

OREI Project Details

Award Year 2005

5 Research Projects

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Integration of Organic Production Systems for Summer Production of Tomato and Pepper in Alabama

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| Performing Institution | COLLEGE OF AGRICULTURE, AUBURN UNIVERSITY, 108 M. WHITE SMITH HALL |

NON-TECHNICAL SUMMARY

Adoption of organic farming in the Deep South lags behind other regions of the United States. Organic vegetable production in Alabama is challenging due to a plethora of disease and insect pests in the hot, humid summers. The purpose of this four-year project is to develop integrated organic vegetable production systems that allow production of transplanted tomato and pepper in the mid-summer.

OBJECTIVES

The long-term goal of the proposed project is to assist organic vegetable farmers in Alabama and other portions of the humid deep South with whole farm planning and ecosystem integration by developing integrated organic vegetable production systems. The emphasis in the proposed work is on the two transplanted vegetables with the highest cash value: tomato and pepper. Specifically, we will work to develop integrated production systems that allow these crops to be grown and harvested in the mid-summer when growing conditions are most unfavorable. The following specific objectives will be addressed: 1) Develop integrated organic production systems to allow mid-summer production of tomato and pepper in Alabama. 2) Determine the effects of production systems on soil health. 3) Develop training systems for county Cooperative Extension personnel and formal courses for organic vegetable producers.

APPROACH

Development of an integrated organic production system for vegetables must involve optimizing several different production tactics, including cover crops; fertility and plant nutrition; soil moisture; farmscaping crops; crop variety; management of weeds, insects, and diseases; and tillage. After optimizing these tactics, integration and selection of a recommended production system must consider impacts on soil health. We propose to address this

multi-faceted research challenge by first conducting a series of tests on each of the individual tactics (year 1). In year 2, two or three combinations of tactics will be assessed for how well tomato and pepper perform and for impacts on soil health. In year 3, a single integrated production system will be extensively studied; tomato and pepper growth, yield, and disease and insect tolerance will be assessed along with impacts on soil health. In year 4, the production system will be further evaluated. All experimental work will be conducted each year at three field research centers: the North Alabama Horticultural Research Center in Cullman, Alabama, the E.V. Smith Research and Education Center near Shorter, Alabama, and the Winfred Thomas Agricultural Research Station, Meridianville, North Alabama. Within each of these field stations is a section that is currently in transition to organic certification, and all activities will be conducted on the transition fields.

PROGRESS

2005/09 TO 2010/08 OUTPUTS: The greenhouse that produced the transplants for the field trials was certified organic, as well as the research plots on the two Auburn University research stations. The following field trials were conducted during the duration of this project: Tomato and pepper variety trials, cover crop trials, tillage treatments, fertilizer treatments, and farmscaping plants for pest control. The organic tomato, pepper, and farmscaping plants were grown in the Auburn University Plant Growth Research Center on campus. Innovative methods of controlling greenhouse pests, such as aphids were developed using beneficial insects and farmscaping plants. The effects of tillage and pre-plant fertilizer levels on soil health were investigated. The indicators of soil health that were measured in this study include chemical (soil tests), biological (microbial population numbers, diversity, and activity), and disease suppressiveness. Groups of microorganisms were selected as indicators of soil microbial diversity: fluorescent psuedomonads, fungi, Actinomycetes, and spore-forming bacilli. Total microbial population numbers were determined using most probable number of bacteria/gram soil. Soil microbial activity was assessed by measuring the production of enzymes produced by bacteria during the oxidation of organic compounds and the release of nutrients. Tests included: fluorescein diacetate hydrolysis (FDA), phosphatase activity, and dehydrogenase activity. Another indicator of soil health that was investigated was disease suppressiveness. Soil samples from the different fertilizer and tillage treatments were planted to tomato plants in the lab. The samples were inoculated with two different pathogens to determine soil disease suppressive properties of the soils: *Pythium ultimum* and *Rhizoctonia solani*. A workshop on organic certification was conducted on the Auburn University campus. The target group was agricultural workers, such as Extension and NRCS. Auburn University collaborated with partners, such as AL A&M, and the Alabama Sustainable Agriculture Network to host annual organic vegetable production conferences. Some of the sessions that were conducted included tomato grafting presented by AU Extension, and organic no-till vegetable production with Ron Morse as the invited speaker. Website - Auburn University Organic Vegetable Production Research hosted a website that was kept updated with research results of the tomato and pepper project. <http://www.aaes.auburn.edu/organicveg/> e-newsletter - A monthly e-newsletter was sent out to over 200 growers, gardeners, and agricultural service providers. Presentations: Information and results from the project were presented to AU Extension staff at their annual meeting, the Deep South Fruit and Vegetable Growers Conference (2 different years), at the annual organic vegetable production conference, and during organic gardening workshops. Advising - many growers called and asked for advice in organic vegetable production. Field days were held at North Alabama Horticultural Research Station, E.V. Smith, and at AL A&M where participants were shown the tomato and pepper plots and cover crops. PARTICIPANTS: Joseph Kloepper, professor, plant pathology, Auburn University, project supervisor. Henry Fadamiro, professor, Entomology, Auburn University, coordinated farmscaping project and directed graduate student thesis. Joseph Molnar, professor, Rural Sociology and Agricultural Economics, coordinated annual organic conferences, and presented, directed two graduate student theses. Joseph Kemble, professor, Horticulture, and Extension for vegetable crops, Auburn University, advised on tomato and pepper production, and directed a graduate student thesis. Carol J. Garrett, Research Fellow, Auburn University, coordinated the research, submitted reports, made presentations, wrote e-newsletters and research updates. Rao Mentreddy, professor, Soil Science, Alabama A&M University. Coordinated research at AL A&M, advised research project, directed dissertation research. Gurudev Mayalagu, PhD student, Soil Science, Alabama A&M - studied effects of cover crops on soil fertility. Timothy Nafziger, M.S. Student, Auburn University, "The Effects of Farmscaping Plants on the Abundance, Diversity, and Longevity of Arthropods in Organic Tomato Fields in Alabama". Mecca Lowe, M.S. Student, Auburn University, "Collaborative Marketing Enterprises: Local Food Exchange and the Promise of Sustainability". Lina Cui, M.S. Student, Auburn University, "Growing Naturally in Alabama: Needs and Possibilities". C.J. McGrath, M.S. Student, Auburn University, "Evaluation of Optimal Substrates and Fertilizers For Organic Vegetable Transplant Production In Alabama" Arnold Caylor, Superintendent, North AL Horticultural Research Station, Directed and implemented field work, advised project design. Jason Burkett, Field superintendent, E.V. Smith Agricultural Research Center, Directed and implemented field work, advised project design. Lewis Bingham, Field staff, Alabama A&M, implemented field research. Karen Wynne, Executive Director, Alabama Sustainable Agriculture

Network, helped organize Annual Organic Vegetable Conferences. Dee Fowler, Research Associate, Auburn University. Maintained website, mailed monthly e-newsletter. Conferences and workshops attended by participants: Southern Sustainable Agriculture Working Group, Auburn University Organic Vegetable Production Conferences, Georgia Organics, Organic Certification workshops at University of Florida and at Auburn University, Alabama Fruit and Vegetable Growers Conference, Master Gardeners Tomato Growers Workshop, Advanced Organic Farming Training, field days at farms and research stations. TARGET AUDIENCES: Small, sustainable vegetable growers of Alabama and the Deep South - website, e-newsletter, annual conferences, field days, advising upon request. Agricultural Service Providers - Extension, Natural Resource Conservation Service, website, e-newsletter, annual conferences, field days, advising upon request, workshops. Home gardeners - website, e-newsletter, annual conferences, field days, advising upon request, gardening workshops. Professional nursery, greenhouse owners, managers, website, e-newsletter, annual conferences, field days, advising upon request, gardening workshops. Agricultural researchers - website, e-newsletter, annual conferences, field days, advising upon request, workshops. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2008/09/15 TO 2009/09/14 OUTPUTS: Sampled fall cover crops and analyzed data. Conducted second year of pre-plant fertilizer trials and tillage trials for tomato and pepper production. Analyzed tomato and pepper yield data. Collected weed samples in all treatments and analyzed data. Conducted soil disease suppressiveness study comparing effects of tillage and pre-plant fertilizer treatments. Attended advanced organic training in NC. Co-hosted the annual Organic Vegetable Production Conference along with the Alabama Sustainable Agriculture Network. Attended Georgia Organics Conference. Attended Southern Sustainable Working Group Conference. Hosted a field day at AL A&M research site. Completed second field season on M.S. graduate research project investigating the effectiveness of farmscaping plants in attracting beneficial insects. Completed final field season of PhD graduate research project at AL A&M. PARTICIPANTS: Timothy Nafziger is a Master of Science student working under the direction of Henry Fadamiro. He completed his research project on the effectiveness of farmscaping plants on attracting beneficial insects to tomato plantings. Gurudev Mayalagu is a PhD student working under the direction of Rao Mentreddy at AL A&M. He is investigating the effects of cover crops on soil properties in organic no-till systems. He is in the process of writing his dissertation. Mecca Lowe was a Master's student in Rural Sociology working under the direction of Joseph Molnar. She finished the requirements for her degree. She was studying collaborative marketing opportunities for small scale organic growers in AL. Jan Garrett is a research fellow in the Plant Pathology Dept. at Auburn University. She works under the direction of Joe Kloepper. She is responsible for coordinating the research on the research stations and collecting and analyzing data. She attended the advanced organic training in NC, the Georgia Organics Conference, and the Southern Sustainable Agriculture Working Group Conference. She also helped to organize the Annual AL Organic Conference and she submits the reports for the project. The Alabama Sustainable Agriculture Network collaborated with Auburn University to host the field day at AL A&M and to host the Annual AL Organic Conference. Dee Fowler maintains a website for the AU Organic Vegetable Production Research Program where the research results of this project are posted. He also sends out a monthly e-newsletter with research updates to the AU Extension community and to many growers throughout the state. Jane Hoehaver grew the transplants for the research plots in the certified organic greenhouse on campus. She experimented with biocontrol of pests using trap crops and banker plants. Arnold Caylor was responsible for the implementation of the project at Cullman, Jason Burkett at E.V. Smith, and Lewis Bingham and Guru Mayalagu at AL A&M. TARGET AUDIENCES: The target audience in this research project are the small scale organic growers and agricultural service providers in Alabama. Information is disseminated at field days on the research stations, the monthly e-newsletter, presentations at conferences and meetings, and through inquiries from interested farmers and agricultural service providers. PROJECT MODIFICATIONS: The field design was changed to accommodate replications for scientific analysis. The design was originally 6 large plots planted to different cover crops, but was changed to a complete randomized block design with each of the original 6 blocks containing a replication of each tillage and fertilizer treatment and planted to the same cover crop.

