the biodiversity of fauna in natural habitats and conventional vs organic orchards on the ground using pitfall traps and in the canopy using aerial Malaise traps were conducted. Results indicated that conventional orchards supported far fewer arthropods throughout the season than the other treatments and biodiversity in organic production was closer to the natural habitats based on the indicator species used in the analyses. Pecan scab disease evaluations were conducted in two ways: by conventional orchard chemical treatments at two locations and by evaluations of pecan cultivars for resistance-tolerance levels in south Alabama. Chemicals: In all experiments conducted over 5 years in Georgia, the fungicide treatment applied was Bordeaux mixture (4 lb CuSO4:1 lb hydrated lime, for the 1st spray; followed by 6 lb CuSO4:2 lb hydrated lime for the 2nd - 6th sprays applied a t 100 gallons per acre. There was a significant reduction in the severity of scab on fruit due to the Bordeaux mixture treatment at the Byron location in 2011 (F=12.3, P=0.0005) and 2014 (F=4.4, P=0.04), and at the Colquitt location in 2014 (F=30.0, P\<0.0001). The percentage reduction in severity of scab was 43.9%, 16.2% and 24.4%, respectively. At the Colquitt location there was an increase (16.3%) in the severity of scab on fruit of Bordeaux mixture-treated trees (F=8.8, P=0.003). In the remaining experiments, there was no significant differences between treatments. In other experiments a total of 6-8 fungicide applications were made at 2-3 week intervals starting in late April and through late August. By late August there was a significant effect on pecan scab on fruit in June (F=39.2, P\<0.0001), with scab severity on the control = 71.8% fruit shuck area with symptoms, and on the treated plots = 54.3% fruit shuck area. Fruit weight in late August was also significantly greater on plots receiving Bordeaux mixture (F=14.1, P=0.0002), with fruit weight = 13.1 g on control plots, and 15.1 g on treated plots, respectively. In the organic alternatives experiment (comparing a control, and various organic treatments (Bordeaux mixture, Regalia, Serenade, Nordox, Sulfur, Sodium bicarbonate and Compost tea), there were significant differences among treatments in mid-June (F=7.5, P\<0.0001). By late August, there was a highly significant effect of treatment (F=8.6, P\<0.0001) on the severity of pecan scab among treatments. Again, Regalia had the least severe pecan scab (24.8%), followed by Serenade (40.0%). Only the Regalia and Serenade treatment showed consistent effects throughout the season. Ultimately, the solution to pecan scab will evolve around the use of pecan cultivars with natural resistance/tolerance to the pathogen. Results from cultivar evaluations of scab susceptibility demonstrated that cultivars are available that contain disease resistance and that data will be forthcoming. Weed suppression: Organic weed control methods, including mechanical mowing, flaming, mulching with pine bark nuggets, vinegar application, and a combination of pine bark mulch and vinegar were evaluated over three years. The combination of pine bark mulch and vinegar provided the greatest overall vegetative control at all sampling dates. Mulching with pine bark nuggets alone provided similar control for the first year, but control decreased in subsequent years. Vinegar alone and flaming treatments provided some vegetative control without the use of mulch, but were inferior overall to the mulch-vinegar combination. While the combination of mulch and vinegar provides superior weed control compared to the other strategies, the presence of mulch can interfere with nut harvesting. **PUBLICATIONS (not previously reported):** 2013/09 TO 2018/08 Type: Journal Articles Status: Awaiting Publication Year Published: 2017 Citation: Shapiro-Ilan, D. T. Cottrell, C. Bock, K. Mae, D. Boykin, L. Wells, W. Hudson and R. Mizell. 2017. Control of pecan weevil with microbial biopesticides. J. Econ. Entomol. In press. Progress 09/01/15 to 08/31/16 Outputs Target Audience:Pecanproducers, potential producers, homeowners, associated associated industry people, people involved in and/or associated with in general agricultural production. Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided?Minority students were exposed to pecan production practices at Ft. Valley State University via visits to a pecan orchard and by helping with establishing and upkeep of the demonstration orchard. How have the results been disseminated to communities of interest?Use of presentations at producer meetings, via the ipmPIPE association, personnel contacts and print materials in scientific and popularmedia. What do you plan to do during the next reporting period to accomplish the goals?Finish all the objectives and initiate and complete publications and the websites. Charge the extension investigators with the results and publicize them to the public andpecan stakeholders. Impacts What was accomplished under these goals? IA. Intercrops for enhancement of aphidophagous insects in pecan orchards. Cool season crops of white Dutch clover and hairy vetch and intercrops were sewn in a large replicated field trial for two seasons. Intercrops of \'clover +vetch\' and \'vetch\' had significantly higher abundance of alternate prey and ladybeetles than intercrops of clover or mowed sod. The canopies of pecan trees with \'clover + vetch\' or \'vetch\' intercrops had significantly more ladybeetles. Trunk sprays were tested to prevent red imported fire ants and argentine ants from interfering with aphidophagous insects in pecan tree canopy. Methyl anthranillate, \"Bird

Stop\", as a trunk spray was found to be an effective repellent to remove foraging fire and argentine ants from the pecan tree canopy. IIA. For weevils, treatments consisted of one entomopathogenic nematode application (Steinernema carpocapsae applied at 2 billion nematodes per acre) and one entomopathogenic fungus application (Beauveria bassiana Mycotrol®O applied at 2 x 1012 per acre). Treatments were made to the soil under the tree canopy in May-June, 2014 and repeated in 2015. Additionally, Grandevo® was applied at 3 lbs per acre. The bacterial product (C. subtsugae) was applied to the canopy 3 times from mid-August to mid-September. To assess treatment effects, pecan weevil adult emergence was monitored with Circle and cone traps. Damage to nuts was assessed at harvest. Results indicated that management regimes suppress pecan weevil relative to control plots. Also, results indicated that all microbial treatments (nematodes & fungi) persisted for approximately 2 months. Grandevo applied alone indicated that itperformed at an equal level compared with a standard chemical treatment. IIB. A fermenting molasses spray was applied to enhance beneficial efficacy on aphids. Yellow and black pecan aphids were significantly lower in the molasses-treated trees than in the nontreated control, blackmargined aphid abundance was not affected by the spray. Ladybeetles were more abundant and lacewings were less abundant in the molasses treated trees. A new sampling technique for measuring the abundance of aphids and aphidophagous insects in the pecan tree canopy was developed by using a large suction trap to collect aphids from samples of the air in the tree canopy. The trap measured dynamics of aphid and aphidophagous insect populations that were not evident in the conventional leaf samples. The method has promise as a more effective method of assessing pest and beneficials biodiversity in pecan and other orchard crops. IIC. Bordeaux mixture is historically an industry standard for scab control. Bordeaux mixture on pecan scab was compared to non-treated control trees. Bordeaux mixture (Cu/lime) was applied as 4:1:100 - 4 lb CuSO4:1 lb hydrated lime:100 gallons water for 1st spray (prepollination) and 6:2:100 - 6 lb CuSO4:2 lb hydrated lime:100 gallons water for 2nd-6th spray (1 week after 1st spray, then every 3 weeks until mid-August). No effect of Bordeaux mixture occurred in either 2014 or 2015, although scab severity was numerically less on the treated trees in 2015. Bordeaux mixture demonstrated only limited efficacy atreducing scab severity. IID. Pecan cultivars were evaluated for innate scab resistance at Fairhope, AL. Experimental trees were managed using organic practices and fungicides were not applied over a 3 year period. Percent coverage of nuts by pecan scab fungus was assessed. Cultivars having the highest incidence of nut scab were \'Desirable\' (96%), \'Farley\' (99%) and \'Melrose\' (92%). Cultivars having the lowest incidence and coverage (0-1%) of nut scab were \'Adams 5\', \'Excalibur\', \'Jenkins\', \'Kanza\', \'Excel\', \'McMillian\' and \'Prilop\'. Many cultivars did not yield marketable pecans due to scab including \'Curtis\', \'Desirable\', \'Farley\', \'Melrose\', and \'Sumner\'. \'Adams 5\', \'Elliott\', \'Kanza\', and \'Prilop\' performed the best, averaging 48, 45, 46, and 48 percent kernel, respectively, from 2013-2015. Interestingly, the cultivar \'Elliott\' exhibited only moderate resistance to scab (50% nut coverage) but was among the best performers. Cultivars that produced the highest percentage of Grade 1 pecans were \'Kanza\' (48%), \'Adams 5\' (43%), \'Elliott\' (43%), and \'Prilop\' (42%). III.In progressas data can only be collected once project field results have been further developed IV.Comparisons of epigeal and canopy occupying insects in conventional vs organic pecan orchards indicated that conventional orchards were virtually devoid of most common epigeal and canopy species found in the orchards without conventional insecticide/fungicide applications. V. Evaluations of farmer knowledge is in progress as data can only be collected once project field results have been further developed. General extension efforts are as follows: The Pecan ipmPIPE Beltwide Program facilitates access to relevant information by stakeholders using the internet. The public website at http://pecan.ipmpipe.org/ supports 200+ organized, searchable web pages. The central element is a Toolbox that contains sections on: 1) Educational Materials 2) Pesticide Search Engines; 3) Pecan Library; and, 4) an interactive pecan budget calculator, templates for records and forms, and videos and E-learning tools for users. Many additional elements are also available. The Organic Pecan Program has interfaced with the Pecan ipmPIPE Beltwide Program to provide an Organic Pecan Outreach Component to better inform producers on organic pecan production. This component will be featured on the Home Page on the Pecan ipmPIPE website and Educational Materials tailored to organic production will be added/integrated into the website to allow intuitive navigation for all pecan stakeholders. The pesticide search engines now include OMRI designations for materials labeled for use on pecan. The text for the Home Page is 90% complete and will be launched shortly. Ongoing work is also being conducted on pecan arthropod and pathogen lists to make them more comprehensive, including text information on each species, and to illustrate each species with photographs to aid identification. The organic pecan producers are also being encouraged to participate in the PNC Risk Window Network. A tracking function is also being added to provide an aid to measuring impact of this new organic component on the pecan industry. Additionally, 8 presentations were provided to pecan growers on various aspects of the project. An extension bulletin has been drafted along with a video on results from the project. Publications Type: Journal Articles Status: Published Year Published: 2015 Citation: Journal of Invertebrate Pathology 124, 114116 Type: Other Status: Published Year Published: 2015 Citation: The Pecan Grower Magazine 24:26-30 Type: Websites Status: Published Year Published: 2016 Citation: http://sepga.com/index.html Type: Journal Articles Status: Awaiting Publication Year Published: 2016 Citation: http://www.pakinsight.com/?ic=journal&journal=106 Type: Journal Articles Status: Published Year Published: 2016 Citation: HORTSCIENCE 51(6):653663 Type: Other

Status: Published Year Published: 2015 Citation: The Pecan Grower Magazine. 26(2): 10-17 Type: Journal Articles Status: Awaiting Publication Year Published: 2016 Citation: HortScience