2007/09/15 TO 2008/09/14 OUTPUTS: This report covers the third year of our Integrated Organic Program Grant titled: Midsummer Production of Organic Tomato and Pepper in the Deep South. The field research was conducted at three locations in Alabama: two Auburn University research centers, E.V. Smith Research Center in Shorter and North Alabama Horticultural Research Center in Cullman, and one Alabama A&M research station: W. Thomas Agricultural Research Station in Normal, AL. Tomato, pepper, and farmscaping seedlings were produced in Auburn University's certified organic greenhouse for transplanting in the field. The seedlings were transplanted into certified organic plots at the Auburn University research stations and into fields in organic transition at AL A&M's research station. The field experiments for 2008 focused on the effects of tillage and fertilizer treatments on tomato and pepper yield, weed populations, and soil health. At each research station, the

no-till method was compared to a tillage treatment that was considered to be most effective for the soil type present at that location. At A&M the tillage treatment was raised beds, at Cullman the tillage treatment was spade-tillage followed by a roto-tiller, and at E.V. Smith it was strip tillage. Fertilizer trials were included in order to determine the most cost-effective amounts for each production method. We also conducted field trials of several OMRI-approved products for foliar disease control of tomato. Additionally, we conducted field trials of several farmscaping plants for their ability to attract beneficial insects and control populations of pest insects on adjacent tomato plants. Cash crop yield data were collected and analyzed, insect samples were collected from farmscaping plots and the insects identified and weed populations were measured in different treatments at E.V. Smith. Soil samples were collected and analyzed for chemical and biological properties as indicators of soil health. Field days were held at two of the research stations during the growing season. Approximately 65 growers and agricultural service providers from throughout the state attended. They toured the organic research plots and received updated information on the experiments and results. Alabama Extension agents were given a tour of the organic plots at E.V. Smith and received instruction about practical aspects of certified organic production. Ten Extension Agents and researchers attended. The Sixth Annual Organic Vegetable Production Conference was held in November. A workshop was conducted on organic greenhouse production at Auburn University. The organic conference also included a session on "Research Priorities for Small Scale Organic Producers in Alabama". Auburn University presented a workshop on organic greenhouse production at the Annual Georgia Organics Conference. The Auburn University Organic Vegetable Production website was kept up to date with information and research results and a monthly e-newsletter sent to constituents throughout the state. A report of the year's field experiments was posted on the website and a link to the report was sent in the monthly e-newsletter. PARTICIPANTS: The following Auburn University researchers worked on the project: Dr. Joseph Kloepper, principle investigator - Directed the project, managed personnel, managed the budget, advised. Dr. Carol Janeen Garrett - Research fellow - coordinated research at the three research locations, ordered supplies, organized meetings between researchers, production decisions, collected and analyzed data, prepared progress reports, wrote e-newsletters about research results, organized Annual Organic Conference, provide information to growers on organic production. Dee Fowler - maintained website, published monthly e-newsletters. Dr. Joseph Molnar - organized Annual Organic Conference, directed graduate student project. Mecca Lowe - Dr. Molnar's graduate student. Mecca Lowe has initiated a study of collaborative marketing efforts by small scale organic producers in the state. Mecca presented her research proposal and some preliminary data at the Rural Sociological Society's Annual Meeting in Manchester, New Hampshire, and at the joint meeting of the Association for Food & Society and the Agriculture, Food and Human values Society in New Orleans, LA. She helped organize the Annual Organic Conference. Dr. Joseph Kemble - directed graduate student project. CJ McGrath - Dr. Kemble's graduate student - investigated various potting media and fertilizers for organic plug production and CJ presented her research results at the Georgia Organics Conference in February and at the 6th Annual Alabama Organic Vegetable Production Conference in November. Dr. Henry Fadamiro - directed a graduate student project. Tim Nafziger is a graduate student with Dr. Fadamiro working on the farmscaping aspect of the project. Dr. Rao Mentreddy - directed a graduate student project. Participated in the Alabama Organic Production Conference. Gurudev Mayalagu - Dr. Mentreddy's graduate student. Alabama Sustainable Agriculture Network - helped organize and finance the Alabama Organic Production Conference. Alabama Cooperative Extension Service participated in the 6th Annual Organic Conference as well. They conducted a session on alternative production methods. They conducted a tour of the research plots at E.V. Smith. Auburn University researchers attended and participated in the Georgia Organics Conference. TARGET AUDIENCES: This information provided by this project is useful to our growers who have expressed an interest in no-till production. Some of them had been hesitant to try no-till due to concerns about yield reductions. The results of our research suggest that no-till does not result in yield reductions. Hence, farmers can feel confident about trying no-till. The results of the pre-plant fertilizer trials suggest that if farmers apply compost and use liquid fertilizer in the drip irrigation system, as many of them do, they may not reap additional benefits from also applying pre-plant fertilizer. The results of this research can help farmers make informed production decisions that will enable them to increase their profit margins. The outreach components of this grant, mainly the monthly e-newsletter, website, and also the annual organic production conference, have resulted in our receiving a lot of inquiries for information on organic production. Alabama does not have an organic certification program consequently people requesting information on organic production practices are often directed to us. Interested parties also come across our Organic Vegetable Production website on the Auburn University website and they call or email for specific information. We have provided many new or prospective growers with information or directed them to other agriculture service providers or experienced growers who can help them. As a result we are beginning to form a community of growers, researchers, and other stakeholders for networking and information sharing regarding organic production and marketing in Alabama. Alabama Cooperative Extension Agents participated in the 6th Annual Organic Conference as well. They conducted a session on alternative production methods. This grant has provided multiple opportunities for AU researchers and Extension staff to collaborate on organic vegetable production techniques which has helped to increase knowledge. Pre-tests given at the Extension tour of the

organic field plots at E.V. Smith produced average scores of 59% and post-test scores averaged 92%. Interest has grown in organic production in Alabama since this project has begun. The number and diversity of small scale organic producers has increased. Effective partnerships have been created, and we have expanded the conference presentations from vegetable production to livestock and small fruit production due to grower demand. This grant has provided a start for a much needed and appreciated organic production program in the state and it will serve as leverage for other such grants in order to continue the work into the future. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2006/09/15 TO 2007/09/14 OUTPUTS: This report covers the second year of our Integrated Organic Program Grant at three research stations in Alabama: E.V. Smith Research Center in Shorter, North Alabama Horticultural Research Center in Cullman, and W. Thomas Agricultural Research Station in Normal, AL. Field days were held at two of the research stations during the growing season. Approximately 125 growers and agricultural service providers from throughout the state attended. They were able to review the organic plots and received updated information on the experiments and results. The Fifth Annual Organic Vegetable Production Conference was held in November in conjunction with the Community Food Leaders Forum organized by Alabama Sustainable Agriculture Network and Auburn University where findings of our project were presented to growers and other interested parties. North Alabama Horticultural Research Center superintendent Arnold Caylor presented the model no-till organic production system that he developed during the first two years of this project. Approximately 70 people attended the conference. The information was also disseminated through brochures, our website, and the monthly e-newsletter. An organic certification workshop titled: "The National Organic Standards: What Service Providers Need to Know about the Organic Rules and Regulations" was held in Auburn in July for Extension staff and other agricultural service providers. Approximately 50 people attended. Grant funds paid for travel expenses to allow Extension workers to receive in-service training. A field day was held at a local farm in cooperation with Alabama Sustainable Agriculture Network. Approximately 30 people attended the event. People viewed demonstrations of successful organic farming techniques. There was a question, answer session following the farm tour. Lina Cui, a graduate student in rural sociology composed a survey requesting information from growers and other agricultural constituents concerning challenges and barriers to adopting organic production techniques. As of this reporting period approximately 70 of these surveys have been returned. The Auburn University Organic Vegetable Production website was kept up to date with information and research results and a monthly e-newsletter sent to constituents throughout the state. The Auburn University Plant Growth Research Center Greenhouse had been certified as organic during the first year of the grant. The research plots at EV Smith and North AL Horticultural Research Center were certified as organic in October 2007.

PARTICIPANTS: Individuals who worked on this project include the principal investigators, Joseph Klopper, Joseph Molnar, Joseph Kemble, Henry Fadamiro, and Rao Mentreddy and their students, Lina Cui and Guru Mayalagu. Jan Garrett was employed as a Research Fellow with the major responsibility of coordinating the research project on the three research stations. Dee Fowler is a research associate in Plant Pathology at Auburn University whose responsibility it is to keep up the website and send out the monthly e-newsletters. Other personnel who worked on this grant included Jane Hoehaver, who manages the Plant Growth Research Center, Arnold Caylor, superintendent of the North Alabama Horticultural Research Center, Jason Burkett, Associate Director of the Horticultural Unit at EV Smith Research Center, and Lewis Bingham, field superintendent at the W. Thomas Agricultural Research Station. The Alabama Sustainable Agriculture Network cooperated with us on field days, farm tours, and the Organic Conference. Jones Valley Urban Farms cooperated with us on a farm tour of their gardens as part of the Organic Conference. The University of FL Center for Organic Agriculture collaborated with us on the National Organic Program workshop. We have many contacts throughout the state who receive our monthly e-newsletter. It goes out to all of the Auburn University school of agriculture, including all of the Extension staff, growers, and any one else who requests a copy. Growers contribute to the e-newsletter with grower's tips. We frequently have requests for more information on organic farming techniques and organic certification. TARGET AUDIENCES: Target audiences include growers, agricultural service providers, and consumers. All of the groups of people attend the annual organic conference, field days, farm tours, and receive the monthly e-newsletter.

2005/09/15 TO 2006/09/15 Field trials were conducted at 3 locations in AL: EV Smith in the south central part of the state, Cullman in the north central area, and AL A&M in the north central area. Five fall cover crops were evaluated for cover, weed control, and biomass production. Canola and rye had the best weed suppression. The results show the potential of cover crops for effective weed management provided the cover crop has good establishment. Soil samples, plant tissue samples, and soil moisture were analyzed from each cover crop plot. Organic soil amendments were applied at the recommended rates. At mid-season, the nitrogen content of the crops was found to be sufficient at all locations. Phosphorus was sufficient at all but A&M. Potassium and calcium were found to be borderline or deficient at all locations. The rye plot had the highest soil moisture content. The

crops in the cover crop plots did not out perform those in the fallow plot at Cullman or at A&M. At EV Smith, the leguminous cover crops out-yielded the fallow plots. Rye did not perform well at any location. The crops in the rye plot had sufficient nitrogen at all locations. Eleven farmscaping plants were evaluated for growth, vigor, flowering periods, and attraction to beneficial insects. All plants grew well and attracted many beneficial insects. Three varieties of tomato: Celebrity, Amelia, and Mountain Fresh Plus and 3 varieties of pepper: Ancho, Hungarian Hot Wax, and Ring-O-Fire Cayenne were evaluated. There were no significant differences in yields of the tomato varieties, except that at A&M Celebrity had significantly higher yields than Amelia. Hungarian Hot Wax had significantly higher yields at all research stations than Ancho, which had higher yields than Cayenne. Some OMRI listed products were tested for disease management in tomato: Champ WP (copper), Serenade, Sonata, and BioYield. There were no significant differences in tomato yield between treatments, which was attributed to the low incidence of disease in this dry year. The results of these experiments will help organic growers to find effective methods of producing organic tomatoes and peppers. The Research Fellow employed by this project attended a three day workshop on training agricultural workers in Organic Certification. A presentation on this research project was provided to Cooperative Extension Agents at their annual Inservice Training. Feedback has indicated that a formal training session is desired, and work is underway to establish such a session. We have supported and provided materials for in-depth extension training in cooperation with Alabama Sustainable Agriculture Network and key Extension stakeholders. We sponsored an on-farm tour, a one-day workshop for growers and agricultural workers on organic growing methods, as well as our annual Organic Conference. We maintain a website with research updates and send out a monthly e-bulletin to the extension service staff, growers, and other interested parties. The initial findings of this project were presented at the Deep South Fruit and Vegetable Growers Conference in December 2006.