2014/09 TO 2015/08 What was accomplished under these goals? I. Large plot tests. Research was conducted at three separate farms at three locations: USDA-ARS research station, Byron, GA; Cleveland Organics, LLC, Fort Valley, GA, DGW Farms, Colquitt, GA. The experiment was conducted with two levels of insect pest & disease management, i.e., treated plots versus non-treated controls. The insect control treatment against pecan weevil consisted of one entomopathogenic nematode application (Steinernema carpocapsae applied at 2 billion nematodes per acre) and one entomopathogenic fungus application (Beauveria bassiana applied at 5 x 1012 per ha). These treatments were made to the soil under the tree canopy in May-June, 2014. Additionally, at the Byron and Fort Valley location, Grandevo (Chromobacterium subtsugae) was applied at 3 lbs per acre. The bacterial product (C. subtsugae) was applied to the canopy 3 times from mid-August to mid-September (when the pecan weevil is emerging). Results indicated that the pest management regimes suppress pecan weevil relative to control plots. Exp. B. In a separate but closely related test, the impact of the relatively new product C. subtsugae (Grandevo) applied alone as a pecan weevil control measure was investigated. Four blocks of 2.5 acres were sprayed with Grandevo at 3 lbs per acre (recommended rate); the applications were made four times between mid-August and mid-September. An equal number of 2.5 acre plots were sprayed four times with a standard chemical insecticide, and an untreated control was also included. Grandevo as a canopy spray, performed at an equal level with a standard chemical treatment. II. A,B. Optimize weevil and aphid control. ARS Shapiro-Ilan,and Bock: Results indicated that organic tactics for pecan weevil control including entomopathogenic nematodes, fungi and bacteria show great promise. Particularly, the relatively new organic product (Grandevo) based on the bacterium, Chromobacterium subtsugae caused pecan weevil suppression akin to the use of insecticides. A regime of C. subtsugae along with entomopathogenic fungi (Beauveria bassiana) and beneficial nematodes (Steinernema carpocapsae) caused lower pecan weevil infestation levels compared with a non-treated control. Application of entomopathogenic fungus, B. bassiana, in conjunction with composted manure, resulted in enhanced persistence and efficacy of the fungus. It was discovered that the pecan weevil pupal cell possess antimicrobial properties that suppress entomopathogenic fungi; this novel finding will be explored further. Disease control: in large plot tests Bordeaux mixture caused reduced pecan scab severity and increased fruit weight. In small plot tests treatments of Regalia and Serenade consistently reduced scab severity throughout the season; some other treatments (e.g., compost tea, %, Sodium bicarbonate =77.3%, and Nordox) exhibited less favorable results. UGA-Dutcher, A field trial was conducted to determine the efficacy of AG1000, an organic spray material for aphid control in pecans manufactured by Teraganix Co. AG1000 did not control aphids. Methyl carbitol, myristate and methyl anthranillate were tested for efficacy as ant repellents on cover crop plants with limited success. Three separate experiments were initiated to investigate organic methods of control of pecan diseases, particularly pecan scab, caused by Fusicladium effusum. A total of 6-8 fungicide applications were made at 2-3 week intervals starting in late April and through late August. By late August there was a significant effect on pecan scab on fruit in June (F=39.2, P\<0.0001), with scab severity on the control = 71.8% fruit shuck area with symptoms, and on the treated plots = 54.3% fruit shuck area. Fruit weight in late August was also significantly greater on plots receiving Bordeaux mixture (F=14.1, P=0.0002), with fruit weight = 13.1 g on control plots, and 15.1 g on treated plots, respectively. In the organic alternatives experiment (comparing a control, and various organic treatments (Bordeaux mixture, Regalia, Serenade, Nordox, Sulfur, Sodium bicarbonate and Compost tea) there were significant differences among treatments in mid-June (F=7.5, P\<0.0001). By late August, there was a highly significant effect of treatment (F=8.6, P\<0.0001) on the severity of pecan scab among treatments. Again, Regalia had the least severe pecan scab (24.8%), followed by Serenade (40.0%). Only the Regalia and Serenade treatment showed consistent effects throughout the season. D. Test promising pecan cultivars for resistance to disease. IIC, D: Wells-Auburn:Evaluated organic methods of weed control including mulch, vinegar, flaming, and combinations thereof., b. Evaluated organic methods of leaf and nut scab control including Serenade, Nordox, Regalia, Bordeaux Mixture, and Sulfur. 2. Pecan cultivar evaluation: a. Continued to evaluate pecan cultivars for scab susceptibility at two locations in Fairhope and Shorter, AL. b. Evaluated scab control in both high and low input orchards. Organic weed control methods, including mechanical mowing, flaming, mulching with pine bark nuggets, vinegar application, and a combination of pine bark mulch and vinegar were evaluated over the past three years. The combination of pine bark mulch and vinegar provided the greatest overall vegetative control at all sampling dates. Mulching with pine bark nuggets alone provided similar control for the first year, but control decreased in subsequent years. Vinegar alone and flaming treatments provided some vegetative control without the use of mulch, but were inferior overall to the mulch-vinegar combination. While the combination of mulch and vinegar provides superior weed control compared to the other strategies, the presence of mulch can cause difficulties when harvesting the crop. III. Too early in project to accomplish, data not in yet. IV. Mizell UFL: In an organic and a conventionally managed orchard in south Georgia ground-level pitfall traps and aerial Malaise traps were used to determine and compare the arthropod biodiversity within these two orchard types. Within the organic orchard, the effects of fungicide use on arthropod populations were also assessed in a

similar manner. Trapping was conducted over the course of the pecan growing season from June until the beginning of harvest in October. Significant differences were observed in both the epigeal arthropods and the aerially trapped species between the organic and conventional orchards. The organic orchard had higher species richness and biodiversity in both sample types. Fungicides used in the organic orchard had little detectable effects on arthropod populations. V. Harris-TAMU:: Real time risk assessment for pecan nut casebearer was on-line for the 2014-2015 season with a volunteer Cooperator Network of \~40 pecan producers recruited and trained to participate in inputting real time information from across the pecan belt that was then analyzed, processed, verified and posted to the website for public use in decision making. The resulting web pages were subsequently accessed by \>4,000 users of the website indicating that \~20% of the target producer audience was able to directly access this information. Brown- FVSU: this effort deals with the project\'s demonstration aspects. Three cultivars of pecan, Desirable, Moreland, and Pawnee, were transplanted and replicated four times in a randomized complete block design in organically prepared soil on FVSU Farm during the first quarter of the winter months of this year, 2015. 1) Questionnaires are being prepared in preparation for taste tests of the nuts in the future, 2) tree seedlings are growing beautifully, 3) the initial tree height measurements have been recorded and three subsequent growth height measurements will be recorded each year, once during the spring, summer and fall, respectively. **PUBLICATIONS (not previously reported):** 2014/09 TO 2015/08 1. Type: Conference Papers and Presentations Status: Published Year Published: 2015 Citation: Shapiro-Ilan, D.I., Mizell, R.F. An insect pupal cell with antimicrobial properties that suppress an entomopathogenic fungus? Journal of Invertebrate Pathology. 124:114-115 2. Type: Journal Articles Status: Published Year Published: 2015 Citation: Cowell, B., D. T. Johnson, R. Mizell and E. Garcia. 2015. Monitoring insect and pest damage in pecan in Arkansas. ISHA ActaHort. 1070: 151-157. 3. Type: Conference Papers and Presentations Status: Published Year Published: 2105 Citation: Shapiro-Ilan, D. I., Mizell, R. F. III. 2015. A novel discovery in pecan weevil?s pupal cell may lead to a new control method for pecan diseases such as scab. The Pecan Grower Magazine. 26(2): 10-17.

2013/09 TO 2014/08 What was accomplished under these goals? Funding had not been released to the University of Georgia by the end of 2014which represents the proposed work for a number of these project goals. These include goals I., IIB, III anda large percentage of V so this is reflected in this reprot. :UGA-Dutcher,A field trial was conducted to determine the efficacy of AG1000, an organic spray material for aphid control in pecansmanufactured by Teraganix Co. The material was applied ten times at two week intervals from bud break in early May through Sept. Tift Co., GA. A 12 acre plot of 28 year-old 'Desirable' pecan trees was transitioned from conventional to organic production beginning in 2014. The AG1000 was applied at a rate of 2.5 gal of formulation per 100 gal of final spray.The results indicated that AG1000 did not control aphids as indicated by the samples taken during two peaks of aphid activity in late August and early October. II.A.UGA-Dutcher, Ants remove beneficial insects that are cultured on alternate prey on the cover crops.Methyl carbitol, myristate and methyl anthranillate were tested for efficacy as ant repellents on cover crop plants with limited success. IIB: ARS-Shapiro-Ilan, Bock: Integrated tactics for control of key insect pests and plant diseases in pecan were investigated in small plot and large plot tests. The research was conducted at three separate farms at three locations: USDA-ARS research station, Byron, GA; Cleveland Organics, LLC, Fort Valley, GA, DGW Farms, Colquitt, GA.The experiment was conducted with two levels of insect pest & disease management, i.e., treated plots versus non-treated controls.These insect control treatments focused on the primary key pest, pecan weevil. The insect control treatment consisted of one entomopathogenic nematode application (Steinernema carpocapsae applied at 2 billion nematodes per acre) and one entomopathogenic fungus application (Beauveria bassiana applied at 5 x 1012 per ha). These treatments were made to the soil under the tree canopy in May-June, 2014. Additionally, at the Byron and Fort Valley location, Grandevo (Chromobacterium subtsugae) was applied at 3 lbs per acre. . To assess treatment effects, soil samples were taken regularly to assess entomopathogen presence and persistence. Pecan weevil adult emergence was monitored with Circle and cone traps. Finally, weevil damage to nuts was assessed at harvest by examining 100 nuts per plot for damage or presence (in the Cleveland and Byron orchards).Grandevo caused levels of pecan weevil suppression akin to the use of chemical insecticides. In other large plots tests, a combined pest management regime of C. subtsugae along with entomopathogenic fungi (Beauveria bassiana) and beneficial nematodes (Steinernema carpocapsae) caused lower pecan weevil infestation levels comparedto anon-treated control.Application of the entomopathogenic fungus, B. bassiana, in conjunction with composted manure, results in enhanced persistence and efficacy of the fungus relative to standard applications. Shapiro-Ilan and Mizell discovered that the pecan weevil pupal cells possess antimicrobial properties that suppress entomopathogenic fungi. IIC: ARS-Bock: Disease control, The effect of Bordeaux mixture on pecan scab was compared to non-treated control trees. In all experiments a total of 6-8 fungicide applications were made at 2-3 week intervals starting in late April and continuing through late August. A single foliar sample was taken in mid-June (when spring shoot growth was completed), and two fruit samples were taken, one in mid-June, and one in late-August. Samples were assessed for scab severity by estimating the extent of symptoms on the fruit shuck surface using standard area diagrams as an aide to ensure accuracy. In large plot tests Bordeaux mixture caused reduced pecan scab severity and

increased fruit weight. In small plot tests treatments of Regalia and Serenade consistently reduced scab severity throughout the season; some other treatments (e.g., compost tea, %, Sodium bicarbonate =77.3%, and Nordox) exhibited less favorable results. IIC, D: Auburn University- Wells: a.Evaluated organic methods of weed control including mulch, vinegar, flaming, and combinations thereof., b.Evaluated organic methods of leaf and nut scab control including Serenade, Nordox, Regalia, Bordeaux Mixture, and Sulfur.2.Pecan cultivar evaluation: a.Continued to evaluate pecan cultivars for scab susceptibility at two locations in Fairhope and Shorter, AL. b.Evaluated scab control in both high and low input orchards. III. Nothing to report, too early for this analysis to be conducted. IV: Experiments by UFL-Mizell were set up in an organic and a conventionally managed orchard in south Georgia using ground-level pitfall traps and aerial Malaise traps to determine and compare the arthropod biodiversity within these two orchard types. Within the organic orchard, the effects of fungicde use on arthropod populations were also assessed in a simialr manner. Trapping was conducted over the course of the pecan growing season in cooperation with Bock and Shapiro-Ilanfrom June untilthe beginning of harvest in October. Traps, 4/treatment were set in the field for 4 daysonce every 14 days over the period. Collected arthropods were removed to the lab, identified and quantified according to treatment. Large differences were observedin both the epigeal arthropodsand the aerially trapped species between the organic and conventional orchards. The organic orchard hadhigher species richness and biodiversity in both sample types. Fungicides used in the organic orchard hadlittle detectable effects on arthropod populations.UGA-Dutcher: Aaerial suction traps with a powerful fan at the base that draws air from the canopy of the pecan tree past a fine mesh screen via a volute extended up into the tree were effective in collecting flying and dispersing insects that were not found in conventional scouting methods. Four traps were run from 8:00 AM -- 3:00 PM for seven hours twice per week (50 times per season) at two pecan orchards in 2013 from May through October and compared to weekly foliage samples of the lower canopy for measuring the abundance of aphids and other flying and dispersing insects in the tree canopy. 2014 had too many rainy days and attempts to effectively run the traps on a regular basis resulted in damage and a loss of traps. Traps, modified to resist rainfall, have been constructed for trials in 2015. V. Outreach: Harris-TAMU:: Real time risk assessment for pecan nut casebearer was on-line for the 2014 season with a volunteer Cooperator Network of \~40 pecan producers recruited and trained to participate in inputting real time information from across the pecan belt that was then analyzed, processed, verified and posted to the website for public use in decision making. The resulting web pages were subsequently accessed by \>4,000 users of the website indicating that \~20% of the target producer audience was able to directly access this information. The project has also begun developing an Organic Pecan component to emphasize this option in pecan management in cooperation withMizell. **PUBLICATIONS (not previously reported):** 2013/09 TO 2014/08 Type: Journal Articles Status: Published Year Published: 2015 Citation: Shapiro-Ilan, D.I., Mizell, R.F. An insect pupal cell with antimicrobial properties that suppress an entomopathogenic fungus? Journal of Invertebrate Pathology. 124:114-115

↑ Return to Index

Subtropical Organic Agriculture Research (soar) Program: a Participatory Academic Program to Fill Knowledge Gaps for Organic Farmers

Accession No.	1003540
Subfile	CRIS
Project No.	TEXW-2013-03943
Agency	NIFA TEXW
Project Type	OTHER GRANTS
Project Status	EXTENDED
Contract / Grant No.	2013-51106-20970
Proposal No.	2013-03943
Start Date	01 SEP 2013
Term Date	31 AUG 2016
Grant Amount	$499,482
Grant Year	2013
Investigator(s)	Racelis, A.; Morris, MI.
Performing Institution	Biology, UNIVERSITY OF TEXAS-PAN AMERICAN, 1201 W. UNIVERSITY DRIVE

NON-TECHNICAL SUMMARY

Organic farmers in South Texas, and those interested in transitioning to organic production, face many challenges, including extremely intense pest pressure. Especially since the 2011 closing of the USDA-ARS Subtropical Agricultural Research Center in Weslaco, Texas, there has been very little research support available to these growers, in one of the most important agricultural regions in Texas. Strategically situated in subtropical south Texas, the University of Texas-Pan American will build upon its status as a USDA-designated Hispanic Serving Agricultural College and University (HSACU) by launching an innovative new academic program that engages students in rigorous, well-designed research projects designed to address real-world problems faced by organic farmers in South Texas. Using a participatory research approach, the project team will identify pressing research needs by interviewing farmers, agency staff, and organic inspectors. Students will help design and carry out supervised research studies to answer these questions. This practical field research experience will be at the center of an innovative experiential learning emphasis that will prepare students to become effective scientific researchers and will raise their awareness of the ecological benefits of organic farming. The project will also provide an educational program to inform growers, extension agents, and others about organic requirements, certification, marketing, processing facilities, enterprise budgets, and production methods. The ultimate goal of the project is to make South Texas organic producers more competitive by meeting some of their most urgent research needs and by publicizing research findings widely.

OBJECTIVES

· Through interviews and surveys of farmers, educators, organic inspectors, and others, identify critical research questions for organic and transitioning farmers in South Texas.· Identify a core group of organic or sustainable growers in south Texas interested in participating in the identification of research gaps· Recruit and hire one research associate that will manage research and collaborative efforts with Co-PI\'s.· Recruit 10 undergraduate students for research internships (2 each semester starting in Spring 2014) to conduct short-term stakeholder

driven research projects.· Recruit and retain one qualified masters student into UTPA\'s Department of Biology to conduct long-term stakeholder driven agroecological research during project period.· Engage UTPA students in carrying out practical field research aimed at answering these questions and solving real-world problems faced by organic and transitioning producers.· Raise awareness by students, faculty, and community members, of the ecological benefits of organic farming, including its benefits for biodiversity.· Add a strong experiential learning component focused on organic agriculture and agroecology to the Biology program at UTPA.· Give students a deep and meaningful experience that includes making a positive impact on agriculture, the economy, and the environment in South Texas.· Increase awareness by Texas crop producers about organic requirements, certification, marketing, processing facilities, enterprise budgets, and production methods.· Broadly disseminate research results to producers, educators, and agency staff via publications (in both English and Spanish), videos, webinars, and workshops.· Increase usage by Texas specialty crop growers of the free resources and technical assistance services available through NCAT\'s ATTRA Project and San Antonio-based office.· Evaluate all project activities for their impact on knowledge, behavior, and attitudes.· Evaluate the suitability of this educational model for replication in other places.· Launch a new interdisciplinary partnership between UTPA and the National Center for Appropriate Technology.

APPROACH

(1) Description of how the project will solicit and use stakeholder involvement; We will directly solicit project ideas from stakeholders. We will also create a steering committee that includes a wide variety of stakeholders, such as organic farmers, educators, organic inspectors, agency representatives, and students. Our goal is to create a community of co-learners. We are optimistic that this can be accomplished because the need for research, the potential for growth in the Texas organic sector, and the associated economic opportunities are obvious and widely-known.(2) Description of the proposed project activities and the sequence in which they are to be carried out ;A. Write a summary research report on the extent and type of existing and potential organic and sustainable production in South Texas. Also study and interview organic research programs in other states, to gather ideas and approaches that may be useful in South Texas. B. Develop an appropriate evaluation plan to capture project outcomes and impacts. C. Create a steering committee that includes a wide variety of stakeholders. Begin holding meetings at least quarterly. D. Hold a series of workshops in the late fall and early winter of Year 1, introducing local organic farmers to the project, engaging them in the research process, and inviting them to participate in the research process, including identification of knowledge gaps, design, and dissemination. Participant farmers will be offered a honorarium for their participation. E. Identify high-priority research needs of organic farmers, in South Texas, through interviews with organic and sustainable farmers; educators and agency staff involved in organic farming; and organic inspectors. Determine questions and problems that are suitable for research by supervised students. F. Choose, through an annual, competitive process, a total of 10 undergraduate students and one graduate student to participate in the project. These students will be paid a competitive salary as student research assistants and will be expected to work closely with Dr. Racelis and his post-doctoral research associate to carry out and help analyze the research. G. Students, producers, and faculty advisors work together to design appropriate research study and methods. H. Carry out the research in the spring and fall semesters during the project period, beginning in January 2014. Academic semesters conveniently coincide with south Texas growing seasons. I. Disseminate research results widely using the following:· Create at least six short instructional videos with how-to information that is directly relevant to organic and transitioning farmers in South Texas.· Offer at least four webinars (two per year in the second and third years of the project) on high-priority topics for South Texas organic growers.· Create at least three new publications, in both English and Spanish, on high-priority topics for South Texas organic growers.· Offer information about this project, disseminating research findings and addressing the organic transition process generally, at the annual conferences of the Texas Organic Farmers & Gardeners\' Association in 2013, 2014, and 2015.J. Simultaneous with all of the above, conduct a statewide educational campaign aimed at conventional growers, offering basic information about organic farming:· Give presentations on organic farming and the transition process at annual conferences of Texas agricultural trade associations, such as the Texas Herb Growers & Marketers, Texas Sweet Potato Growers, Texas High Plains Potato Growers, Texas Pecan Growers, Texas International Produce Growers, Edinburg Citrus Association, Texas Nursery Landscape Association, Texas Pomegranate Growers, Texas Olive Oil Council, Texas Blueberry Growers, Texas Fruit Growers, Texas State Florists, Texas Watermelon Growers, Hill Country Fruit Council, and Fort Bend County Vegetable Growers.K. Work closely with NCAT\'s Evaluation Specialist to rigorously evaluate project impacts and objectives bi-annually.

PROGRESS

2013/09 TO 2018/08 Target Audience: UT-RGV students, staff, and faculty Existing organic and transitioning farmers in South Texas, especially Hispanic (spanish-language) farmers New and beginning farmers Resource Personnel (Agricultural Extension Agents, Vendors, Advisory personnel) Programs at Hispanic Serving Institutions or other University Institutions interested in replicating participatory research approach Changes/Problems:In 2016, we requested a one year no-cost extension due various factors, including a late start for the project (at the establishment of the project period was a 15-day government shutdown). We only succesfully hired a post-doc research associate beginning January 2014. This post-doc landed a tenure track job with the University of Idaho, and resulting in a five month transition before we advertised and successfully hired a qualified replacement. In 2017, we requested another 6 month extension to present some of our accomplishments at the 2017 Texas Hispanic Farmers and Ranchers Program held in McAllen, TX (Sept 2017). What opportunities for training and professional development has the project provided?Through this project, we engaged a number of students to engage in various projects releted to the needs of farmers in south Texas. Students contributed to a number of different research projects, some of which resulted in publications and scientific presentations. Graduate and undergraduate students received technical training by faculty and staff related to this project, as well as training in extension. These opportunities included internships, travel to professional conferences (such as to the Southern SARE Cover Crop Conference, Texas Organic Farmers and Growers Conference), and participating and presenting at annual farmer meetings. Students also recieved basic training available through the university, including USAJobs.gov training available through the College of Science. Post doctoral scholars involved in this project received various training opportunities associated with professional development as a university employee, and also participated in various workshops for beginning faculty at the university. Such workshops included: Writing and Publishing, Grant Development, and Effective Supervision. Both post docs successfully drafted small research proposals to southern SARE. The first post doc, Dr. Carlo Moreno is now a tenure track faculty at the College of Wooster. The second post-doc scholar, is now a tenure track faculty at UTRGV, recently hired as a weed ecologist. This is of note because these were the first two full time post-doc scholars in the department at UTRGV. How have the results been disseminated to communities of interest?Results and progress from this project was disseminated though various presentations, publications and educational videos, and yearly contributions at the Texas Organic Farmers and Growers Association Annual meeting. This includes a strong extension effort on organic farming to producers, including 2 different field days, 9 short instructional videos, 2 different webinars, three publications on high-priority topics for South Texas organic growers. Students have made research presentations at various conferences, and NCAT partners also have disseminated results at various meetings. PI Racelis was also invited to present this model at other conferences such as the North America College and Teachers Association in 2016, and was invited to present this model at Sacramento State (California) and Florida INternational University (FIU) and the Universidad del Valle, (Cali, Colombia). The PI Racelis was the plenary speaker at the 2017 TOFGA Conference, and promoted a project publication \"Who are organic farmers in Texas?\", which has had a national distribution. We have repeated this at the 2018 TOFGA Conference. Finally, the model has been shared to more than 350 attendees at the 2017 Texas Hispanic Farmers and Ranchers Conference. What do you plan to do during the next reporting period to accomplish the goals? Nothing Reported

2014/09 TO 2015/08 Target Audience:UT-RGV students, staff, and faculty Organic and sustainable farmers in South Texas Resource Personnel (Agricultural Extension Agents, Vendors, Advisory personnel) Programs at Hispanic Serving Institutions or other University Institutionsinterested in replicating participatory research approach Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided? Insect scouting workshop held November 5, 2014 in partnering farm Hilltop Gardens in Lyford Texas (22 attendees) Two SOAR students and post doctoral research scholar attended 2015 Texas Organic Farmers and Growers meeting in San Antonio TX. Project students and scientists were invited to bepart of a paneldescribing the SOAR project.SOAR partnership-led panel at Texas Organic Farmers and Grower\'s Association Annual Meeting in San Antonio TX.Panel included student presentations for research, and general overview of the impacts and outcomes to date of the SOAR program How have the results been disseminated to communities of interest? Information is communicateddirecly in person. Much of our reseach to datewas disseminated directly to them at our annual SOAR PartnershipMeeting held on October 5, 2014. 8 Farms were represented (at total of 15participants). Insect scouting workshop held November 5, 2014 in partnering farm Hilltop Gardens in Lyford Texas (22 attendees Social Media includes Facebook (The SOAR Partnership), Website(www.utpa.edu/agroecology), direct emails,SOAR Listserv,Texas Organic Chronicles (1400+ members), • SOAR Newsletter What do you plan to do during the next reporting period to accomplish the goals? 3rd Annual SOAR meeting planned for November 5, 2015. Meeting will include SOAR advisor board and UTRGV Administrators. We will work closely with partners at NCAT to develop other communications about the project. We expect graduate student to finish thesis research as part of SOAR program and present this work,at conferences and in scientific publication Complete 3rd annual student survey at UTRGV and complete summary report.

2013/09 TO 2014/08 Target Audience: · UTPA University community, including students, faculty and staff · Local area farmers, especially those interested in transition to organic agriculture · Agricultural stakeholders, including consumers, extension agents, producers, processors, vendors, certifiers, in Texas and subtropical US, · Other universities interested in integration of education, research and extension efforts, especially in organic/sustainable agriculture. Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided? · Recruited and hired one research associate to manage research and collaborative efforts with Co-PI's. Dr. Carlo Moreno began as a full time Post-doctoral Research Scientist in January 2014 and is committed 100% of time and effort to the SOAR program · Recruited 2 undergraduate students for research internships to conduct short-term stakeholder driven research projects. Mr. Ricardo Marez and Ms. Heather Hernandez began with the SOAR program in January 2014 and will continue as undergraduate interns through to their expected graduation in December 2014. Both students received a USDA-NIFA-ORG SOAR scholarship of \$3500 in the spring 2014. · Recruited one qualified masters student into UTPA's Department of Biology to conduct long-term stakeholder driven agroecological research during project period. Ms. Savannah Rugg has been accepted into the program and will begin as a full time MS student in Fall 2014. · Engage UTPA students in carrying out practical field research aimed at answering real-world problems faced by organic and transitioning producers. Students are currently working on four projects: (1) a survey of insect fauna in organic-certified kale production; (2) a comparison of the effectiveness of flame-weeding and hand weeding; (3) an exploration of 6 different heirloom tomato varieties that are both heat- and disease tolerant, i.e. appropriate for cultivation in south Texas; and (4) a comparison of the effectiveness of 4 different summer cover-crop treatments to suppress weed pressure. How have the results been disseminated to communities of interest? Wide dissemination of SOAR progress: a. On October 15, Dr. Racelis spoke at an event at the UTPA Farmers Market Workshop (sponsored by NIFA-FMPP) highlighting our programs objectives. Several farmers were in attendance that eventually participated in our November stakeholder meeting. b. Robert Maggiani (NCAT) spoke about organic farming at three annual meetings: the Texas Certified Market Association (in Seguin, TX), Texas Olive Oil Growers' Association (in San Antonio, TX), and Fort Bend Vegetable Growers (in Rosenberg, Texas). *Not funded through this SOAR project. c. On January 31, Dr. Alex Racelis was invited as a guest speaker in a panel arranged by NCAT at the Texas Organic Farmers and Grower's Association Annual Meeting in Houston, TX. d. NCAT staff met with senior managers from H-E-B Grocery (on April 3, in San Antonio) and Whole Foods (April 17, in Austin). Among other topics of discussion, NCAT made them aware of our SOAR partnership and efforts to increase organic production in Texas. e. SOAR partnership with Plantation Produce referenced in a GO TEXAN insert in this April 6-13 week's edition of THE PACKER. f. On April 30, NCAT hosted a reception in San Antonio for members of the National Organic Standards Board. The SOAR program was showcased among attendees. g. SOAR program was highlighted in a USDA Strikeforce Taskforce visit to UTPA May 11. h. Invited presentation at the Annual Meeting of the Ecological Society of America meeting (held in August 10-15, 2014 in Sacramento CA) highlighting the SOAR program. Presentation is part of an Organized Symposium titled "Agroecology and its Application". What do you plan to do during the next reporting period to accomplish the goals? · Annual meeting with farmer/grower partners to held in late September to disseminate research advances and redefine research questions to pursue during the 2 discrete growing seasons in south Texas · Continue to participate in the co-generation of agricultural knowledge with core group of organic or sustainable growers in south Texas · Work closely research associate to manage research and collaborative efforts with farmer partners and NCAT. · In December 2014 recruit new undergraduate students for research internships to conduct short-term stakeholder driven research projects. · Retain masters student (Savannah Rugg) who will conduct long-term stakeholder driven agroecological research as part of MS thesis. · Continue to engage UTPA students in carrying out practical field research aimed at answering these questions and solving real-world problems faced by organic and transitioning producers. · Add a strong experiential learning component focused on organic agriculture and agroecology to the Biology program at UTPA. · Give students a deep and meaningful experience that includes making a positive impact on agriculture, the economy, and the environment in South Texas. · Raise awareness by students, faculty, and community members, of the ecological benefits of organic farming, including its benefits for biodiversity. · Increase awareness by Texas crop producers about organic requirements, certification, marketing, processing facilities, enterprise budgets, and production methods. · Broadly disseminate research results to producers, educators, and agency staff via publications (in both English and Spanish), videos, webinars, and workshops. · Increase usage by Texas specialty crop growers of the free resources and technical assistance ervices available through NCAT's ATTRA Project and San Antonio-based office. · Continue with evaluation of all project activities for their impact on knowledge, behavior, and attitudes. · Evaluate the suitability of this educational model for replication in other places. · Continue to foment and build interdisciplinary partnership between UTPA and the National Center for Appropriate Technology.