IMPACT

2005/09 TO 2010/08 An effective organic no-till method for tomato and pepper production was developed planting transplants into compost mulch placed over cover crop residue. Four graduate student theses were funded by this project: "Evaluation of Optimal Substrates and Fertilizers For Organic Vegetable Transplant Production In Alabama", "The Effects of Farmscaping Plants on the Abundance, Diversity, and Longevity of Arthropods in Organic Tomato Fields in Alabama", "Collaborative Marketing Enterprises: Local Food Exchange and the Promise of Sustainability", "Growing Naturally in Alabama: Needs and Possibilities". Tomato variety trials: the tomato spotted wilt virus resistant variety, Amelia, out-performed Celebrity and Mountain Fresh, especially in dry weather when thrips were a greater problem. Pepper variety trials: Hungarian Hot Wax consistently performed the best. Cover crops were grown without irrigation. Sunn hemp performed the best of the summer cover crops. It is drought tolerant, produces abundant biomass, suppresses weeds, and deer do not eat it. The winter cover crop that consistently performed the best was cereal rye. It produced more biomass and weed suppressing mulch, which lasted for most of the growing season when left on the soil surface. When the planting rows were covered with compost mulch prior to planting the cash crop, there was no cover crop effect; that is, the previous season cover crop did not affect the yield of the subsequent cash crop. The effects of tillage on tomato and pepper yields: At A&M there was no difference between tillage treatments in pepper production, but tomato yield was higher in the raised beds than in the no-till plots. At Cullman, there was no difference in tomato production, but pepper production was greater in conventional tillage. At E.V. Smith, there was no difference between tillage treatments for either crop; crop yields were poor in both tillage treatments due to weed pressure. This study showed that when sufficient compost was used, fertilizer application had no effect. Aphids were controlled in the greenhouse production of tomato and pepper transplants by the use of barley as banker plants to sustain beneficial insects through the early growing season. Several products labeled for organic production were compared for foliar disease control effectiveness in tomatoes. Champion WP (copper), Serenade, Sonata, BioYield, Oxidate and alternating combinations of treatments were tried. No differences were observed due to production problems each year and dry weather that was not conducive to foliar disease incidence. No differences between tillage or fertilizer treatments were observed in the chemical or biological tests conducted, with the exception of significantly greater numbers of fluorescent pseudomonads and total bacteria in strip till as compared to no-till. Tillage and fertilizer effects on soil disease suppressiveness: the no-till and full fertilizer treatments resulted in significantly fewer emerged seedlings and lower seedling weight with the addition of the pathogen in both pathogen trials, indicating that these soil treatments decrease the disease suppressive ability of soils. **PUBLICATIONS (not previously reported):** 2005/09 TO 2010/08 1. Joysee M. Rodriguez, Joseph John Molnar, Robin A. Fazio, Emily Sydnor and Mecca J. Lowe (2009). Barriers to adoption of sustainable agriculture practices: Change agent perspectives. *Renewable Agriculture and Food Systems*, 24, pp 60-71 doi:10.1017/S1742170508002421 2. Nafziger, T.D. Jr., and H.Y. Fadamiro. 2011. Suitability of some farmscaping plants as nectar sources for the parasitoid wasp, *Microplitis croceipes*(Hymenoptera: Braconidae):

Effects on longevity and body nutrients. *Biological Control*. 56(3). March 2011, Pages 225-229. 3. Nafziger, T.D. 2009. The Effects of Farmscaping Plants on the Abundance, Diversity, and Longevity of Arthropods in Organic Tomato Fields in Alabama. A Thesis Submitted to the Graduate Faculty of Auburn University in Partial Fulfillment of the Requirements for the Degree of Master of Science. 4. Fowler, D., and J. Garrett. 2006 through 2010. Auburn University Organic Vegetable Production Research E-Newsletter. Monthly. Provides research updates from Auburn University Organic Vegetable Production Program. Via email. 5. Lowe, Mecca. 2009. Collaborative Marketing Enterprises: Local Food Exchanges and the Promise of Sustainability. A thesis submitted to the Graduate Faculty of Auburn University in partial fulfillment of the requirements for the Degree of Master of Science. 90pp. 6. Cui, Lina. 2008. Growing Naturally in Alabama: Needs and Possibilities. A Thesis Submitted to the Graduate Faculty of Auburn University in Partial Fulfillment of the Requirements for the Degree of Master of Science. 79pp. 7. Nafziger, T.D. and H. Fadamiro. 2009. Effects of Farmscaping plants on the abundance and diversity of arthropods in organic tomato fields. *Proceedings. Annual Meeting of the Entomological Society of America*. University of Florida. 8. McGrath, C.J. 2008. Evaluation of Optimal Substrates and Fertilizers for Organic Vegetable Transplant Production in Alabama. A Thesis Submitted to the Graduate Faculty of Auburn University in Partial Fulfillment of the Requirements for the Degree of Master of Science. 102 pp. 9. Nyochembeng, L.M., R.N. Mankolo, S.R. Mentreddy, and G. Mayalagu. 2011. Cover crop, reflective polyethylene mulch and biofungicide effects on yield and management of diseases in field-grown organic tomato (Submitted to *HortScience*). 10. Mankolo, R.N., L.M. Nyochembeng, and S.R., Mentreddy. 2011. Utilizing Organic Mulches for Weed Control and Nutrient Management in Organic Cropping System. 16th ARD Research Symposium. April 9-13, 2011. Atlanta, GA. (Accepted for presentation). 11. Mankolo, R.N. L.M. Nyochembeng, S.R., Mentreddy, and G. Mayalagu, 2010. Cover crop effects on phosphorus bioavailability under organic production system. ASA Annual meetings, Long Beach, CA. Oct 31-Nov 3, 2010. 12. Nyochembeng, L.M., R.N. Mankolo, S.R. Mentreddy. 2010. Organic and polyethylene mulches with biofungicides for managing diseases in organic tomato production system. *Phytopathology* 100:S91. 13. Mayalagu, G., S.R. Mentreddy, J. Kloepper, and C.J. Garrett. 2009. Summer cover crops for organic production systems. ASA, CSSA, ASSA Abstracts, 2009. 2nd Place winner, Graduate student poster competitions. 14. Nyochembeng, L.M., R.N. Mankolo, S.R. Mentreddy and G. Mayalagu. 2009. Effect of fall cover crops on tomato and pepper diseases and fruit yield under organic production in North Alabama. *Phytopathology* 99:S95. 15. Mankolo, R.N. L.M. Nyochembeng, S.R., Mentreddy, R. Ward, and G. Mayalagu, 2009. Effect of cover crop on nutrient availability and vegetable production under organic and conventional production systems. *Soil Science Society of America*. Pittsburg, PA. 16. Nyochembeng, L.M., S.R. Mentreddy, and R.N. Mankolo. 2009. Effect of plastic mulch and biofungicide on fruit yield and severity of foliar diseases in organic tomato production system. *Proceedings, ARD Symposium*, Atlanta, GA. 17. Mentreddy R., R. Mankolo, L. Nyochembeng, R. Ward and G. Mayalagu. 2009. Tomato and pepper yields in response to fall cover crops in organic production system. 15th ARD Symposium, Atlanta, GA. 18. Mayalagu, G, Rao Mentreddy, C.J. Garrett, and Joseph Kloepper. 2009. Sustainable tomato production: Tillage and fertilizer effects. 15th ARD Symposium, Atlanta, GA. Mayalagu, G. , S.R. Mentreddy, J. Kloepper, and C.J. Garrett. 2008. Choice of a Cover Crop for Weed Management in Organic Vegetable Production. Abstract, American Society of Agronomy, Madison, WI. 19. Mayalagu, G. , Rao Mentreddy, C.J. Garrett, and Joseph Kloepper. 2008. Environmentally friendly production methods for tomato and pepper in Alabama. Featured graduate student presentation at AG Week Celebrations, School of Agricultural and Environmental Sciences, Alabama A&M University. April 23, 2008. 20. Mayalagu, G., S.R. Mentreddy, and J. Kloepper. 2007. Organic No-Till Vegetable Production System: Weed Management with Cover Crops. Abstract, American Society of Agronomy, Madison, WI. 21. Mayalagu, G., and S.R. Mentreddy. 2007. Organic production of Tomato and Pepper. STEM Day. Graduate Student Competitive Poster Presentation. AAMU, March 30, 2007. 22. Mayalagu, G., S.R. Mentreddy, C.J. Garrett, A. Caylor, and J. Kloepper. 2007. Cover Crops for Weed Management in Organic Production Systems. Southern Branch ASA Meetings, Feb 3-7, 2007, Mobile, AL.

2008/09/15 TO 2009/09/14 There was no difference between tillage treatments in pepper yield at E.V. Smith or at A&M, but the CT plots produced greater pepper yields at Cullman. The number of tomatoes was greater in the raised bed than in NT at A&M, but the weight of the tomatoes was not significantly different between the two tillage treatments. At Cullman the tomatoes in the CT tillage treatment produced significantly more marketable tomatoes in number and weight than those in the NT plots. At E.V. Smith there was no difference in tomato or pepper yield between tillage treatments. At E.V. Smith and at Cullman there was no difference between pre-plant fertilizer levels in tomato or pepper yield. At A&M the higher levels of pre-plant fertilizer produced higher crop yields; this location did not apply much compost to the crops. The results of this research indicate that the farmer may experience some crop yield reductions when transitioning to organic no till. By using compost mulch and liquid fertilizer through the drip irrigation system, farmers can omit the use of pre-plant fertilizer. These other sources of soil fertility substituted for half of the recommended amount of nitrogen. Further research is needed in order to determine if the compost and cover crop residues can adequately substitute for the liquid fertilizer as well. Fertilizer is often one of the most expensive inputs that must be purchased. However, the amount of

compost that was required in order to cover the soil surface 5-6" deep and 2-3' wide also represents a substantial investment of money so that the cost-effectiveness of this method would depend upon the farmers' sources of organic material and their means of managing it. For our experiment, cotton gin trash, dairy waste, sawdust, and chicken litter were used. Some of these materials were expensive and hard to locate. Additionally, specialized pieces of machinery, such as a compost turner, front end loader, and spreader, were used to manage this amount of compost. For some farmers pre-plant fertilizer, along with cover crop residues, may be more cost effective for supplying necessary plant nutrients. It is expected that the need for pre-plant fertilizer, as well as the need for large quantities of imported compost, will diminish with the increase in soil organic matter content that occurs through time with the use of high residue cover crops in no till systems.