IMPACT

2013/09 TO 2018/08 What was accomplished under these goals? We successfully identified high-priority research needs of organic and sustainable farmers and transitioning farmers in South Texas via various surveys, interviews, and informal communications with beginning and established farmers in the region. We successfully hired two post doctoral research associates to help manage research and efforts of this project. THe first helped answer and address research questions related to entomology and pests. First post-doc successfully landed a tenure track job with the University of Idaho. We successfully hired a second postdoc that was skilled at addressing farmer questions about weed control and soil health. Second post-doc successfully applied to a USDA-NIFA Postdoctoral Fellowship and current is a NIFA Fellow at UTRGV. Through this project, we engaged a number of students to engage in various projects releted to the needs of farmers in south Texas. Students contributed to a number of different research projects, some of which resulted in publications and scientific presentations. The project was a tremendous success and elevated the role of community engagement across the entire university. The SOAR project was recognized by UTRGV, earning PI Racelis the UTRGV Faculty Excellence Award in Community Engagement. This project also helped inspire new facilities, new degrees and research tracks at UTRGV. For example, UTRGV now boasts the only certified organic teaching farm on a Texas University Campus across the entire state. There is a second garden facility established at the UTRGV Brownsville Campus. The School for Earth, Environmental, and Marine Sciences (home department of the PI) has two new degrees: a new MS degree in Agricultural, Environmental, and Sustainability Sciences, and a new BS degree in Sustainable Agriculture and Food Systems. In addition, the College of Sciences has recently advertised a cluster hire to support these new degrees and new research emphasis, successfully hiring in 2017 Tenure Track Assistant Professors in Entomology, Plant Physiology, and Soil Ecology and in 2018 we successfully hired Food Chemist, Food Safety Specialist, Food Packaging Engineer, Urban Systems Specialist, and Weed Ecologist. for 2019, we are advertising two additional positions in Plant Pathology and Integrated Pest Management. Many of these positions have gone to fulfil needs identified from community partners identified by this project. Through various publications and educational videos, and yearly contributions at the Texas Organic Farmers and Growers Association Annual meeting this program has increased awareness by Texas crop producers about organic requirements, certification, marketing, processing facilities, enterprise budgets, and production methods. This includes a strong extension effort on organic farming to producers, including 2 different field days, 9 short instructional videos, 2 different webinars, three publications on high-priority topics for South Texas organic growers.The PI Racelis was the plenary speaker at the 2017 TOFGA Conference, and promoted a project publication \"Who are organic farmers in Texas?\", which has had a national distribution. With the network of farmers and growers in the region, we helped planned the 2017 Texas Hispanic Farmers and Ranchers conference fall 2017 (with support from SARE and USDA-NRCS) which we are repeating Fall 2018. Under the SOAR Program, 4 farmers (specialty and commodity farmers) have transitioned to certified organic practice, with a total of nearly 2000 acres either currently certified organic or under organic transition. Another farmer has started working with UTRGV in 2018, with more than 12,000 acres of commodity crops. The educational model of participatory research has proven replicabilty. We have presented this program at various venues (including as part of a broader presentation at the 2016 annual meeting for the National Association for Colleges and Teachers in Agriculture). We have worked with Texas State University to put together a collaborative program to expand this model across central Texas, evidenced by a submitted proposal to the 2017 RFA for the USDA-NIFA Organic Transitions Program (not funded). This also expanded research at UTRGV\--we successfully applied for a Conservation Innovation Grant Proposal (\"Subtropical Soil Health Initiative\") for funding by the Natural Resources Conservation Service. UTRGV, NCAT, PPC Farms, and Hilltop Gardens (SOAR Partners) are all major partners. **PUBLICATIONS (not previously reported):** 2013/09 TO 2018/08 1. Type: Journal Articles Status: Accepted Year Published: 2016 Citation: Soti, P.G., S. Rugg, A. Racelis (2016). Potential of Cover Crops in Promoting Mycorrhizal Diversity and Soil Quality in Organic Farms. J. of Agricultural Science 8(8): 42-47. http://dx.doi.org/10.5539/jas.v8n8p42 2. Type: Conference Papers and Presentations Status: Accepted Year Published: 2016 Citation: Savannah Rugg, P.Soti, A. Racelis (2016) On-farm benefits of four warm season cover crops in subtropical organic farms. Southern Cover Crop Conference, Goldsboro, NC. July 18-19. 3. Type: Conference Papers and Presentations Status: Accepted Year Published: 2015 Citation: Savannah Rugg# and A. Racelis. 2015. Multifunctionality of Cover Crops in South Texas: Restoring ecosystem services in agroecosystems. Texas Society of Ecological Restoration Annual Meeting, November San Antonio, TX. 4. Type: Conference Papers and Presentations Status: Accepted Year Published: 2016 Citation: Amrita Singh, Diana Cantu, P. Soti, and A. Racelis (2016) Using Mycorrhizal fungi to increase productivity in organic farming. Subtropical Agriculture and Environment Society Annual Meeting. Weslaco, TX. Feb. 6 5. Type: Websites Status: Published Year Published: 2016 Citation: Duncan, J. (2016) Cover Crop Options for Hot and Humid Climates. Webinar available on https://www.youtube.com/watch?v= ERXyjX0rHI&feature=youtu.be 6. Type: Other Status: Published Year Published: 2016 Citation: Morris, M. and R. Maggiani (2016) Who Are the Organic Farmers of Texas? National Center for Appropriate Technology, Butte, MT. 24 p. https://attra.ncat.org/downloads/TX Organic Farmers.pdf 7. Type: Websites Status: Published Year Published: 2015 Citation: Subtropical Organic Agriculture

Research (SOAR) Partnership Videos.
https://www.youtube.com/playlist?list=PLDu0ElBiEy9x7YyLIpqu8mTdLRuInfMNG 8. Type: Journal Articles Status: Accepted Year Published: 2018 Citation: Soti, P., Van Camp, Q.**, Racelis, A. (in press). Laboratory Evaluation of Efficacy of Entomopathogenic Nematodes on Texas Leaf-cutting Ants, Atta texana. Southwestern Entomologist. 9. Type: Conference Papers and Presentations Status: Other Year Published: 2018 Citation: Kariyat, R., Soti, P., Racelis, A., (February 1, 2018). Cover cropping for attracting pests and predators in subtropical organic vegetable farms., Annual Meeting of Texas Organic Farmers and Gardners Association (TOFGA) Texas Organic Farmers and Gardners Association (TOFGA) (Georgetown, TX) 10. Type: Other Status: Published Year Published: 2016 Citation: George Kuepper & Mardi Dodson, updated by Justin Duncan, NCAT Agriculture Specialist (2016).? NCAT IP125. 20 pages 11. Type: Other Status: Published Year Published: 2014 Citation: Maggiani (2014). Organic Specialty Crop Production In Texas: A Grower\'s Handbook. ? NCAT IP488. 11 pages 12. Type: Other Status: Published Year Published: 2016 Citation: Duncan (2016). Aphids ? Botanical Control Formulations. ? NCAT IP520 13. Type: Other Status: Published Year Published: 2016 Citation: Duncan (2016) Leaf Miners - Botanical Control Formulations ?NCAT IP521 14. Type: Other Status: Published Year Published: 2016 Citation: Duncan (2016) Spider Mites - Botanical Control Formulations. ?NCAT IP522 15. Type: Other Status: Published Year Published: 2017 Citation: Duncan (2017). Cover Crop Options for Hot and Humid Areas. ?NCAT IP535 16. Type: Other Status: Published Year Published: 2016 Citation: Duncan (2016). Stink Bugs - Botanical Control Formulations. ? NCAT IP528 2 pages 17. Type: Other Status: Published Year Published: 2016 Citation: Duncan (2016). Grasshoppers - Botanical Control Formulations. ?NCAT IP519 18. Type: Other Status: Published Year Published: 2017 Citation: Duncan (2016) Whiteflies - Botanical Control Formulations. ? NCAT IP544 2 pages 19. Type: Theses/Dissertations Status: Accepted Year Published: 2017 Citation: Rugg, S. (2017). Multifunctionality of Cover Crops in Subtropical Organic Farms of South Texas. University of Texas Rio Grande Valley MS Biology Thesis. 87 p. 20. Type: Books Status: Published Year Published: 2017 Citation: Morris, M., Racelis, A. E., Moreno, C. (2015). Brassica Pests and their Natural Enemies: A Field Guide for Texas Organic Farmers. (pp. 45). Butte, MT: National Center for Appropriate Technology. Progress 09/01/15 to 08/31/16 Outputs Target Audience:• UT-RGV students, staff, and faculty • Existing organic and transitioning farmers in South Texas • New and beginning farmers • Resource Personnel (Agricultural Extension Agents, Vendors, Advisory personnel) • Programs at Hispanic Serving Institutions or other University Institutions interested in replicating participatory research Changes/Problems:During this project period we requested a one year no-cost extension due a cumulation of various factors. In addition to the late start for the project (with some delay at the establishment of the project period due to a 15-day government shutdown). We only succesfully hired a post-doc research associate beginning January 2014. When this post doc left in May 2015, this resulting in a four month transition before we advertised and successfully hired a qualified replacement in September 2015. What opportunities for training and professional development has the project provided?Through this project, we engaged a number of students to engage in various projects releted to the needs of farmers in south Texas. Students contributed to a number of different research projects, some of which resulted in publications and scientific presentations, and participation in field days related to this project. Graduate and undergraduate students received technical training by faculty and staff related to this project, as well as training in extension. These opportunities included internships, travel to professional conferences (such as to the Southern SARE Cover Crop Conference, Texas Organic Farmers and Growers Conference), and participating and presenting at annual farmer meetings. Students also recieved basic training available through the university, including USAJobs.gov training available through the College of Science. Post doctoral scholar involved in this project received various training opportunities associated with professional development as a university employee, and also participated in various workshops for beginning faculty at the university. She attended various seminars available through the Blology Department and the School for Earth, Environmental, and Marine Sciences. During this project period, she attended a university workshop in Writing and Publishing. How have the results been disseminated to communities of interest?Results and progress from this project have been disseminated though various presentations, publications and educational videos,and yearly contributions at the Texas Organic Farmers and Growers Association Annual meeting. This project period there was a strong extension effort on organic farming to producers, including a field day in November 2015, the publication of 9 short instructional videos (available on youtube in English and Spanish), 2 different webinars, and one scientific publication and three conference presentations on high-priority topics for South Texas organic growers. What do you plan to do during the next reporting period to accomplish the goals?Using this year extension, we will continue with developing discrete farmer driven research projects on weed management and soil health using cover crops. This is one of the more salient, emergent technologies that have multiple potential benefits. In response to this we hired a research associate who can help students design and conduct research leading to new knowledge in this field. We will also augment our publication and extension of our progress and results. This includes reporting on cover crop research, as well as five additional short ATTRA publications (tipsheets) are forthcoming, featuring botanical pesticides that are effective on various pests, all to include the USDA-NIFA Acknowledgement. Targeted audience includes farmers and growers who are members in Texas Organic

Farmers and Growers Association (TOFGA), and well as beginning and/or Hispanic farmers and ranchers in south Texas. Impacts What was accomplished under these goals? We successfully identified high-priority research needs of organic and sustainable farmers and transitioning farmers in South Texas via various surveys, interviews, and informal communications with beginning and established farmers in the region We successfully hired a replacement post doctoral research associate to help manage research and efforts of this project. THe first research associate participated in the project for 16 months, and then landed a tenure track job with the University of Idaho. We successfully hired a second postdoc, chosen based on her ability to address farmer questions about weed control and soil health, which have emerged as a potential tool to deal with subtropical conditions in these areas. Through this project, we have engaged a 8 different students to engage in various projects releted to the needs of farmers in south Texas. Students contributed to a number of different research projects, some of which resulted in publications and scientific presentations. The project was a tremendous success and elevated the role of community engagement across the entire university. The SOAR project was recognized by UTRGV, earning PI Racelis the UTRGV 2015 Faculty Excellence Award in Community Engagement. This project also helped inspire new facilities, new degrees and research tracks at UTRGV. For example, UTRGV now boasts the only certified organic teaching farm on a Texas University Campus across the entire state. Through various publications and educational videos, and yearly contributions at the Texas Organic Farmers and Growers Association Annual meeting this program has increased awareness by Texas crop producers about organic requirements, certification, marketing, processing facilities, enterprise budgets, and production methods.This project period included a field day, and the publication of 9 short instructional videos, 2 different webinars, and one peer-reviewed publication. Under the SOAR Program, 4 farmers have transitioned to certified organic practice, with a total of nearly 750 acres either currently certified organic or under organic transition. Publications Type: Journal Articles Status: Accepted Year Published: 2016 Citation: Soti, P.G., S. Rugg, A. Racelis (2016). Potential of Cover Crops in Promoting Mycorrhizal Diversity and Soil Quality in Organic Farms. J. of Agricultural Science 8(8): 42-47. http://dx.doi.org/10.5539/jas.v8n8p42 Type: Conference Papers and Presentations Status: Accepted Year Published: 2016 Citation: Savannah Rugg, P.Soti, A. Racelis (2016) On-farm benefits of four warm season cover crops in subtropical organic farms. Southern Cover Crop Conference, Goldsboro, NC. July 18-19 Type: Conference Papers and Presentations Status: Accepted Year Published: 2016 Citation: Amrita Singh, Diana Cantu, P. Soti, and A. Racelis (2016) Using Mycorrhizal fungi to increase productivity in organic farming. Subtropical Agriculture and Environment Society Annual Meeting. Weslaco, TX. Feb. 6 Type: Websites Status: Published Year Published: 2015 Citation: Subtropical Organic Agriculture Research (SOAR) Partnership Videos.
https://www.youtube.com/playlist?list=PLDu0ElBiEy9x7YyLIpqu8mTdLRuInfMNG