2007/09/15 TO 2008/09/14 There were no differences observed between tillage treatments and fertilizer treatments at any of the research stations in tomato and pepper yields, with the exception of an increase in pepper yield in the raised beds at A&M as compared to the no-till treatment. At E.V. Smith where weeds were measured, there were no differences between treatments in weed populations. This information is useful to our growers who have expressed an interest in no-till production. Some of them had been hesitant to try no-till due to concerns about yield reductions and weed problems. The results of our research suggest that no-till does not result in yield reductions or increases in weed populations. Hence, farmers can feel confident about trying no-till. We will repeat the experiment again during the summer of 2009 in order to increase the confidence level of our results and recommendations. The results of the pre-plant fertilizer trials suggest that if farmers apply compost and use liquid fertilizer in the drip irrigation system, as many of them do, they may not reap additional benefits from also applying pre-plant fertilizer. The tillage treatments were not found to be different with respect to soil health indicators. The foliar disease trials did not succeed due to production problems. These trials will be attempted again next summer. The farmscaping experiment yielded some preliminary results that facilitated the re-design and improvement of the field design for next summer. An important impact of this grant has been to build a working relationship between farmers of the state and this land grant research institution to investigate appropriate methods of organic production for small scale producers. As a result, we have submitted a proposal for a SARE grant titled "A Farmer-Researcher Collaborative Effort to Design No-till Systems Appropriate for Small-scale Organic Producers in Alabama and the Deep South". If funded this SARE grant will serve as a follow up to the present CSREES grant. The outreach components of this grant, mainly the monthly e-newsletter, website, and also the annual organic production conference, have resulted in our receiving a lot of inquiries for information on organic production. Alabama does not have an organic certification program consequently people requesting information on organic production practices are often directed to us. Interested parties also come across our Organic Vegetable Production website on the Auburn University website and they call or email for specific information. We have provided many new or prospective growers with information or directed them to other agriculture service providers or experienced growers who can help them. As a result we are beginning to form a community of growers, researchers, and other stakeholders for networking and information sharing regarding organic production and marketing in Alabama.

2006/09/15 TO 2007/09/14 Last year's field experiments were repeated in 2007. Additionally, several new cover crop combinations were planted and evaluated. One of the methods we explored last summer shows great promise for allowing producers to obtain good yields with an integrated, organic no-till system. It involves producing a large quantity of compost; cotton gin trash was used here. The finished compost was banded into the planting rows in a layer 3 feet wide by 4-6 inches deep and the tomato and pepper transplants were planted into the compost mulch. This helped suppress weeds, conserve soil moisture, and also added nutrients to the soil. The yields obtained by this system were above the average yields obtained by conventional production methods in this state. Growers were informed of this method through the monthly e-newsletter and also through a presentation at the Community Food Leaders Forum. We have had requests for more information and are providing that. There was no significant difference in the performance of the three tomato varieties, with the exception that Celebrity performed significantly poorer than the other two at W. Thomas. This was due to disease. Hungarian hot wax performed the best of the three pepper varieties. Due to the extreme drought of this past growing season, the cover crops did not perform well. However, the drought did aid in weed control. The living mulches that we attempted to establish in the alleyways appeared to have died during the summer, but they did come back to some extent when it rained later in the summer. We re-planted them but this fall has also been extremely dry. There was no significant difference in biomass production between the cover crop monocultures and the fallow plot because of poor establishment due to the drought. The cover crop mixtures, however, grew well. They had been planted a few days earlier when the soil was moist, whereas the monocultures had been planted in dryer soil just before a rain came and washed away much of the seed. Though the crops were re-planted, conditions were not favorable for germination and growth. In spite of the poor establishment, we found that canola, crimson clover, and hairy vetch had significantly fewer summer weeds than the fallow control plot. In

the cover crop mixtures trials, we found that rye and triticale in monoculture produced the most biomass. The rye/hairy vetch/crimson clover mixture produced the most nitrogen per acre. There was no significant effect of cover crops on crop yields at two of the locations, probably because of poor establishment due to the drought. At one of the locations, though, all cover crops produced higher yields than the fallow plot, with the exception of canola. Canola did not die back when it was mowed down and it competed with the crop for water. There was no significant difference in tomato yield with the various organically approved pesticides. Foliar diseases were not much of a problem in this dry summer. Next year we plan to use overhead irrigation to increase the disease pressure in the foliar disease trials.

2005/09/15 TO 2006/09/15 Expected Impact: The consumption of organic produce has recently increased in AL as evidenced by the increase in organic produce sections in the local grocery store chains; however, the supply of locally grown organic produce has not kept up with the demand. This presents a potentially lucrative opportunity for AL farmers, but they need information on viable growing techniques applicable to the state. The AL Cooperative Extension Service has had an increased demand for information on organic growing techniques and methods, but the information is not available. Hence there is an information gap that research needs to fill. The objective of this project is to provide growers with the critical information that they need in order to fill Alabama consumers' demand for locally grown organic produce. Training systems for Cooperative Extension personnel are being developed as a vital component of this objective.

PUBLICATIONS

2008/09/15 TO 2009/09/14 No publications reported this period

2007/09/15 TO 2008/09/14 No publications reported this period

2006/09/15 TO 2007/09/14 No publications reported this period

2005/09/15 TO 2006/09/15 No publications reported this period

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Development of Sustainable Gastrointestinal Nematode Control in Organic Small Ruminant Production

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| Investigator(s) | Burke, J. M. |

NON-TECHNICAL SUMMARY

Organic production of small ruminants is difficult. The purpose of this study is develop organic and sustainable methods of GI parasite control.

OBJECTIVES

The objective of this cooperative research project is to 1) Increase level of awareness and adoption of available organic GIN control strategies in the southeastern US by disseminating state-of-the-art knowledge and procedures and conduct cost-benefit analyses of these systems; 2) To examine the effectiveness and efficiency of managing *H. contortus* in weaned lambs and kids by grazing high nutritional value forages and/or sericea lespedeza or other tannin-rich forages with and without rotational grazing strategies for control of *H. contortus*; and 3) Test novel methods and/or integrated strategies for control of *H. contortus*.

APPROACH

1) Small plot grazing trials with tannin-containing plants will be established for goats and/or sheep during year 1 of the project. Percentage of available forage consumed will be determined and forage samples taken for quality analyses, extractable and bound CT, and tested for anti-parasitic efficacy using larval development/migration inhibition and egg hatch assays. 2) Dose titration trials feeding sericea lespedeza hay, pellets, or cubes to determine optimal concentration of SL to include in the diet for control of *H. contortus*. Fecal cultures will be prepared to determine percent egg hatch, and larval migration assays to determine activity of developed larvae. Abomasal and intestinal numbers and genus of adult worms will be determined. Use of tannin-rich plants for parasite control will be integrated with smart drenching concepts and FAMACHA at each research site. 3) On-farm trials to evaluate the establishment and use of tannin-rich plants (grazing and processed) with integrated control methods for parasite control in sheep and goats will be conducted. Cost-benefit analyses will be completed for each integrated system to determine impact on profitability of sheep and goat farming operations.

PROGRESS

2005/09 TO 2008/09 OUTPUTS: PI attended IOP Project Director Workshop and SARE Conference, Kansas City in 2008, presenting a poster of results of research associated with IOP grant. Dissemination of results by investigators occurred in all states involved, including a Sheep and Goat Field Day held in Booneville, AR in 2005 and 2007, Conway, AR, and Harrison, AR in 2007, to producer groups in Texas, Missouri (4), to Department of Animal Science, West Virginia University, and ARS, Beaver, WV in 2006. Investigators received numerous telephone calls and emails from sheep and goat producers. For each call or email, all questions are answered so that producers understand steps they can take to improve their operations. Majority of questions were on management of gastrointestinal nematode control. PARTICIPANTS: Joan M. Burke, Research Animal Scientist, USDA, ARS, Dale Bumpers Small Farms Research Center, Booneville, AR was the PI for this project. Dr. Burke conducted and reported research, including on-farm work. Dr. Burke participated in producer workshops and presentation of results at scientific meetings. Thomas H. Terrill, Forage Agronomist, Agricultural Research Station, Fort Valley State University, Georgia was a co-PI and conducted and reported university and on-farm research in Georgia and was involved in producer workshops and presentation of results at scientific meetings. James E. Miller, Veterinary Parasitologist, Department of Pathobiological Sciences, School of Veterinary Medicine, Louisiana State University was a co-PI and conducted and reported parasitology research and was involved in producer training and presentation of results at scientific and extension meetings. Jim Muir, Forage Research Ecologist, Texas Agriculture Experiment Station, Texas A&M, Stephenville, TX was a co-PI and conducted and reported research on condensed tannin forages and on-farm studies in Texas and was involved in producer workshops. Mimi Williams, Forage Physiologist, took a position with NRCS and was not able to be involved in this project. Jorge Mosjidis, Forage Legume Breeder, Alabama Agricultural Experimental Station, Auburn University, AL was a co-PI and assisted in establishment and management of SL for grazing at University and on-farm sites and participated in research planning, manuscript preparation and publication, and presentation of research results at scientific and extension-type meetings. Linda Coffey, Program Specialist, NCAT, Fayetteville, AR. Linda Coffey was involved in the production and delivery of producer-friendly publications. Holly Born, Program and Economic Specialist, NCAT, Fayetteville, AR was involved in economic analyses of research results. TARGET AUDIENCES: Target audience included small ruminant producers, extension agents and professionals that contribute to the small ruminant industry. A majority of small ruminant producers addressed by this project are from small farms. PROJECT MODIFICATIONS: Not relevant to this project.

2006/09/15 TO 2007/09/14 Two years of continuous vs. rotational grazing (three complete rotations) of Katahdin lambs on bermudagrass during summer months occurred. Lambs were selectively dewormed with copper oxide wire particles (COWP) based on FAMACHA scores and none was dewormed before entering plots. In Louisiana, multiple strategies were used for GIN control when FAMACHA score increased to 4 or 5 in lambs grazing summer pastures. Strategies were 1) 2 g COWP and returned to pasture, 2) fed sericea lespedeza (SL) pellets in confinement for 14 days and returned to pasture, or 3) fed a complete ration for 14 days and returned to pasture (n = 15/treatment). Similarly, a complete ration was offered to weaned goats in Arkansas. Multiple strategies for GIN control in Katahdin lambs (n = 96) were used on-farm in Arkansas. These strategies included use of COWP, garlic extract, papaya seed, or grazing of chicory as part of a rotation. All lambs co-grazed with dams on rotational pastures. Dose titration trials with ground SL hay fed to goats or SL pellets fed to lambs was completed at Fort Valley State University and USDA, ARS, Booneville, respectively. SL was fed at 0, 25, 50, and 75% of the diet. Bermudagrass hay or SL pellets (450 g/ewe daily then increased to 1.6 kg) were fed to grazing periparturient ewes in Louisiana. In another study, SL pellets or bermudagrass hay were fed to lambs for 35 days then only the hay to both groups for an additional 14 days. Organic establishment of SL forage occurred at Fort Valley State University and on-farm sites in Georgia. In the university trial, SL was planted into established 5 x 20-ft plots of annual cool-season grasses (oats, rye, wheat, ryegrass), or planted at the same time as the grasses to determine effects on weed suppression and SL establishment. For the on-farm trials, SL was established in 2-acre paddocks using various planting methods. No fertilizer, lime, or herbicide treatments were used. At Auburn University, SL was established alone, with oats, rye, annual ryegrass or wheat. The SL alone was treated conventionally with one application of Post to eliminate narrow-leaf weeds the other plots have remained untreated up to now. By the end of the growing season, plots were evaluated for SL stand, SL dry matter and weed dry matter. Organic establishment of SL was attempted on-farm at two locations in Arkansas. Screening for condensed tannin-rich forages occurred at Texas Agricultural Experiment Station in Stephenville and Fort Valley State University from plants submitted by sites in Texas, Arkansas, Georgia, Louisiana, and Alabama. There were several plants identified with moderate levels of condensed tannins, but none as high as SL. Dissemination of results by investigators occurred in all states involved, including a Sheep and Goat Field Day held in

Booneville, AR in October 2007 and posting of publications on the Southern Consortium for Small Ruminant Parasite Control website (www.scsrpc.org) as well as scientific journals.

2005/09/15 TO 2006/09/14 The objective of this research was to develop improved practices with little or no chemical intervention applicable to US organic farms to prevent, control, and treat gastrointestinal parasites in small ruminants. This is the first year of this project. Producer workshops were held in several locations in Arkansas, Texas, and Missouri on smart drenching, acceptable methods of parasite control for organic production, and use of FAMACHA for control of internal parasites in sheep and goats. Results from an Organic Interest Survey indicated that there is an interest in organic small ruminant production, but parasite control, organic feed availability, processing, and marketing are issues that may inhibit organic production. The first of a two year study was initiated on the impact of rotational compared with continuous grazing of weaned lambs on management of gastrointestinal parasites. Results will be summarized and recommendations regarding impact of rotational grazing will be developed. Studies on dose titration of feeding sericea lespedeza pellets and meal for control of gastrointestinal parasites have been initiated in lambs, kids, and sheep in Arkansas, Georgia, and Louisiana. A screening for condensed tannins of native herbaceous Texas, St. Croix, Arkansas, Georgia, Louisiana, and Alabama legumes and browse species palatable to goats and sheep that may have anthelmintic properties was initiated. An experiment was initiated in Texas to examine the effect of harvesting interval and spacing density on condensed tannins of two native herbaceous legumes with potential for organic gastrointestinal nematode control. Studies will continue and data analysis is pending.

IMPACT

2005/09 TO 2008/09 Sericea lespedeza (SL) has been the most widely used condensed tannin rich forage for parasite control. SL can be pelleted for producers that cannot grow these forages. Grazing fresh or preserved SL represents an estimated savings on dewormer of more than 50%. Examination of the use of dried SL for control of gastrointestinal nematodes in goats revealed that as little as 25% of the diet exhibited control over *Haemonchus contortus*, an abomasal nematode, but not intestinal nematodes. Overall, SL as grazed forage contributes to reduced fecal egg counts, but use of harvested SL for parasite control is more variable. Perhaps degradation of the condensed tannin in SL decreases efficacy as an anthelmintic. The use of low doses of copper oxide wire particles (COWP), a low cost nutritional supplement, has been extensively examined in sheep in goats for control of abomasal worms. Use of COWP by producers without any effective chemical dewormers has the potential to save over \$7 million on more than 204,500 lambs produced in the southeastern US annually. COWP mixed in feed may be more or equally as effective compared with a bolus for control of *H. contortus* in goats. The impact of rotational grazing on GIN infection of weaned lambs was studied. Between 0 and 3 deworming treatments per lamb were necessary and there tended to be fewer RB than CB lambs dewormed by Day 84 for both years combined. Abomasal worm burden tended to be greater in RB than CB or RBH tracer lambs, but intestinal worm numbers were similar. Body weight gains were similar between CB and RB groups. Economic value between the CB and RB lambs was similar based on number of lambs that could have been marketed as organic. For both years, lambs relied exclusively on COWP for GIN control with the exception of one lamb. In summary, while there was a reduced incidence of deworming in the RB compared with the CB group of lambs, estimated economic value of these systems was similar. The FAMACHA system, a tool to classify color of lower eye lid into stages of anemia which correlates with *H. contortus* infection, was validated in the U.S., but its use for genetic selection has not been documented. We determined that the FAMACHA system can be used to identify superior sires with parasite resilience, thus, resilience within a flock can be increased. In addition, other research indicates a 75% reduction in dewormer use and a potential to eliminate all treatment on animals identified as parasite resistant. A simple testing procedure was used to determine whether condensed tannins were present in legume species by adding butanol hydrochloride directly to processed plant material with heat to visualize a blue or purple color indicative of CT. This was part of a project to identify condensed tannin-rich forages throughout the southeastern US. **PUBLICATIONS (not previously reported):** 2005/09 TO 2008/09 1. Muir, J.P., J.R. Bow, W. Rodriguez, and J.M. Patterson. 2009. Defoliation of Panicked tick-clover, Tweedys tick-clover and Tall bush-clover: II. Herbage Nutritive Value and Condensed Tannin Concentrations. *Agron. J.* (In press). 2. Muir, J.P., J.R. Bow, and J. White. 2009. Defoliation of Panicked tick-clover, Tweedys tick-clover and Tall bush-clover: I. Winter survival and yields of herbage and seed. *Agron. J.* (In press). 3. Burke JM, Wells A, Casey P, Miller, JE. 2009. Garlic and papaya lack control over gastrointestinal nematodes in goats and lambs. *Vet. Parasitol.* 159, 171-174. 4. Wolfe. R.M., T.H. Terrill, and J.P. Muir. 2008. Season and drying method effects on condensed tannin levels in perennial herbaceous legumes. *J. Sci. Food Agri.* 88, 1060-1067. 5. Burke JM, Miller JE. Use of FAMACHA system to evaluate gastrointestinal nematode resistance in offspring of stud rams. *Veterinary Parasitology* 2008; 153, 85-92. 6. Burke JM, Wells A, Casey P, Kaplan RM. 2009. Herbal dewormer fails to control gastrointestinal

nematodes in goats. *Vet. Parasitol.* 160, 168-170. 7. Pawelek, D., J.P. Muir, B.D. Lambert, and R. Wittie. 2008. In sacco rumen degradability of condensed tannins, fiber, and nitrogen from herbaceous native Texas legumes in goats. *Anim. Feed Tech.* 140, 225-240. 8. Moore DA, Terrill TH, Kouakou B, Shaik SA, Mosjidis JA, Miller JE, Vanguru M, Kannan G, Burke JM. 2008. The effects of feeding sericea lespedeza hay on growth rate of goats naturally infected with gastrointestinal nematodes. *J. Anim. Sci.* 86, 2328-2337. 9. Burke JM, Terrill TH, Kallu RR, Miller JE. 2007. Use of copper oxide wire particles to control gastrointestinal nematodes in goats. *J. Anim. Sci.* 85, 2753-2761. 10. Terrill TH, Mosjidis JA, Moore DA, Shaik SA, Miller JE, Burke JM, Muir JP, Wolfe R. 2007. Effect of pelleting on efficacy of sericea lespedeza hay as a natural dewormer in goats. *Vet. Parasitol.* 146, 117-122. 11. Lange KC, Olcott DD, Miller JE, Mosjidis JA, Terrill TH, Burke JM, Kearney MT. 2006. Effect of the condensed tannin containing hay, sericea lespedeza, on natural and experimental challenge *Haemonchus contortus* infection in lambs. *Vet. Parasitol.* 141, 273-278. 12. Shaik SA, Terrill TH, Miller JE, Kouakou B, Kannan G, Kaplan RM, Burke JM, Mosjidis J. 2006. Sericea lespedeza hay as a natural deworming agent against *Haemonchus contortus* infection in goats. *Vet. Parasitol.* 139, 150-157. 13. Hale M, Burke J, Miller J, Terrill T. Tools for Managing Internal Parasites in Small Ruminants: Copper Wire Particles. 2007. NCAT/ATTRA and SCSRPC ([http://www.scsrpc.org/SCSRPC/Files/copper wire.pdf](http://www.scsrpc.org/SCSRPC/Files/copper%20wire.pdf)). 14. Coffey L, Hale M, Terrill T, Mosjidis J, Miller J, Burke J. Tools for Managing Internal Parasites in Small Ruminants: Sericea Lespedeza. 2007. NCAT/ATTRA and SCSRPC ([http://www.scsrpc.org/SCSRPC/Files/sericea lespedeza.pdf](http://www.scsrpc.org/SCSRPC/Files/sericea%20lespedeza.pdf)).

2006/09/15 TO 2007/09/14 There was a greater percentage of lambs dewormed on the continuous compared with the rotational grazing. Poor forage quality by mid-summer necessitated supplementation of all lambs to meet nutritional requirements in both years. For the multiple strategy trial, copper oxide wire particles (COWP) were very effective for control of GIN; however, sericea lespedeza (SL) and complete rations fed for 14 days failed to control GIN. In this study a FAMACHA score of 3 or greater was used to determine need for deworming rather than 4 or 5. This may be because heavily infected and anemic (FAMACHA of 4 or 5) animals are too far in extremis to adequately respond to SL and/or complete ration treatment and may not be appropriate for organic farming or GIN control. Similarly, the complete ration offered to weaned goats in Arkansas was ineffective at controlling GIN. Because of the low number of animals treated using multiple strategies on-farm it cannot be determined whether treatments were effective. Dose titration trials with SL hay reduced fecal egg counts (FEC) in goats fed the 50 and 75% SL ration, but no differences were observed among lambs fed the SL or control diet. SL pellets initially reduced FEC in ewes, but the effect was short lived. When SL pellets were fed exclusively, FEC was reduced, but the effect was lost when feeding stopped. It appears that SL pellet supplementation of ewes during the periparturient period may not effectively control GIN. SL pellets reduced FEC by 50% in lambs within 7 days and remained low even after SL withdrawal. Several bermudagrass fed lambs required deworming. Results indicated that SL, fed as pellets to lambs, reduced the worm burden (based on FEC) of naturally acquired infections which could help reduce pasture contamination. These results help producers understand methods to control GIN in organic sheep and goat production. Project evaluation occurred through email and telephone communication and at meetings held at Virginia Tech in May and Fort Valley State University in October as part of the Southern Consortium for Small Ruminant Parasite Control. Discussion at these meetings helped with experimental design for upcoming projects and interpretation for completed projects.

2005/09/15 TO 2006/09/14 Specific information on control of gastrointestinal parasites in small ruminants by grazing practices and inclusion of plant materials in the diet that inhibit gastrointestinal nematodes will enable producers to maximize numbers of animals that can be marketed organically. By examining the practicality and success of control methods researchers will be able to develop best management practices for small ruminants. The expectation is that these practices will eliminate need for chemical control of gastrointestinal parasites.