2014/09 TO 2015/08 What was accomplished under these goals? 2nd annual SOAR Partnership Meeting held on October 5, 2014. 8 Farms represented. Undergraduate students presented summaries of their participatory research. Insect scouting workshop held November 5, 2014 in partnering farm Hilltop Gardens in Lyford Texas (22 attendees) Recruited a total of 4 undergraduates and 1 MS student into project.3 UG have graduated of which 2 successfully entered graduate program in agriculture related studies, and other currently technician with the USDA.Students were awarded a scholarship for each semester involved in SOAR and were key participants in research endeavors.Successfully recruited graduate student, who currently is in the second year of MS degree in Biology.Student doing graduate research on subtropical covercrops In summer of 2014 held \"meet the buyers\" meeting with buyersHEB in San Antonio Texas (August 20) and Whole Foods in Austin TX (August 27).A total of 11 and 13 participants respectively. Identified and formed a 22-member SOAR advisory board of federal and state scientists, extension agents, industry who have agreed to support local area organic farms. Advised 3 SOAR Partners in the certification process, including the processing facilities at Plantation Produce, and Terra Preta Farms (Edinburg TX) and Yahweh All Natural Farms (Harlingen TX).Successful applications were submitted to Nature\'s International Certification Services, WI. Assisting two other SOAR Partners in the organic certification process:El Sabroso (Jesus Navar, San Benito TX) and Garza Family Farms (Rio Grande City Texas) SOAR partnership-led panel at Texas Organic Farmers and Grower\'s Association Annual Meeting in San Antonio TX.Panel included student presentations for research, and general overview of the impacts and outcomes to date of the SOAR program Inaugurated the UTRGV Certified Organic Agroecology Garden and Greenhouse, first certified organic garden on a Texas university campus (October 2014) (No NIFA funds were spent on the construction of the garden, although grant funding was used as an impetus for such as space on campus)Currently, the 12000 sq ft space is used for demonstration plots for ongoing research carried out in partnering farms. Spring 2015\--Completed 2nd annual survey designed to rank awareness of the ecological benefits of organic farming on the UTRGV campus. This past summer (2015) helped negotiate separate agreements between 2 partnering farms and local hospitals/health agencies in a farm to work program.Doctors Hospital at Renaissance is has agreed to sponsor Terra Preta Farms, and the Texas Health and Human Services (Children and Pregnant Women Program) is currently in negotiations with Yahweh All Natural Farms. Site visit by Whole Foods officials (July2015) to partnering farm in Lyford TX. \< \> **PUBLICATIONS (not previously

reported):** 2014/09 TO 2015/08 1. Type: Journal Articles Status: Accepted Year Published: 2015 Citation: Moreno C. and A. Racelis. 2015. Attraction, Repellence, and Predation: The Role of Companion Plants in Regulating Myzus persicae (Sulzer) (Hemiptera: Aphidae) in Organic Kale Systems of South Texas. Southwestern Entomology 40 (1) : 1-14 2. Type: Other Status: Other Year Published: 2014 Citation: Morris, M., C. Moreno, and A. Racelis. (2014) Brassica Pests and their Natural Enemies: A Field Guide For Texas Organic Farmers. National Center for Appropriate Technology (Butte, MT) (Published for Local Distribution, 25 pp) 3. Type: Other Status: Published Year Published: 2014 Citation: Maggiani, R. (2014) Organic Specialty Crop Production in Texas: A Growers Handbook. ATTRA Publication (retrieved from: https://attra.ncat.org/\...-pub/summaries/summary.php?pub=474)

2013/09 TO 2014/08 What was accomplished under these goals? · A key outcome of the November 20 meeting was the identification of critical research questions for organic and transitioning farmers in South Texas. This was accomplished through interviews and surveys of local farmers and growers. · Through a participatory process (largely voluntary from the farmer) we've identified a core group of organic or sustainable growers in south Texas interested in participating in the identification of research gaps. This list includes certified organic growers such as Plantation Produce (Mission, TX), Hilltop Gardens (Lyford, TX), as well as transitioning growers such as Yahweh Farms (Harlingen, TX), Gracia Farms (San Benito, TX), and Terra Preta Farms (Edinburg TX). · Recruited and hired one research associate to manage research and collaborative efforts with Co-PI's. Dr. Carlo Moreno began as a full time Post-doctoral Research Scientist in January 2014 and is committed 100% of time and effort to the SOAR program · Recruited 2 undergraduate students for research internships to conduct short-term stakeholder driven research projects. Mr. Ricardo Marez and Ms. Heather Hernandez began with the SOAR program in January 2014 and will continue through to their expected graduation in December 2014. · Recruited one qualified masters student into UTPA's Department of Biology to conduct long-term stakeholder driven agroecological research during project period. Ms. Savannah Rugg has been accepted into the program and will begin as a full time MS student in Fall 2014. · Engage UTPA students in carrying out practical field research aimed at answering real-world problems faced by organic and transitioning producers. Students are currently working on four projects: (1) a survey of insect fauna in organic-certified kale production; (2) a comparison of the effectiveness of flame-weeding and hand weeding; (3) an exploration of 6 different heirloom tomato varieties that are both heat- and disease tolerant, i.e. appropriate for cultivation in south Texas; and (4) a comparison of the effectiveness of 4 different summer cover-crop treatments to suppress weed pressure. · Provide technical support to participating stakeholders a. In early April we provided technical assistance to Hilltop Gardens, which experienced severe insect damage by army worms and aphids. b. We also provided technical assistance to Terra Preta Farms, who had severe impacts by rabbits and crop losses due to leaf-cutter ants. c. Provided technical assistance via NCAT to Plantation Produce in terms of the organic certification of their processing plant. · Add a strong experiential learning component focusing on organic agriculture and agroecology to the Biology program at UTPA through the establishment of 8,000 sq ft. research and teaching garden on campus. No NIFA funds were spent on the construction of the garden, although grant funding was used as an impetus for such as space on campus. However, it is mentioned here since the garden will undoubtedly direct attitudes of students toward awareness of issues and careers in agriculture and is an example of UTPA 's co-investment in programs such as these. Part of the campus garden will be certified organic, and will be used for research in this program. · Begun preliminary evaluation of project activities for their impact on knowledge, behavior, and attitudes toward sustainable and organic agriculture at UTPA. This is done in close collaboration with Mr. Al Kurki, evaluation specialist at NCAT. a. Campus survey at UT-Pan American (including questions about organic food and the ecological benefits of organic farming) ran for about a month and ended on April 25. A total of 512 responses were collected. b. As part of Earth Week at UTPA, NCAT partners offered a booth at the Student Union, coordinated with the campus Office for Sustainability, and provided information about organic farming as part of Earth Week activities on the UT-Pan American campus. · Launched a new interdisciplinary partnership between UTPA and the National Center for Appropriate Technology. UTPA and NCAT have met several times to discuss and plan our methods, and have spoken by phone at least once a month for periodic updates. · Wide dissemination of SOAR progress: a. On October 15, Dr. Racelis spoke at an event at the UTPA Farmers Market Workshop (sponsored by NIFA-FMPP) highlighting our programs objectives. Several farmers were in attendance that eventually participated in our November stakeholder meeting. b. Robert Maggiani (NCAT) spoke about organic farming at three annual meetings: the Texas Certified Market Association (in Seguin, TX), Texas Olive Oil Growers' Association (in San Antonio, TX), and Fort Bend Vegetable Growers (in Rosenberg, Texas). *Not funded through this SOAR project. c. On January 31, Dr. Alex Racelis was invited as a guest speaker in a panel arranged by NCAT at the Texas Organic Farmers and Grower's Association Annual Meeting in Houston, TX. d. NCAT staff met with senior managers from H-E-B Grocery (on April 3, in San Antonio) and Whole Foods (April 17, in Austin). Among other topics of discussion, NCAT made them aware of our SOAR partnership and efforts to increase organic production in Texas. e. SOAR partnership with Plantation Produce referenced in a GO TEXAN insert in this April 6-13 week's edition of THE PACKER. f. On April 30, NCAT hosted a reception in San Antonio for members of the

National Organic Standards Board. The SOAR program was showcased among attendees. g. SOAR program was highlighted in a USDA Strikeforce Taskforce visit to UTPA May 11. h. Invited presentation at the Annual Meeting of the Ecological Society of America meeting (held in August 10-15, 2014 in Sacramento CA) highlighting the SOAR program. Presentation is part of an Organized Symposium titled "Agroecology and its Application". **PUBLICATIONS (not previously reported):** 2013/09 TO 2014/08 No publications reported this period.

↑ Return to Index

Principles for Transitioning to Organic Farming: E-learning Materials and Decision Case Studies for Educators

Accession No.	1000447
Subfile	CRIS
Project No.	MIN-13-G27
Agency	NIFA MIN
Project Type	OTHER GRANTS
Project Status	NEW
Contract / Grant No.	2013-51106-21005
Proposal No.	2013-03973
Start Date	01 SEP 2013
Term Date	31 AUG 2016
Grant Amount	$0
Grant Year	2013
Investigator(s)	Sheaffer, C.
Performing Institution	Agronomy and Plant Genetics, UNIV OF MINNESOTA, ST PAUL, MINNESOTA 55108

NON-TECHNICAL SUMMARY

Our outreach, education and Extension project is based on the critical need for quality educational materials on transitioning to organic farming. Our team will create a series of online, interactive educational modules with a focus on the fundamentals of organic agriculture and how to transition to organic farming. Modules will cover important crop production topics including rotation, soil fertility, crops to grow during transition, weed and pest management, and many other subjects for both agronomic and horticultural producers. Each of our modules will be composed of a core-principle component and a decision case study. The core-principle component will be designed to provide fundamental information that will be combined with interactive learning such as self-guided quizzes and tests, as well as multimedia aspects such as video, music and narration. The decision case studies component will engage higher level learning in each subject through the study of dilemmas based on experiences of organic producers in our region. By utilizing e-learning tools and teaching methods that enhance critical thinking skills, we will increase the value and availability of educational resources on transitioning to organic agriculture. Modules will be used by university instructors, Extension educators, and regional sustainable agriculture organizations to educate transitioning farmers, undergraduate students, and organic consultants. Our e-learning resources will be designed to be adaptable for multiple uses including workshops, an intensive training class on transitioning for farmers, and undergraduate agriculture classes.

OBJECTIVES

Transitioning to organic farming can be a risky prospect for those who have only farmed conventionally. A transitioning organic farmer is thrown into a whole new world with new rules, new methods, and unfamiliar problems. When this new world is combined with a much-reduced support system, the risk of failure can be great. Information is available to farmers regarding the basic facts about organic agriculture, but real world situations that are beyond commonly-available knowledge can stymie even experienced producers. Undergraduate education is in transition. The conventional mode of lecturing by faculty with passive learning of facts by students is being reevaluated. In many fields, educators can now rely on interactive online tools to disseminate important

information, while reserving classroom time for collaborative group work and faculty-guided discussions that provide a greater emphasis on higher learning processes that develop critical thinking skills. Developing deeper thinking skills for undergraduate courses is important for organic and sustainable agriculture topics. There is a critical need for quality educational materials on transitioning to organic farming for farmers and students. Our project will design a series of online, interactive educational modules with a focus on fundamentals of organic agriculture and how to transition to organic farming for selected agronomic and horticultural crops. Each of the 14 modules will have a core-principle component and a decision case study. The general model of disseminating information to the public by university and extension personnel has evolved over the years. We will use all the modern tools available to promote learning to a higher capacity. In summary, our overall objective is to develop the next generation of educational materials in organic agriculture, specifically designed for active learning and development of critical thinking skills. Our materials will be used by university instructors, Extension educators, and regional sustainable agriculture organizations to educate transitioning farmers, undergraduate students, and organic consultants.