PUBLICATIONS

2006/09/15 TO 2007/09/14 1. Burke JM, Terrill TH, Kallu RR, Miller JE. Use of copper oxide wire particles to control gastrointestinal nematodes in goats. 2007. *J. Anim. Sci.* 85, 2753-2761. 2. Terrill TH, Mosjidis JA, Moore DA, Shaik SA, Miller JE, Burke JM, Muir JP, Wolfe R. 2007. Effect of pelleting on efficacy of sericea lespedeza hay as a natural dewormer in goats. *Vet. Parasitol.* 146, 117-122. 3. Lange KC, Olcott DD, Miller JE, Mosjidis JA, Terrill TH, Burke JM, Kearney MT. 2006. Effect of the condensed tannin containing hay, sericea lespedeza, on natural and experimental challenge *Haemonchus contortus* infection in lambs. *Vet. Parasitol.* 141, 273-278. 4. Hale, M., Burke, J., Miller, J., and T. Terrill. (2007). Tools for Managing Internal Parasites in Small Ruminants: Copper Wire Particles. NCAT/ATTRA and SCSRPC ([www.scsrpc.org/SCSRPC/Files/copper wire.pdf](http://www.scsrpc.org/SCSRPC/Files/copper%20wire.pdf)). 5. Coffey, L., Hale, M., Terrill, T., Mosjidis, J., Miller, J., and J. Burke. (2007). Tools for Managing Internal Parasites in Small

Ruminants: Sericea Lespedeza. NCAT/ATTRRA and SCSRPC (www.scsrpc.org/SCSRPC/Files/sericea_lespedeza.pdf). 6. Mosjidis, J.A., T.H. Terrill, J.E. Miller, J.M. Burke, D. Ball and J. Bostick . 2007. Frequent Questions and Answers Regarding Sericea Lespedeza. Available at www.ag.auburn.edu/agrn//mosjidis/sericea1lespedeza.htm (verified 15 October 2007). Mosjidis, J.A., T.H. Terrill, J.E. Miller, J.M. Burke, and D. Ball. 2007. Misconception of Sericea Lespedeza as an Invasive Species. Available at www.ag.auburn.edu/agrn//mosjidis/sericea1lespedeza.htm (verified 13 August 2007). 7. Valentin, K.A.H., B.R. Min, E. Valencia, A. Rodriguez, J.E. Miller, and J.P. Muir. 2007. In vitro larval activity and in vivo gastro-intestinal parasite infestation in goats grazing tropical legumes. American Society Animal Science National Meetings, San Antonio, TX July 8-12. *J. Anim. Sci.* 85 (Suppl. 1):595. 8. Wolfe, R., T. Terrill, and J.P. Muir. 2007. Season and drying method effects on condensed tannin levels in perennial herbaceous legumes. American Society Animal Science National Meetings, San Antonio, TX July 8-12. *Anim. Sci.* 85 (Suppl. 1):T146. 9. Pawelek, D.L., J.P. Muir, B.D. Lambert, and R.D. Wittie. 2007. In sacco rumen disappearance of condensed tannins, fiber, and nitrogen from herbaceous native Texas legumes in goats. American Society Animal Science National Meetings, San Antonio, TX July 8-12. *Anim. Sci.* 85 (Suppl. 1):T145. 10. Muir, J.P., E. Valencia, R. Wolfe, T.T. Terrill. 2007. The role of tropical legume condensed tannins in the ruminant:forage interface. Caribbean Food Crops Society 43rd Annual Meeting, San Jose, Costa Rica. 11. Wolfe, R.M., T.H. Terrill, and J.P. Muir. 2007. Fiber analysis of browse species varying in condensed tannin content. Vol. 16 on CD. AFGC.

2005/09/15 TO 2006/09/14 No publications reported this period

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Evaluation of Strategies for Management of Soybean Rust in Organic Systems

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NON-TECHNICAL SUMMARY

There are no known NOP approved strategies to control Asian Soybean Rust (*Phakopsora pachyrhizi*) (ASR) in organic production systems. There are, however, some intervention and cultural strategies that hold some promise of efficacy. The purpose is to evaluate the following strategies for soybean rust: system effects, including extended crop rotations and windbreaks (to mitigate spore dispersal) and tools, including NOP-compliant fungicides, such as copper sulfate and hydrogen peroxide, and biological controls (*Bacillus pumilus* and other microbial products).

OBJECTIVES

Objective 1: Evaluate the susceptibility of organic soybeans to Asian Rust in Florida, Pennsylvania, Michigan and Iowa under both transition and certified organic systems: with special reference to varietal susceptibility, soybean maturity group, date of planting, crop rotation system and site-specific functional ecology (including soil quality, insects and other arthropods). Objective 2: Evaluate eight NOP-complaint pesticides that are reported to have fungicidal properties that are efficacious against *Phakospora pachyrhiza*, not phytotoxic to *Glycine max*, and economically suitable for use in organic soybean production systems. Objective 3: Development of a uniform database management system for use by all participants and in all components of this organic soybean rust project. Objective 4: Provide organic Asian soybean rust diagnostic and management educational materials through existing websites (New Farm, The New Ag Network, OrganicAgInfo and each institutions' organic website); regional workshops; multi-region Extension fact sheets; and refereed journal articles. Objective 5: Conduct a rapid, comprehensive, agroecological analysis of successful organic Asian Soybean Rust management systems (living laboratories) throughout South America, Africa and Asia.

APPROACH

1: We will compile a list of organic farms where rust has been confirmed and create a database of farmers using extended rotations (beyond a two-year rotation) and/or windbreaks, strip-cropping, or other practices that appear to restrict soybean rust in their organic soybean systems. 2: Biological or botanical substances included on the National List of natural and synthetic substances allowed for use in organic crop production will be applied to prevent, suppress, or control soybean rust. 3: We will investigate the effect of these materials on organic soybean growth, yield and health (insect and disease pressure), and on soybean rust, should the disease arrive at these sites.

PROGRESS

2005/09 TO 2008/09 OUTPUTS: Fortunately for the major organic soybean producing areas of the U.S., Asian soybean rust (ASR) did not reach an epidemic stage during the course of the project (2005 to 2008), despite isolated findings in Iowa in 2007 and other states outside of this project's scope. As of December 2008, ASR was reported in 396 counties in the U.S. Research supported by this project in Florida, where ASR has been occurring since 2004, led to the identification of viable strategies, including NOP-compliant copper-based fungicides, for effectively managing ASR in organic systems and mitigating losses in the event of severe infection. In addition, the application of natural silicon was investigated and found to delay ASR disease onset in Florida. Other successful pest management strategies included trap crops to prevent stink bugs from colonizing organic soybeans. In areas where ASR has not yet arrived, methods of improving organic soybean systems, including reduced tillage and varietal selection to mitigate other soybean diseases, resulted in greater maintenance of soil quality and higher returns for farmers. Over the three years of the project, dissemination of information to over 1,200 people has occurred through presentations at annual Field Days held in each state, and at the Iowa Organic Conference, Michigan Sustainable Farming Association Conference and the Upper Midwest Organic Farming Conference each year. On-line reports have been posted at the following sites: NewFarm, New Ag Network, OrganicAgInfo and each institutions' research farm and individual organic websites, including <http://extension.agron.iastate.edu/organicag/>. Through these efforts, we have increased the knowledge base and skills of thousands of organic farmers across the U.S. in Asian soybean rust diagnostic and management tools. Activities supported through this project in 2008 included the establishment of four research experiments in Florida, Iowa, Michigan and Pennsylvania; analyzing all data from sites; four state reports and one overall project report; three Field Days in Michigan, Iowa, and Pennsylvania; and the Florida site serving as a demonstration site for ag professionals receiving training in ASR. Products produced included new applied knowledge and technology for ASR management in organic systems, and the sharing of this information on websites listed below. A hands-on training of the latest technology for ASR detection, an ELISA strip test (EnviroLogix, Portland, Maine) was demonstrated to 68 producers and Extension personnel in Iowa on September 23, 2008. PARTICIPANTS: Participants in this project include Jerry DeWitt and Robert Turnbull (Iowa State University), Ann Blount, David Wright, Cheryl Mackowiak, Jim Marois, Richard Sprengel, Steve Olson and Russell Mizell (University of Florida), Dale Mutch, George Bird and Mark Whalon (Michigan State University), and Jeff Moyer and Paul Hepperly, The Rodale Institute. Partner organizations include the Iowa Organic Association, Michigan Sustainable Farmers Association and the many outreach agencies through The Rodale Institute's efforts. Professional development opportunities for Extension and farmers from this project have included participation in Field Days and conferences described above. TARGET AUDIENCES: Target audiences have been organic soybean growers in the U.S. and in the world. Organic and non-GMO soybean processors are also interested in these results. Efforts include Extension-based dissemination, such as Field Days, conferences and on-line reports. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2006/09/15 TO 2007/09/14 OUTPUTS: This research has identified potential strategies, such as copper-based fungicides, for effectively managing ASR in organic systems and mitigating losses in the event of severe infection. In areas where ASR has not yet arrived, methods of improving organic soybean systems, including reduced tillage and varietal selection for other soybean diseases, can result in greater maintenance of soil quality and higher returns for farmers. Dissemination of information to over 600 people has occurred through presentations at Field Days and the Iowa Organic Conference, Michigan Sustainable Farming Association Conference and the Upper Midwest Organic Farming Conference. On-line reports have been posted at the following sites: NewFarm, New Ag Network, OrganicAgInfo and each institutions' research farm and individual organic websites, including <http://extension.agron.iastate.edu/organicag/>. Through these efforts, we have increased the knowledge base and skills of thousands of organic farmers across the U.S. in Asian soybean rust diagnostic and management tools. Activities supported through this project in 2007 included the establishment of four research experiments in Florida, Iowa, Michigan and Pennsylvania; analyzing all data from sites; four state reports and one overall project report; three Field Days in Michigan, Iowa, and Pennsylvania; the Florida site serving as a demonstration site for over 50 people who received training in ASR; and individual consulting with

three organic soybean companies regarding ASR management. Products produced included new applied knowledge and technology for ASR management in organic systems, and the sharing of this information on websites listed below. PARTICIPANTS: Participants in this project include Dr. Jerry DeWitt and Robert Turnbull (Iowa State University), Ann Blount, David Wright, Cheryl Mackowiak, Jim Marois, Richard Sprengel, Steve Olson and Russell Mizell (University of Florida), Dale Mutch, George Bird and Mark Whalon (Michigan State University), and Jeff Moyer and Paul Hepperly, The Rodale Institute. Partner organizations include the Iowa Organic Association, Michigan Sustainable Farmers Association and the many outreach agencies through The Rodale Institute's efforts. Professional development opportunities for Extension and farmers from this project have included participation in Field Days and conferences described above. TARGET AUDIENCES: Target audiences have been organic soybean growers in the U.S. and in the world. Organic and non-GMO soybean processors are also interested in these results. Efforts include Extension-based dissemination, such as Field Days, conferences and on-line reports. PROJECT MODIFICATIONS: None

2005/09/15 TO 2006/09/15 Asian soybean rust (*Phakopsora pachyrhizi*) (ASR), which arrived in the U.S. in 2004, has the potential to be the single most important impediment to organic soybean production in the U.S. As of December 2006, ASR has ranged as far north as Indiana and Illinois. At the initiation of this research, there was no known organic-compliant control of ASR, thus the purpose of this project is to evaluate tools, including organic-compliant fungicides and cultural strategies, such as extended crop rotations and windbreaks to mitigate spore dispersal. Our objectives include on-station studies and on-farm surveys conducted in Florida, where rust has been discovered, and in Iowa, Michigan and Pennsylvania. The Upper Midwest and Pennsylvania missed ASR in 2006, probably due to exceptionally dry weather in the Southeast during the early soybean-growing season. In Florida an organic trial was established in 2005 to examine effects of organic-compliant fungicides on ASR on soybeans grown on land in transition to certified organic status. The fungicides tested in 2006 and the resulting ASR disease severity ratings, according to the Horsfall-Baratt rating scale (0 = 0%; 11 = 100% diseased) were as follows: Control (untreated)-7; copper hydroxide-2; copper sulfate-2; *Bacillus pumilis*-3-4 (early); 5-6 (later in season); caprylic acid-4-5; Hoshizaki water-5; hydrogen dioxide-5; microbial combination (AN)-6; and microbial combination (MAF)-6. These results suggest promise for copper-based products for organic management of ASR. The issues associated with extended copper use, however, must be considered. Research to date through this project has shown that in Iowa, Pennsylvania and Michigan, no significant differences in organic soybean yields were found in soybeans treated with *Bacillus pumilis*, an OMRI-listed fungicide that has shown some efficacy against ASR in South Africa. However, plants treated with *Bacillus pumilis* were taller and deeper green at harvest, with a delayed senescence in Pennsylvania. Other ASR fungicide products tested in Pennsylvania (lime-sulfur and soybean oil) caused some phytotoxicity in organic soybeans. Organic soybean yields were excellent in 2006, despite extensive drought conditions in Iowa in June and July. Yields ranged from 38 to 51 bushels per acre across all sites. No significant differences in soybean yields were detected in Michigan when soybeans were planted earlier (May 22) versus later (June 16), a possible strategy for ASR management. Another potential strategy, planting soybeans into a rolled cover crop, was evaluated for yield and disease effects in 2006 in Iowa, Pennsylvania and Michigan. Yields ranged from 22 to 38 bushels per acre in Michigan; up to 30 bushels per acre in Pennsylvania; but reduced in Iowa because of the drought.

IMPACT

2005/09 TO 2008/09 Asian soybean rust (*Phakopsora pachyrhizi*) (ASR), arrived in the U.S. in 2004 and ranged to Canada in 2008. Because there was no organic-compliant control of ASR the purpose of this project was to evaluate tools, including organic-compliant fungicides and cultural strategies to limit damage from ASR. On-station organic fungicide efficacy studies in Florida, where rust has been extremely active and in Iowa, Michigan and Pennsylvania for their effect on yields and other soybean diseases were conducted. In Florida, an organic trial was established in 2005 to examine the effects of organic-compliant fungicides on ASR on soybeans grown on land in transition to certified organic status. Over all years, the most effective fungicides were copper hydroxide and copper sulfate when plants were rated according to the Horsfall-Barrett rating scale (0 = 0%; 11 = 100% diseased). At the highest disease rating period in 2006, soybean plants treated with Champion (copper hydroxide) and basic copper sulfate were rated 2.0 and 2.6, respectively, compared to the control at 7.4. In 2007, copper-treated plants averaged 2.6 compared to the control at 4.8. Yields were greater in these treatments in 2006 and 2007. There were few differences detected between the control and *Bacillus pumilis*, caprylic acid, Hoshizaki water, hydrogen dioxide, and microbial combinations (AN and MAF). These results suggest promise for copper-based products for organic management of ASR, but build-up in routine use of copper fungicides must be considered. Across all years, data have shown that in Iowa, Pennsylvania and Michigan, no significant differences in organic soybean yields were found in soybeans treated with *Bacillus pumilis*, an OMRI-listed

fungicide that has shown some efficacy against ASR in South Africa. Other ASR fungicide products that were tested in this project showed no effects on yields or soybean diseases, although soybean oil in Pennsylvania caused some phytotoxicity in organic soybeans in 2007. Organic soybean yields were excellent in 2008 (averaging 53 bu/acre), despite significant flooding in Iowa in 2008. Diseases were low, despite long periods of flooding. Across all years, yields ranged from 13 bu/acre in a severe drought year in Michigan in 2007 to 65 bu/acre in Iowa the same year. Later planting, a possible strategy for ASR management, led to equivalent yields if planting occurred before June 16. No significant differences in mite or natural enemy diversity, or nematode community structure were detected among the fungicide treatment or planting dates, but the population densities of bacterivores in organic plots were generally higher than those associated with conventional soybean production sites in Michigan. Another potential strategy, planting soybeans into a rolled cover crop, was evaluated for yield and disease effects. Across all years, the highest organic soybean yield occurred in Iowa in 2007, when yields averaged 45 bu/acre in a rolled cover crop of hairy vetch/rye with no rust detected and other soybean diseases ranging from 0 to 2.3% of leaves infected. As a result of this effort soybean producers now have an effective tool with which to counter ASR. **PUBLICATIONS (not previously reported):** 2005/09 TO 2008/09 1. Delate, K. 2008. Evaluation of Organic Soybean Rust Treatments for Organic Production. Neely Kinyon Trial 2008. Iowa State University Experiment Station Reports Ames, IA. 2. Delate, K., A. Blount, C. Mackowiak, D. Wright, and R. Turnbull. 2008. Efficacy of organic-compliant fungicides for Asian soybean rust. Proc. National Soybean Rust Symposium, Louisville, KY, December 12-14, 2007. On-line at: <http://www.plantmanagementnetwork.org/infocenter/topic/soybeanrust/2007/posters/49.asp>. 3. DeWitt, J., R. Turnbull, A. Blount, C. Mackowiak, and D. Wright. 2008. Evaluation of organic-compliant fungicides for ASR in organic soybean production. USDA National SARE Conference, March 25-27, 2008, Kansas City, MO. 4. Gevens, A.J., D.L. Wright, A. Blount, R.F. Mizell, R.K. Sprenkel, C. Mackowiak, S.M. Olson, J.A. Smith, J.J. Marois, and L.E. Datnoff. 2007. Using foliar fungicides to manage soybean rust (Alternatives for organic soybean production). On-line at: NCERA-208. <http://oardc.osu.edu/soyrust/> 5. Lemes, E., C. Mackowiak, L. Datnoff, J. Marois, and A. Blount. 2008. Effects of soil and foliar applied silicon on Asian soybean rust (*Phakopsora pachyrhizi*) development in organic production systems. European Network for Durable Exploitation of Crop Protection Strategies, Oct. 12-15, La Grande Motte, France.

2006/09/15 TO 2007/09/14 Asian soybean rust (*Phakopsora pachyrhizi*) (ASR), arrived in the U.S. in 2004, continues to spread across the U.S., affecting more regions in 2007 than at any other time and has the potential for being the most important impediment to organic soybean production. As of December 2007, ASR has ranged as far north as Canada and Iowa, although the disease appeared late in the season and did not affect yields. At the initiation of this research, there was no organic-compliant control of ASR. The purpose of this project is to evaluate tools, including organic-compliant fungicides and cultural strategies to limit damage. Our objectives include on-station studies and on-farm surveys conducted in Florida, where rust has been extremely active and testing organic fungicides in Iowa, Michigan and Pennsylvania for their effect on yields and other soybean diseases. Pennsylvania and Michigan missed ASR in 2007, and no ASR was found in organic soybean trials in Iowa, probably due to exceptionally dry weather in the Southeast during the early soybean-growing season. In Florida, an organic trial was established in 2005 to examine effects of organic-compliant fungicides on ASR on soybeans grown on land in transition to certified organic status. Fungicides were tested in 2007 and plants rated according to the Horsfall-Barrett rating scale (0 = 0%; 11 = 100% diseased). Plants treated with copper hydroxide and copper sulfate exhibited the lowest rates of disease, with no differences detected between the control and *Bacillus pumilis*, caprylic acid, Hoshizaki water, hydrogen dioxide, and microbial combinations (AN and MAF). These results suggest promise for copper-based products for organic management of ASR, but issues associated with extended copper use must be considered. Research to date has shown that in Iowa, Pennsylvania and Michigan, no significant differences in organic soybean yields were found in soybeans treated with *Bacillus pumilis*, an OMRI-listed fungicide that has shown some efficacy against ASR in South Africa. Other ASR fungicide products tested in Pennsylvania (soybean oil) caused some phytotoxicity in organic soybeans. Organic soybean yields were excellent in 2007 in Iowa and Pennsylvania with no differences between three varieties tested. Due to severe drought in Michigan, yields only reached 13 bu/acre. No significant differences in yields were detected when soybeans were planted earlier (May 22) versus later (June 16), a possible strategy for ASR management. No significant differences in mite or natural enemy diversity, or nematode community structure were detected among the fungicide treatment or planting dates, but the population densities of bacterivores in organic plots were generally higher than those associated with conventional soybean production sites in Michigan. Another potential strategy, planting soybeans into a rolled cover crop, was evaluated for yield and disease effects. In Iowa, in 2007, yields averaged 45 bu/acre in a rolled cover crop of hairy vetch/rye with no rust detected and other soybean diseases ranging from 0 to 2.3% of leaves infected.

2005/09/15 TO 2006/09/15 Impact: With the economic impact of ASR in organic systems ranging from \ \$30 to \ \$120 million in yield loss, this research has begun to identify potential strategies, such as copper-based fungicides and *Bacillus pumilis* for reducing loss in organic systems in the event of soybean rust. In areas where ASR has not yet arrived, methods of improving organic soybean systems, including reduced tillage and varietal selection for other soybean diseases can result in greater maintenance of soil quality and higher returns for farmers. Through the New Farm, New Ag Network, OrganicAgInfo and each institutions' organic websites, we have increased the knowledge base and skills of thousands of organic farmers across the U.S. in Asian soybean rust diagnostic and management tools.

PUBLICATIONS

2006/09/15 TO 2007/09/14 1. Bird, G. W. 2007. Correction: Asian Soybean Rust not found in Michigan in 2007. *The IPM Practitioner: Monitoring the Field of Pest Management* 29 (7/8):9. 2. Delate, K. 2007. Evaluation of Organic Soybean Rust Treatments for Organic Production. Neely-Kinyon Trial. 2007. Iowa State University Experiment Station Reports, Ames, IA: <http://www.ag.iastate.edu/farms/06reports/arm/EvalOrganicSoybean.pdf> 3. Grossman, J. 2007. ESA 2006 Annual Meeting Highlights 3rd Part: Organic Soy Fungicides. *The IPM Practitioner: Monitoring the Field of Pest Management* 29 (5/6):14. 4. Hepperly, P. 2007. Old Asian Soybean Rust research from many places holds valuable natural defense clues. *The Rodale Institute New Farm on-line journal*: http://www.newfarm.org/columns/research_paul/2007/0407/soybeanrust.shtml 5. Johnson, A.m., M. E. Whalon, D. R. Norton, W. W. Byran. 2006. Effect of organic fungicides on natural enemies in Michigan soybean production. *Proceedings of the 2006 Annual Meeting of the Entomological Society of America*. Abstr. D 0038.