APPROACH

The primary project activities that will lead to accomplishing our objectives are described below. Learning group meetings. Learning groups are an innovative technique where producers, educators, and researchers interact with the goal of education for all involved. We have a network of organic farmers throughout the state with whom we meet periodically on other projects or to do on-farm research. We will meet with organic farmers in learning groups at all steps of the process - to review subject matter, to interview for decision case studies, and to test out the modules when they are complete. We will hold learning group meetings with our established members and invite newly transitioning farmers to meet each other and discuss our topics. One of the most important factors in organic farming success, according to our learning group members, is having a good network of other organic farmers. We have found that learning groups are great ways for established farmers to network and discuss their experiences and learn from others; this model would also greatly benefit transitioning farmers. Learning groups will offer the opportunity for transitioning farmers to meet experienced organic farmers in their areas and add to their support system. We have also discovered that when we hold learning groups, all parties benefit, especially us as educators and researchers. Outcome: we will form three learning groups in different regions that meet three times a year. Train-the-trainers. The University of Minnesota Extension Service will play a large role in reaching farmers. Extension educators who have promoted organic agriculture in Minnesota will work on this project to help develop content. These lead educators will offer classes on learning materials and train Extension personnel in utilizing the interactive materials and decision case studies. Outcome: Train 10 Extension educators. Workshops on transitioning topics. Extension educators will hold several workshops on topics relating to transitioning in different sections of the state. We will gauge the demand for length, timing, and frequency of offering the workshops and training. Extension educators will hold workshops in several locations across the state every year. We will apply for Continuing Education Units (CEU) for Certified Crop Advisers through the Certified Crop Adviser Program. Crop consultants will be able to take these workshops with Extension personnel\'s guidance for CEUs. Outcome: Use materials to teach 100 transitioning farmers, organic farmers and other interested individuals each year. Intensive training course for transitioning farmers. An in-depth training course on transitioning using these materials will be offered at our field stations. This course will integrate the entirety of the learning materials we develop into a comprehensive class. Outcome: Use materials to train 25 transitioning farmers each year. Educational materials for undergraduate students. The University of Minnesota is in the process of developing a Food Systems major that will include a track on Organic and Local Food Productions. Our modules will be used in several of the classes within the major by our faculty to teach undergraduate students in this program and perhaps even in conventional agricultural classes. Being on a large university campus, we have many students that can \"beta test\" the modules for interest in the subject matter, level of engagement and overall function. We will hold focus groups to test the materials with undergraduate students. These materials will be available to faculty at other colleges and universities in the U.S. Outcome: Use materials in 5 undergraduate courses at the University of Minnesota to teach 125 students per year, instructors at other colleges to use materials for 100 students per year. Educational materials for regional organizations. Our partners, MOSES (Midwest Organic and Sustainable Education Service) and the CIAS (Center for Integrated Agricultural systems), have extensive relationships with organic farmers in WI, both with agronomic and horticultural farmers. MOSES will utilize and evaluate the materials at workshops during their annual conference and at other less formal educational events. Another partner, eOrganic, will aid us in obtaining a national audience of farmers and students by publishing our versions of our modules for the general public on eOrganic\'s YouTube channel. We will make our educational resources available to other regional organizations as well. Outcome: Reach a regional audience of 300 farmers per year and national audience of 3,000 people each year. Adaptability of materials. We will design our e-Learning materials to be truly modular. Many of the elements can be stand-alone products. For example, a professor could use one of the decision case studies in a class on

sustainable agriculture. Versions of the modules, perhaps without some of the interactive elements like quizzes, can be played during lecture, just as an educator might use a video. An extension educator could use our modules on weed control to educate both conventional and organic audiences about the overall principles of weed management. While the components can be used on their own, they will also function together as a course. We will provide an instructor\'s manual to guide educators in using the materials as a course.

PROGRESS

2013/09 TO 2017/08 Target Audience:We have a broad target audience including organic producers, Extension educators, organic agricultural professionals, college teachers, undergraduate students, and sustainable agriculture organizations. Our efforts to reach our target audience include the following: During our outreach activities for this project, we have encouraged attendees to sign up for our mailing list. We maintain regular contact with those who are interested and let them know about upcoming project activities, in addition to other events of interest, through our email list. We have a project webpage on eOrganic. This site connects the general public to information about our project including our objectives, details of our e-learning modules and decision case studies, and our project team. The site is located at http://eorganic.info/transitioning. Our project has a strong outreach component as part of our primary objectives. As a result, we are in contact with our target audience routinely through our listening sessions and workshops, in classrooms where we test decision cases, and at conferences we attend. For more details, please see the \"Accomplishments\" section of this report. In the recent review of organic research \"Taking Stock: Analyzing and reporting Organic Research Investments, 2002-2014\" conducted by the Organic Farming Research Foundation, our \"Principles to Transitioning\" project was listed as one of the projects \"that seemed especially effective and innovative in their approaches to producer engagement.\" Our audience will continue to be targeted via our project website organictransition.umn.edu. Please see more on our outreach efforts in the \"Results Dissemination\" section of this report. Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided?Several of our team members are being provided with new opportunities to work with organic producers and organic professionals. Our partners at the Midwest Organic and Sustainable Education Service and the Center for Integrated Agricultural Systems (University of Wisconsin), as well as several of us from the University of Minnesota, have learned how to develop and use decision case studies. How have the results been disseminated to communities of interest?Our communities of interest have been involved at all steps of our project. Please see \"Accomplishments\" section for our listening sessions, transitioning workshops, and undergraduate classes that involved our communities of interest. At the start of the project, we engaged our target audience in several ways: We put announcements on SUSTAG eOrganic, and Organic Network listservs that includes producers, agricultural professionals, college students, and other interested parties from around the region. We participated in the Sustainable Agriculture Open Forum Discussion on February 11, 2014 at the University of Minnesota Southwest Research and Outreach Center (SWROC) in Lamberton, MN. One of the main topics for this session was transitioning to organic farming. Carmen Fernholz introduced our project and handed out flyers to participants. Several participants of this forum signed on to be listening session participants for our project. Jill Sackett Eberhart gave a presentation about the project at the Southern Minnesota Organic Crops Day in Owatonna, MN on March 19. She provided an overview of the project to get people interested in either participating in our upcoming listening sessions or as subjects for our decision case studies. Agrinews interviewed Jill Sackett Eberhart about the launch of our grant and project in April 2014. See this link for the article - http://www.postbulletin.com/archives/u-of-m-to-launch-organic-project/article 1 4c98355-7b29-508b-a458-691542f3ff75.html We were part of the Organic Field Day at the Lamberton Southwest Research and Outreach Center held on July 11, 2014. Jill Sackett Eberhart had a booth display set up that included information on this and other organic projects. She was on-hand to answer questions about our project. This field day is the largest in the state and generally has at least 100 attendees including producers, agricultural professionals, and students. Jill Sackett Eberhart gave a presentation about the project at the Southern Minnesota Organic Crops Day in Owatonna, MN on March 31, 2015. She provided an overview of the project to get people interested in either participating in our upcoming events or as subjects for our decision case studies. Our materials will be located at organictransition.umn.edu. We will publicize our website with our decision case studies and educational modules to further reach our communities of interest. Our goal is to promote awareness of our project and increase the use of these materials. Our college communications team will help us develop a communications plan for publicizing our project. We will also continue to work with our partners at eOrganic, MOSES and CIAS to publicize our materials to a national audience. A targeted campaign will be conducted including news releases, postcards notifying organic educators throughout the region, articles in relevant agricultural publications, presentations at organic conferences, and announcements on email listservs such as eOrganic, eXtension, Sustag, Sustainable Agriculture Research & Education (SARE), Midwest Organic and Sustainable Education Service (MOSES), Organic Grain Resource and Information Network (OGRAIN), National Sustainable Agriculture Assistance Program (ATTRA), Sustainable Farming Association (SFA), Land

Stewardship Project (LSP), NIFA Fresh From the Field (USDA), Practical Farmers of Iowa, Iowa Organic Association, regional Departments of Agriculture, and other universities in our region. Based on our past experiences with our Risk Management Guide for Organic Producers publication (https://organicriskmanagement.umn.edu/), we anticipate gaining a large audience for our unique transitioning-to-organic materials. We will monitor website visits and module viewing using Google Analytics, and will keep track of educator inquiries for gated materials, which include PowerPoint presentations for educators and teacher versions of the case studies that contain Teaching Outlines and Epilogues. We will also develop a survey using Qualtrics to gauge the opinions of our users. While, our project has ended, our team will continue to support the website housing our educational materials by maintaining the website; providing support to educators, farmers and students who use our materials; and upgrading the technology as necessary. What do you plan to do during the next reporting period to accomplish the goals? Nothing Reported

2014/09 TO 2015/08 Target Audience:We have a broad target audience including organic producers, Extension educators, organic agricultural professionals, college teachers, undergraduate students, and sustainable agriculture organizations. Our efforts to reach our target audience include the following: Jill Sackett, our Extension outreach coordinator, gave a presentation about the project at the Southern Minnesota Organic Crops Day in Owatonna, MN on March 31, 2015. She provided an overview of the project to get people interested in either participating in our upcoming events or as subjects for our decision case studies. During our outreach activities for this project, we have encouraged attendees to sign up for our mailing list. We maintain regular contact with those who are interested and let them know about upcoming project activities, in addition to other events of interest, through our email list. We have a project webpage on eOrganic. This site connects the general public to information about our project including our objectives, details of our e-learning modules and decision case studies, and our project team. The site is located at http://eorganic.info/transitioning. Our project has a strong outreach component as part of our primary objectives. As a result, we are in contact with our target audience routinely through our listening sessions and workshops, in classrooms where we test decision cases, and at conferences we attend. For more details, please see the \"Accomplishments\" section of this report. Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided?Jill Sackett, our Extension outreach coordinator, is being provided with new opportunities to work with organic producers and organic professionals. Her previous background is in sustainable agriculture so this current work will allow her to expand her role in Extension to other organic projects in the future. Our partners at the Midwest Organic and Sustainable Education Service and the Center for Integrated Agricultural Systems (University of Wisconsin), as well as several of us from the University of Minnesota team, have learned the details of how to develop decision case studies from Dr. Steve Simmons, our decision case consultant. How have the results been disseminated to communities of interest?Presently, none of our products (decision case studies and e-learning modules) have been published and thus we do not have results to share at this time. However, in our listening sessions and other outreach activities, we are regularly communicating our plans to our audience and are incorporating their ideas into our project. What do you plan to do during the next reporting period to accomplish the goals?Objective 1: Listening Sessions. We plan to continue holding listening sessions several times per year throughout the project to get farmer input on our materials. From our listening sessions, we have enlisted volunteers who will review our materials on their own and offer more substantive input than we can get in group settings. Objective 2: Decision case studies for farmers and undergrads. Our decision case developers will continue to create more case studies that complement the topics of our e-learning modules. Objective 3: e-learning modules for farmers and undergrads. By the end of Year 3, we will have the e-learning module content completed and the interactive functionality finished. Objective 4: Workshops on transitioning. In December, we will hold three day-long workshops on transitioning in Morris, Lamberton, and Rochester, MN. These workshops will be led by Kristine Moncada, Jill Sackett and Carmen Fernholz. The curriculum will include versions of our modules and our decision case studies. We will also include a question and answer session led by Carmen Fernholz, an organic farmer for over 30 years. We plan to hold another day-long workshop led by Carmen Fernholz, on transitioning to organic in conjunction with the Minnesota Organic Conference in St. Cloud, MN in January 2016. In 2016, we will also hold several more workshops in other regions to test out additional educational materials. Objective 5: Train-the-trainers. This objective will be addressed in Year 3. Objective 6: Intensive training course for transitioning farmers. This objective will be addressed in Year 3.

2013/09 TO 2014/08 Target Audience: We have a broad target audience including organic producers, Extension educators, organic agricultural professionals, college teachers, undergraduate students, and sustainable agriculture outreach organizations. Our efforts to reach our target audience include the following: We publicized the start of our project with an announcement on the SUSTAG and Organic Network listservs that includes producers, agricultural professionals, college students, and other interested parties from around the region. We participated in the Sustainable Agriculture Open Forum Discussion on February 11, 2014 at the University of

Minnesota Southwest Research and Outreach Center (SWROC) in Lamberton, MN. One of the main topics for this session was transitioning to organic farming. It was a facilitated open forum where everyone had the opportunity to interact with others including experienced farmers, marketers and product end users. Carmen Fernholz, the organic coordinator for the University of Minnesota, introduced our project and handed out flyers to participants. Several participants of this forum signed on to be listening session participants for our project. Jill Sackett, our Extension outreach coordinator, gave a presentation about the project at the Southern Minnesota Organic Crops Day in Owatonna, MN on March 19. She provided an overview of the project to get people interested in either participating in our upcoming listening sessions or as subjects for our decision case studies. Agrinews interviewed Jill Sackett, the Extension educator on this project, about the launch of our grant and project in April 2014. See this link for the article - http://www.postbulletin.com/archives/u-of-m-to-launch-organic-project/article 1 4c98355-7b29-508b-a458-691542f3ff75.html We were part of the Organic Field Day at the Lamberton Southwest Research and Outreach Center held on July 11, 2014. Jill Sackett had a booth display set up that included information on this and other organic projects. She was on-hand to answer questions about our project. This field day is the largest in the state and generally has at least 100 attendees including producers, agricultural professionals, and students. We made contact with our target audience through our listening sessions. For more information on these, please see the "Accomplishments" section of this report. Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided? Jill Sackett, our Extension outreach coordinator, is being provided with new opportunities to work with organic producers and organic professionals. Her previous background is in sustainable agriculture so this current work will allow her to expand her role in Extension to other organic projects in the future. Our partners at the Midwest Organic and Sustainable Education Service and the Center for Integrated Agricultural Systems (University of Wisconsin), as well as several of us from the University of Minnesota team, are learning the details of how to develop decision case studies from Dr. Steve Simmons, our decision case consultant. How have the results been disseminated to communities of interest? Presently, all of our products (decision case studies and e-learning modules) are still works in progress and thus we do not have results to share at this time. However, in our listening sessions and other outreach activities, we are regularly communicating our plans to our audience and are incorporating their ideas into our project. What do you plan to do during the next reporting period to accomplish the goals? Objective 1: Listening Sessions. We plan to continue holding listening sessions several times per year throughout the project to get farmer input on our materials. Objective 2: Decision case studies for farmers and undergrads. Our decision case developers will continue to create more case studies that complement the topics of our e-learning modules. Objective 3: e-learning modules for farmers and undergrads. By the end of Year 2, we hope to have most of the 14 e-learning modules completed. Objective 4: Workshops on transitioning. We will be holding a day-long workshop led by Carmen Fernholz, on transitioning to organic in conjunction with the Minnesota Organic Conference in St. Cloud, MN in January 2015. Included in the curriculum will be some of our decision case studies. This will be a great opportunity to test and fine-tune these case studies. In Year 2, we will also hold several half-day workshops in other regions to test out additional educational materials. Objective 5: Train-the-trainers. This objective will be addressed in Year 3. Objective 6: Intensive training course for transitioning farmers. This objective will be addressed in Year 3.

IMPACT

2013/09 TO 2017/08 What was accomplished under these goals? Objective 1: Listening Sessions In the spring of the first year of our project, we organized listening sessions around the region in Waite Park, Farmington, and Rochester, MN. Attendees included agricultural professionals such as organic crops consultants, organic inspectors, and organic grain buyers, as well as organic and transitioning farmers. For this first round of discussions on transitioning to organic production, we gathered input from our participants on our project plans. Our discussion topics included: what are the best ways to reach transitioning farmers, what they thought was preventing more conventional farmers from transitioning, what are the biggest obstacles to transitioning, and who organic farmers turn to for education during transition. Participants noted the great need for educational materials due to the risk associated with the transition process. As we anticipated based on our previous work with learning groups of organic farmers, weed control and fertility were at the top of the list of their concerns for transitioning. In the second year of our project, we organized listening sessions in St. Cloud and Owatonna, MN. Attendees included agricultural professionals such as organic crops consultants, organic inspectors, and organic grain buyers, as well as organic and transitioning farmers. This year, we noticed that a large number of participants were concerned about marketing, which we addressed in the development of our marketing modules (Objective 3). Objective 2: Decision Case Studies Decision case studies are an excellent way to develop higher learning processes because they are based on actual \"real life\" situations where a farmer is faced with a dilemma. What differentiates decision case studies from descriptive cases is the requirement that a decision be made by the

participant through the discussion questions and instructor-led discussions. Along with our partners from the Midwest Organic and Sustainable Education Service (MOSES) and the Center for Integrated Agricultural Systems (CIAS), we developed sixteen decision case studies. Our decision case studies consists of several parts: 1) case objectives - what the student is expected to learn from the study, 2) a narrative of the background and context - this is the farmer\'s story and the facts pertaining to the dilemma, 3) exhibits that provide additional details on the dilemma, and 4) questions to consider - this section helps summarize the primary evidence the student needs to consider. We have also created educator editions that have teaching notes to accompany each case and guide its use, lesson outlines, and epilogues that provide resolution to the dilemmas that are only for the instructor who may choose to use or not use in their class. Our case studies are ultimately designed to help farmers and students learn more about the real life problems that face transitioning and organic farmers. We increased the number of decision case studies we completed beyond our original plan to encompass more areas where farmers encounter problems. Our sixteen completed case studies are listed in the \"Publications\" section of this report. The topics are wide-ranging from beginning farmers to established farmers near retirement who are considering transitioning to organic. Several cases are appropriate for our undergraduate audience, while many others involve topics that can challenge even the most experienced organic farmers. We have tested our case studies on farmers in our workshops and on undergraduates in classrooms. Our case studies have met our expectations in provoking critical thinking and greater understanding of the case topics. For example, when we conducted a discussion on the winter wheat in rotation case where the farmer was having a Canada thistle problem, participants provided many different solutions, some of them quite novel. These decision case studies will be housed on our website at organictransition.umn.edu. Objective 3: e-learning modules for farmers and undergraduates We designed e-learning modules to teach principles of organic farming to conventional farmers considering transitioning and also to undergraduate students in agriculture who may be considering organic farming as an occupation. Our modules are comparable to advanced lectures, but with improved capabilities such as narration, music, animation, and video. We used Adobe Presenter as the software to develop our modules. Module presentations can be accessed wherever the Internet is available and learners will not need any specialized software. The web-based modules have built-in narration just as a professor would lecture in class. Each module contains a comprehensive list of references and website links for supplemental reading. We also will have non-interactive versions of the modules that are PowerPoint-based for educators who want to use the materials to develop their own presentations. We revised our original plan and developed several additional modules to include more topics based on input from farmers in our listening sessions and workshops. Our twenty modules are listed in the \"Publications\" section of this report. We have created some unique materials on topics that are not often covered in depth. Highlights include Marketing Organic Crops, Resources for Transition, Growing and Marketing a New Crop, and Preventing GMO Contamination. Our modules will be housed at organictransition.umn.edu. Objective 4: Workshops on transitioning Our project incorporated several workshops using our case studies and module materials on topics relating to transitioning. Our first workshop was held in early 2015 at the Minnesota Organic Conference in St. Cloud, where we tested the decision case study on cover crops. Our second round of workshops were held in the winter of December 2015 - January 2016. Our team, consisting of Carmen Fernholz, Jill Sackett Eberhart, and Kristine Moncada, held three workshops in Lamberton, Rochester, and St. Cloud, MN with 70 participants total. 10 of the participants came from other states including Iowa, Wisconsin, and South Dakota. The topics covered in these workshops included What Is Organic, Resources for Organic, Certification and Record Keeping, a decision case study group discussion, Transitioning Soil Management, and Transitioning Weed Management. We surveyed the participants before and after the workshops. Of the people who answered this question: \"Overall, how satisfied are you with the Transitioning to Organic Workshop?\", 95% replied they were \"much satisfied\" or \"very much satisfied\". Our last round of workshops was held in December 2016 in Mankato and St. Cloud, MN. These workshops were led by Kristine Moncada, Carmen Fernholz, Gigi DiGiacomo, Connie Carlson, and Adria Fernandez. The curriculum included versions of our modules and our decision case studies. However, to test even more of the materials we had been developing, we presented materials on Weed Biology, Mechanical Weed Control, Marketing Organic Crops, Soil Microbial Communities, and a decision case study on how to provide fertility to organic crops. In this round of workshops, we had 60 people attend, and like our first workshops, the majority of participants were \"much satisfied\" or \"very much satisfied\". Objective 5: Train-the-trainers Extension educators will offer classes using our learning materials. We have already been contacted by educators from around the country about our materials. We will continue to support these and other educators who use our materials. Some of this audience (NRCS and Extension educators, etc) have attended our transitioning workshops to see the materials used firsthand. **PUBLICATIONS (not previously reported):** 2013/09 TO 2017/08 1. Type: Other Status: Published Year Published: 2017 Citation: Eberhart, J. 2017. Cover Crop Conundrum. A Decision Case Study in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. S. Simmons, K. Moncada, C. Sheaffer, G. DiGiacomo, and N. Tautges (Eds). University of Minnesota, St. Paul, MN. 2. Type: Other Status: Published Year Published: 2017 Citation: Eberhart, J. 2017. Will Changing the Rotation Change It All? A Decision Case Study in Principles for Transitioning to Organic Farming: e-Learning Materials

and Decision Case Studies for Educators. S. Simmons, K. Moncada, C. Sheaffer, G. DiGiacomo, and N. Tautges (Eds). University of Minnesota, St. Paul, MN. 3. Type: Other Status: Published Year Published: 2017 Citation: Eberhart, J. 2017. Saying \"Yes\" to Raising Organic Soybeans. A Decision Case Study in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. K. Moncada, C. Sheaffer, G. DiGiacomo, and N. Tautges (Eds). University of Minnesota, St. Paul, MN. 4. Type: Other Status: Published Year Published: 2017 Citation: Eberhart, J. and C. Carlson. 2017. Should We Transition Our Livestock to Organic? A Decision Case Study in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. K. Moncada, C. Sheaffer, G. DiGiacomo, and N. Tautges (Eds). University of Minnesota, St. Paul, MN. 5. Type: Other Status: Published Year Published: 2017 Citation: Miller. M. 2017. Fighting Fire Blight. A Decision Case Study in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. K. Moncada, C. Sheaffer, G. DiGiacomo, and N. Tautges (Eds). University of Minnesota, St. Paul, MN. 6. Type: Other Status: Published Year Published: 2017 Citation: DiGiacomo, G. 2017. Cash Flow Crunch. A Decision Case Study in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. K. Moncada, C. Sheaffer, and N. Tautges (Eds). University of Minnesota, St. Paul, MN. 7. Type: Other Status: Published Year Published: 2017 Citation: Nelson, J. 2017. Managing Weeds Organically: Do We Have to Use Plastic? A Decision Case Study in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. K. Moncada, C. Sheaffer, G. DiGiacomo, and N. Tautges (Eds). University of Minnesota, St. Paul, MN. 8. Type: Other Status: Published Year Published: 2017 Citation: Eberhart, J. 2017. Finding Fertility without Livestock. A Decision Case Study in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. K. Moncada, C. Sheaffer, G. DiGiacomo, and N. Tautges (Eds). University of Minnesota, St. Paul, MN. 9. Type: Other Status: Published Year Published: 2017 Citation: DiGiacomo, G. 2017. Marketing Transitional Grains. A Decision Case Study in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. K. Moncada, C. Sheaffer, and N. Tautges (Eds). University of Minnesota, St. Paul, MN. 10. Type: Other Status: Published Year Published: 2017 Citation: Miller, M. 2017. Marketing Poultry without a Processor. A Decision Case Study in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. K. Moncada, C. Sheaffer, G. DiGiacomo, and N. Tautges (Eds). University of Minnesota, St. Paul, MN. 11. Type: Other Status: Published Year Published: 2017 Citation: Carlson, C. and K. Moncada. 2017. Sharing a Fenceline: Keeping the Peace when Pesticide Drifts. A Decision Case Study in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. C. Sheaffer, G. DiGiacomo, J. Riddle, and N. Tautges (Eds). University of Minnesota, St. Paul, MN. 12. Type: Other Status: Published Year Published: 2017 Citation: Behar, H. and J. Padgham. 2017. Should I Become an Organic Farmer? A Decision Case Study in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. S. Simmons, M. Miller, K. Moncada, C. Sheaffer, G. DiGiacomo, and N. Tautges (Eds). University of Minnesota, St. Paul, MN. 13. Type: Other Status: Published Year Published: 2017 Citation: Carlson, C. 2017. Too Late to Transition? A Decision Case Study in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. K. Moncada, C. Sheaffer, G. DiGiacomo, and N. Tautges (Eds). University of Minnesota, St. Paul, MN. 14. Type: Other Status: Published Year Published: 2017 Citation: Miller, M. 2017. Should We Transition our Orchard to Organic? A Decision Case Study in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. S. Simmons, K. Moncada, C. Sheaffer, G. DiGiacomo, and N. Tautges (Eds). University of Minnesota, St. Paul, MN. 15. Type: Other Status: Published Year Published: 2017 Citation: DiGiacomo, G. 2017. Transitioning on Rented Land. A Decision Case Study in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. K. Moncada, C. Sheaffer, and N. Tautges (Eds). University of Minnesota, St. Paul, MN. 16. Type: Other Status: Published Year Published: 2017 Citation: Nelson, J. 2017. How Do I Manage Perennial Weeds in My Transitioning Row Crops? A Decision Case Study in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. K. Moncada, C. Sheaffer, and N. Tautges (Eds). University of Minnesota, St. Paul, MN. 17. Type: Other Status: Published Year Published: 2017 Citation: Moncada, K., J. Eberhart, H. Behar, C. Carlson, and C. Sheaffer. 2017. Resources for Transitioning. A Learning Module in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. University of Minnesota, St. Paul, MN. 18. Type: Other Status: Published Year Published: 2017 Citation: Moncada, K., J. Gunsolus, C. Carlson, and C. Sheaffer. 2017. Weed Biology. A Learning Module in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. University of Minnesota, St. Paul, MN. 19. Type: Other Status: Published Year Published: 2017 Citation: Moncada, K., J. Gunsolus, C. Carlson, and C. Sheaffer. 2017. Cultural Weed Management. A Learning Module in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. University of Minnesota, St. Paul, MN. 20. Type: Other Status: Published Year Published: 2017 Citation: Moncada, K., C. Fernholz, J. Gunsolus, C. Carlson, and C. Sheaffer. 2017. Mechanical Weed Management. A Learning Module in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. University of Minnesota, St. Paul, MN. 21. Type:

Other Status: Published Year Published: 2017 Citation: Moncada, K., H. Behar, C. Carlson, G. DiGiacomo, and C. Sheaffer. 2017. What is Organic? A Learning Module in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. University of Minnesota, St. Paul, MN. 22. Type: Other Status: Published Year Published: 2017 Citation: Moncada, K., H. Behar, J. Riddle, C. Carlson, and C. Sheaffer. 2017. Organic Certification. A Learning Module in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. University of Minnesota, St. Paul, MN. 23. Type: Other Status: Published Year Published: 2017 Citation: Moncada, K., H. Behar, J. Riddle, C. Carlson, and C. Sheaffer. 2017. Record Keeping. A Learning Module in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. University of Minnesota, St. Paul, MN. 24. Type: Other Status: Published Year Published: 2017 Citation: Moncada, K., C. Carlson, G. DiGiacomo, and C. Sheaffer. 2017. Rotations for Organic Grain Cropping Systems. A Learning Module in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. University of Minnesota, St. Paul, MN. 25. Type: Other Status: Published Year Published: 2017 Citation: Fernandez, A., J. Riddle, K. Moncada, C. Carlson, and C. Sheaffer. 2017. Preventing GMO Contamination. A Learning Module in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. University of Minnesota, St. Paul, MN. 26. Type: Other Status: Published Year Published: 2017 Citation: Moncada, K., C. Carlson, J. Riddle, G. DiGiacomo, and C. Sheaffer. 2017. History of Organic. A Learning Module in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. University of Minnesota, St. Paul, MN. 27. Type: Other Status: Published Year Published: 2017 Citation: DiGiacomo, G., K. Moncada, C. Carlson, and C. Sheaffer. 2017. Organic Marketing. A Learning Module in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. University of Minnesota, St. Paul, MN. 28. Type: Other Status: Published Year Published: 2017 Citation: Fernandez, A., C. Flavin, K. Moncada, C. Carlson, and C. Sheaffer. 2017. Cover Crops for Organic Systems. A Learning Module in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. University of Minnesota, St. Paul, MN. 29. Type: Other Status: Published Year Published: 2017 Citation: Sheaffer, C., C. Carlson, and K. Moncada. 2017. Introduction to Forages. A Learning Module in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. University of Minnesota, St. Paul, MN. 30. Type: Other Status: Published Year Published: 2017 Citation: Sheaffer, C., C. Carlson, and K. Moncada. 2017. Harvesting and Storing Forages. A Learning Module in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. University of Minnesota, St. Paul, MN. 31. Type: Other Status: Published Year Published: 2017 Citation: Fernandez, A., K. Moncada, C. Carlson, and C. Sheaffer. 2017. Alternative Crops for Organic Systems. A Learning Module in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. University of Minnesota, St. Paul, MN. 32. Type: Other Status: Published Year Published: 2017 Citation: DiGiacomo, G., K. Moncada, A. Fernandez, C. Carlson, and C. Sheaffer. 2017. Growing and Marketing a New Crop. A Learning Module in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. University of Minnesota, St. Paul, MN. 33. Type: Other Status: Published Year Published: 2017 Citation: Fernandez, A., J. Lamb, K. Moncada, C. Carlson, and C. Sheaffer. 2017. Soils: Fertility in Organic Systems. A Learning Module in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. University of Minnesota, St. Paul, MN. 34. Type: Other Status: Published Year Published: 2017 Citation: Fernandez, A., J. Lamb, K. Moncada, C. Carlson, and C. Sheaffer. 2017. Soils: Sources of Organic Nutrients. A Learning Module in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. University of Minnesota, St. Paul, MN. 35. Type: Other Status: Published Year Published: 2017 Citation: Tautges, N., K. Moncada, C. Carlson, and C. Sheaffer. 2017. Small Grains for Organic Systems. A Learning Module in Principles for Transitioning to Organic Farming: e-Learning Materials and Decision Case Studies for Educators. University of Minnesota, St. Paul, MN.

2014/09 TO 2015/08 What was accomplished under these goals? Objective 1: Listening Sessions. We organized two listening sessions in St. Cloud and in Owatonna, MN. Attendees included agricultural professionals such as organic crops consultants, organic inspectors, and organic grain buyers, as well as organic and transitioning farmers. Our discussion topics included: what are the best ways to reach transitioning farmers, what they thought was preventing more conventional farmers from transitioning, what are the biggest obstacles to transitioning, and who organic farmers turn to for help during transition. This year, we noticed that a large number of participants were concerned about marketing, which we will address in the development of our marketing e-learning module. Objective 2: Decision case studies for farmers and undergrads. Three decision case studies are completed. The first case profiles an organic grain farmer from Minnesota and his struggles with incorporating cover crops into his rotation. After completing this case study, learners will understand the NOP rotation guidelines, become familiar with the potential benefits and risks of using cover crops, and use critical thinking skills to form an opinion on the next step this farmer should take (either continuing or discontinuing the use of cover crops). The second decision case profiles someone who is new to farming. A recent college graduate, he has plans to attend law school.

However, he now has an opportunity to farm land his parents recently bought. He needs to decide whether to get a law degree or become an organic farmer. This case will help the audience (especially undergraduate students) to better understand what farming entails and the considerations of transitioning into organic production. The third decision case study is about a couple who have a profitable conventional apple orchard, but yet they feel organic was more consistent with their values. Student will consider whether they should risk transitioning. This case offers a good example of how community and support from others can be important for making decisions during the transition phase. We have two decision case studies that are in review. The first is about an experienced organic farmer who has reduced the amount of tillage in his operation to protect his soils. However, as a result, Canada thistle has become prevalent, threatening his crops. Students will learn how there may be tradeoffs in the decisions that farmers make. The second case is about an organic apple orchard and the grower\'s struggles with fire blight. The NOSB may be putting the best treatment (an antibiotic) on the prohibited list and the grower is worried about how she will manage to stay profitable without it. The audience will learn about disease management in organic systems. We have two other cases that are in progress; one concerns variety selection in organic grain systems and the other involves vegetable production. We have tested our case studies on farmer and undergraduate audiences several times. So far, they have met our expectations in provoking critical thinking and greater understanding of the case topics. Objective 3: e-learning modules for farmers and undergrads. We have developed much of the content for our e-learning modules. We have revised our original plan to include a few more topics based on input from farmers in our listening sessions. A summary of the modules is below. What is Organic? Guiding principles, NOP standards, how organic is regulated, who are organic farmers, and history of organic farming Should You Go Organic? Why consider organic, common misconceptions, what you will need to become organic, common challenges, and a decision checklist Resources for Transition: NOP standards, how to find organic seed, verifying organic inputs, NRCS programs for transitioning producers, working with a certifier during transition, MN Transition Cost Share Program, and finding a certifier Record Keeping - Transition and Beyond: What needs to be documented, field maps, field history, activity log, other records, items to save for future reference, and the Organic System Plan Certification - Post-Transition: Who needs to be certified, who are certifiers, how to find certifiers, choosing a certifier, application, OSP, overview of certification, cost share programs, and re-certification Production Strategies in Transition: What to expect during transition, gradual vs whole farm transition, which fields to transition first, the best crops to grow, timing the transition, buffers, providing nitrogen, and split operations Crop Rotation: Rotations under NOP rules, benefits of diverse rotations, rotations for agronomic and horticultural crops Row Crops: Management of corn and soybean, variety selection, planting, weed and pest management, nutrient requirements, harvesting Small Grains Crops: Management of oat, spring wheat, winter wheat, barley and rye; variety selection; planting; weed and pest management, nutrient requirements, harvesting Forage Crops: Management of forages (alfalfa, red clover, perennial grasses, and pasture), variety selection, planting, weed and pest management, nutrient requirements, harvesting Other Crops : Management of alternative crops (field beans, field peas, sweet corn, canning peas and snap beans), variety selection, planting, weed and pest management, nutrient requirements, harvesting Soil Health: Soil organisms, soil properties, organic matter, tillage, soil conservation, essential soil elements, and soil testing Soil Fertility: Adjusting pH, organic fertilizers (green manures, animal manures, compost, other organic amendments) Cover Crops: Benefits of cover crops, ways organic farmers use cover crops, what is your goal for including cover crops, selecting cover crops, and terminating Weed Biology: What is a weed, life cycles, reproduction in weeds, weed seed banks, weed emergence, and weed effects on crops Weed Management: Cultural weed control, mechanical weed control, equipment, rescue operations, and scouting for weeds Preventing GMO contamination: Corn susceptibility, ways contamination can occur, ways to prevent contamination Marketing; Developing market plans, how to decide which crops to grow, marketability of various crops, knowing the customer, buyer specifications, transportation, storage, and contracts Objective 4: Workshops on transitioning. Our project will incorporate several workshops on topics relating to transitioning. Our first workshop was held in 2015 at the Minnesota Organic Conference in St. Cloud, where we tested the decision case study on cover crops. We have four more workshops planned (see section on plans for the next reporting period). Objective 5: Train-the-trainers. Extension educators will offer classes on our learning materials and train other Extension personnel in utilizing the interactive materials and decision case studies in Year 3. Objective 6: Intensive training course for transitioning farmers. An in-depth training course on transitioning using these materials will be offered. This course will integrate the entirety of the learning materials we develop for a comprehensive class. We will develop the training course for transitioning farmers in Year 3.

2013/09 TO 2014/08 What was accomplished under these goals? Objective 1: Listening Sessions. We organized 4 listening sessions around the region this past spring with 3 sessions for grain/forage producers and one session for fruit and vegetable producers. However, the one at Lamberton, MN (grain/forage session) was canceled due to flooding in the area. The other three sessions were held in Waite Park, Farmington, and Rochester, MN. Attendees included agricultural professionals such as organic crops consultants, organic inspectors, and organic grain buyers, as well as organic and transitioning farmers. For this first round of discussions on transitioning to

organic production, we gathered input from our participants on our project plans. Our discussion topics included: what are the best ways to reach transitioning farmers, what they thought was preventing more conventional farmers from transitioning, what are the biggest obstacles to transitioning, and who organic farmers turn to for help during transition. Participants noted the great need for these types of educational materials due to the risk associated with the transition process. We reviewed the 14 module topics and summaries for this project with them for input on topics they thought should be included. As we anticipated based on our previous work with learning groups of organic farmers, weed control and fertility were at the top of the list of their concerns for transitioning. Objective 2: Decision case studies for farmers and undergrads. We held several meetings with our project partners, Midwest Organic and Sustainable Education Service and the Center for Integrated Agricultural Systems (University of Wisconsin), to determine the format of the decision case studies with our consultant Dr. Steve Simmons. Once we determined the format, case study developers chose possible topics and the group selected the ones with the best potential for quality case studies. After the topics were determined, the case study developers met with their farmer subjects for several interviews. Three decision case studies are nearing completion. The first profiles an organic grain farmer from Minnesota and his struggles with incorporating cover crops into his rotation. After completing this case study, learners will understand the NOP rotation guidelines, become familiar with the potential benefits and risks of using cover crops, and use critical thinking skills to form an opinion on the next step this farmer should take (either continuing or discontinuing the use of cover crops). The second decision case study is about another Minnesota grain farmer who is in the process of transitioning to organic. This farmer is struggling with choosing fertility inputs and developing the best rotation. This case will help the audience to better understand the importance of fertility in organic systems, the benefits of having a diverse rotation, and the process of moving into organic production. The third decision case study is about a couple who grow apples in Wisconsin and their decision process in how to transition and the challenges of a split operation. This case offers a good example of how community and support from others can be important for making decisions during the transition phase. Objective 3: e-learning modules for farmers and undergrads. We are in the process of developing materials to use in the e-learning modules. Using the input from farmers from the listening sessions, we are tailoring materials to our audience. A summary of the 14 modules we are developing is below. What is Organic? NOP guidelines, basic overview of the differences between conventional and organic farming, organic philosophy, who are organic farmers, and organic farming in our region. Crops for organic systems: Widely-grown agronomic crops (corn, soybean, small grains, alfalfa, red clover, perennial grasses), and alternative agronomic crops (amaranth, millets, field beans, peas, lentils) and widely-grown horticultural crops (peas, sweet corn, snap beans) and other selected crops; their competitiveness with weeds, nutrient requirements, effect on soil health, and marketability (based on Midwest organic prices). Soil Health: Soil organisms, soil properties, organic matter, tillage, soil conservation, essential soil elements, and soil testing. Soil Fertility: pH, organic fertilizers (green manures, animal manures, compost, other organic amendments). Crop Rotation: Benefits of diverse rotations (soil health, weeds, insects), allowed rotations under NOP rules, recommended crop sequences, rotations for agronomic and horticultural crops, annual and perennial crops in rotations, and cover crops in rotations. Weed ID: Weed species, describe weed biology and life cycles, weed emergence, and weed effects on crops. Weed Management: Cultural weed control, mechanical weed control, equipment, rescue operations, and scouting for weeds. Pest Management: Insect control, disease control, cultural pest management (rotation, resistant varieties), scouting for pests. Should You Go Organic? Will help growers determine if they are ready to start the transition process by covering what to expect, what the differences are between conventional and organic farming, and the economics of organic farming. Cropping: The First Three Years: What to expect during transition (weeds, fertility, and crop yields), the best crops to grow, the organic certification process, reducing risks. Record Keeping and NOP Rules: Organic System Plans (OSP), working with organic certifiers, suggestions on record keeping, and current National Organic Program regulations. Agronomic Cropping Systems: Management of row crops, small grains, and forages; variety selection; weed and pest management. Horticultural Cropping Systems: Management of horticultural crops, variety selection, weed and pest management. Marketing; Developing market plans, how to decide which crops to grow, knowing the customer, buyer specifications, transportation, storage, and contracts Objective 4: Workshops on transitioning. Extension educators will hold several workshops on topics relating to transitioning in different regions. We will use decision case studies and modules, once they are developed, in our workshops on transitioning. These workshops will occur in Year 2 of the project. Objective 5: Train-the-trainers. Extension educators will offer classes on our learning materials and train Extension personnel in utilizing the interactive materials and decision case studies. Once we develop all the decision case studies and e-learning modules, we will be able to develop a train-the-trainer program in Year 3. Objective 6: Intensive training course for transitioning farmers. An in-depth training course on transitioning using these materials will be offered. This course will integrate the entirety of the learning materials we develop for a comprehensive class. After we have completed all the decision case studies and e-learning modules, we will be able to develop the training course for transitioning farmers in Year 3. **PUBLICATIONS (not previously reported):** 2013/09 TO 2014/08 No publications reported this period.

↑ Return to Index