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Partnering to Cultivate Organic Agriculture in Michigan and the Midwest

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| Accession No. | 0205007 |
| Subfile | CRIS |
| Project No. | MICL08370 |
| Agency | NIFA MICL |
| Project Type | OTHER GRANTS |
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| Contract / Grant No. | 2005-51300-02391 |
| Proposal No. | 2005-04473 |
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| Investigator(s) | Snapp, S. S.; Mutch, D. K.; Biernbaum, J. A.; Ngouajio, M.; Brewer, M.; Bingen, J. |
| Performing Institution | Plant, Soil and Microbial Science, MICHIGAN STATE UNIV, EAST LANSING, MICHIGAN 48824 |

NON-TECHNICAL SUMMARY

Midwest organic farmers are growing in number and there are many farmers interested in transitioning to organic. However, organic production faces unique problems, such as highly variable weather and limited market connections. This requires whole systems approaches and protocols that enhance resilience, and help farmers manage variable weather, nutrient availability and pests while at the same time developing new marketing approaches. This integrated project conducted in partnership with farmers focuses on developing knowledge and innovation around soil nutrition, quality and pest management for Midwest organic systems. Biological, systems based practices for organic production are linked to market research and facilitation. The knowledge generated guides the design and implementation of innovative educational activities to improve the viability and competitiveness of organic and transitioning farmers, from diverse backgrounds in Michigan and nearby states.

OBJECTIVES

Objective 1 is to provide support for organic and transitioning farmers through ecologically-based research that addresses farmer priorities, notably climatic variation, nutrient and pest management and building soil quality. Objective 2 is enhance research relevance through constructive, long-term partnerships among university researchers, extension agents, organic and transition organic growers, and non-profit food and farming groups to improve the competitiveness of diverse and multi-cultural organic growers of Michigan and the Midwest. Objective 3 is to develop and deliver a) up-to date and seasonal information for Upper Midwest organic and transitioning growers through conference calls and targeted articles published by the internet based New Agriculture Network and b) an organic curriculum at the MSU Student Organic Farm of short courses and on farm experience for new farmers with the short courses available for extension/outreach personnel and current farmers.

APPROACH

Integrated research and extension will be carried out through field crop and vegetable biological studies that link long-term trials and farmer-led research. These include: (i) A long-term trial at the Student Organic Farm on campus (vegetable systems) and Kellogg Biological Station (field crop systems), (ii) On-farm trials with transitioning growers (Initially, George McManus and Fred Leitz for vegetables and Peter Velguth and Matt Talladay for field crops, to be expanded over time to 8 growers), and (iii) On-farm trials with certified and experienced growers (Anthony Cinzori for vegetables and Gene Vogel for field crops). This participatory research approach will allow simultaneous testing of biological hypotheses along with recommendations that require testing at a larger scale, with practical equipment. To facilitate on-going learning of organic and transitioning farmers we will carry out a) an innovative internet-based biweekly forum of conference calls, the five-state New Agricultural Network, b) a series of roundtable forums, and c) organic courses developed as part of a complete experiential organic curriculum for a student operated 48 week CSA farm, we will facilitate co-learning and mentoring among researchers, extension personnel, crop consultants, and farmers from multicultural backgrounds. In addition to fostering knowledge and innovation around biologically-based organic technologies, our social scientists and cooperating organic farmer groups will focus on improving the competitiveness of organic farmers. The approach will be to facilitate efforts to take advantage of diverse marketing opportunities such as connecting feed to organic livestock producers and vegetables to produce wholesalers.

PROGRESS

2005/09 TO 2009/09 OUTPUTS: The organic partnership in Michigan and the Upper Midwest was initiated in the fall of 2005 with an advisory group of 15. Representatives of the advisory group included organic and transitioning farmers producing vegetables and field crops, extension staff, researchers, and the Michigan Dept. of Ag. Two long-term systems trials were started, one focused on organic pest management strategies and biodiversity in vegetable systems (East Lansing, MI initiated 2005), and the other on nutrient management and sustainable production systems for organic field crops (KBS, initiated 1997, new phase 2005). Technologies being tested in the vegetable East Lansing trial included tomato-cucumber sole crops and polycrops, and the use of row covers in different combinations to provide control of cucumber beetles. Organic soil management and cover crops at different rates, integrated with compost were evaluated in terms of field and vegetable crop growth and yield. Outreach activities included four organic field days with workshops on soil quality and market development, and seven field days reached 450 people. At two of the field days evaluations were conducted and seventy percent of participants said the information would change their farming practice. A biweekly conference call supported organic farmers and farmers interested in transitioning to organic. The call was linked to a website, the New Agriculture Network (NAN) which has had over 200,000 hits, and is linked to over a 100 sites. Farmers (15) participate regularly in NAN, including organic, transitioning field crop and vegetable producers across the upper Midwest; and 10 specialists and four state leaders. A new listserve was started as a sounding board and information exchange for organic farmers (see www.michiganorganic.msu.edu). Expanded educational programming for organic production was conducted at the Great Lakes Expo in 2006, 2007 and 2008. The key role of marketing channels as drivers of organic transition is recognized by this project, and was recently documented in a report, see (www.msu.edu/bingen/CommFoodAgPage.htm). An interview guide was developed and 29 farmers surveyed during two rounds of interviews. Results were discussed with growers and used to design retail and wholesale market surveys. Semi-structured telephone interviews with 112 fresh produce wholesalers and merchants with businesses in Michigan were carried out and qualitative analysis undertaken. The survey documented that the major challenges to intermediaries sourcing local and organic produce from Midwestern farms were the short and variable growing season, and the perceived high potential for pest damage. Supported by this project, curriculum for organic market gardening and a sustainable agriculture and food systems undergraduate specialization was approved. A participatory learning approach with farm visits and experiential internships provide hands on experience. This complements a curriculum that presents organic farming principles and Organic certification training materials were developed, presented and farmers are using this information to certify their ground. PARTICIPANTS: Sieg Snapp - Coordinator of the project. Dale Mutch - Lead on Field Crop research and extension supporting organic and transitioning farmers Mathieu Ngouajio- Lead on Vegetable research supporting organic farmers Vicki Morrone - Lead extension educator for organic vegetable and field crop farmers John Biernbaum - Lead on teaching organic curriculum Jim Bingen - Lead on organic farmer marketing systems TARGET AUDIENCES: Transitioning and certified organic farmers in Michigan and the upper Midwest, and educators that serve this audience PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2007/09/15 TO 2008/09/14 OUTPUTS: The organic partnership in Michigan and the Upper Midwest has grown rapidly since initiated in the fall of 2005 with an advisory group of 15. Representatives of the advisory group

include organic and transitioning farmers producing vegetables and field crops, extension staff, researchers, and the Michigan Dept. of Ag. Two long-term systems trials were started, one focuses on organic pest management strategies and biodiversity in vegetable systems (East Lansing, MI initiated 2005), and the other on nutrient management and sustainable production systems for organic field crops (KBS, SW MI initiated 1997, new phase 2005). Technologies being tested in the vegetable trial include tomato-cucumber sole crops and polycrops, and the use of row covers in different combinations to provide control of cucumber beetles. Organic soil management and cover crops at different rates, integrated with compost are being evaluated in terms of field and vegetable crop growth and yield. Outreach activities so far have included four organic field days with workshops on soil quality and market development, and seven field days reached 450 people. At two of the field days evaluations were conducted and seventy percent of participants said the information would change their farming practice. A biweekly conference call supporting organic farmers transitioning is linked to a website, the New Agriculture Network (NAN) with 100,000+ hits, further linked to over a 100 sites. Farmers (15) participate regularly including organic, transitioning field crop and vegetable producers and 10 specialists. A new listserve was started as a sounding board and information exchange for organic farmers (see www.michiganorganic.msu.edu). Expanded educational programming for organic production was conducted at the Great Lakes Expo in 2006, 2007 and 2008. Marketing channels as drivers of organic transition were documented in a report on a survey of 29 farmers, and subsequent interviews documenting market perspectives. Results were discussed with growers and used to design retail and wholesale market surveys. Semi-structured telephone interviews conducted with 112 fresh produce wholesalers and merchants. Supporting project hypotheses about risk factors, the survey documented that the major challenges to intermediaries sourcing local and organic produce from Midwestern farms were the short and variable growing season, and perceived high potential for pest damage. A barrier is that some larger-scale producers do not accept organic as a viable alternative. Students are signing up with enthusiasm and a new generation of organic farmers is being nurtured by our project through a new Organic Farming certificate program in the department of Horticulture at MSU. Supported by this project, the curriculum was approved, and the program initiated with 7 full time students in 2007 and 12 in 2008. Participatory learning addresses organic farming principles and practice, and unique courses such as marketing, greenhouse organic production and the experiential Study A Farm. Further, organic certification training materials were developed and farmers are using this information to certify ground. PARTICIPANTS: Participants in the project beyond the team of researchers and extension educators listed above, guided by farmer input and representatives from the following groups. Great Lakes Fruits, Vegetables, and Farm Marketing EXPO in Grand Rapids Michigan. Michigan's Organic Research Reporting Session, Michigan Organic Conference, MOFFA Organic & Alternative Vegetable Farming Workshops through MSU Extension Vegetable and Field Crop AoE Team members at MSU Land O'Lakes Herbuck Organic Poultry Production, Grand Rapids, MI MOSES Organic Farming Conference, LaCrosse Wisconsin TARGET AUDIENCES: Nothing significant to report during this reporting period. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2006/09/15 TO 2007/09/14 OUTPUTS: The organic partnership for Michigan and the Upper Midwest is growing rapidly in the second year of the grant. An advisory group of 15 is meeting frequently to plan and oversee activities, with representatives from organic and transitioning farmers, extension staff, researchers, and the Michigan Dept. of Ag. Long-term systems trials focus on organic pest management strategies and biodiversity in vegetable systems (East Lansing, MI initiated 2005), and nutrient management and sustainable production in organic field crops (KBS, SW MI initiated 1997, new phase 2005). The intercrops and row covers when combined provide control of cucumber beetles, while organic soil management and cover crops promote crop growth and yield. Outreach activities included two organic field days with workshops on soil quality and market development, and six field days reached 325 people. Seventy percent of participants said the information would change their farming practice. A biweekly conference call supporting organic farmers transitioning is linked to a website, the New Agriculture Network (NAN) with 100,000+ hits, now linked to 90 sites. Farmers (15) participated regularly in NAN, including organic, transitioning field crop and vegetable producers across the upper Midwest; and 10 specialists and four state leaders. A new listserv was started as a sounding board and information exchange. Expanded educational programming for organic production was conducted at the Great Lakes Expo in 2006 and 2007. The key role of marketing channels as drivers of organic transition is recognized by this project. An interview guide was developed and 29 farmers surveyed during two rounds of interviews. Results were discussed with growers and used to design retail and wholesale market surveys. Semi-structured telephone interviews with 112 fresh produce wholesalers and merchants with businesses in Michigan were carried out and qualitative analysis undertaken. Supporting project hypotheses about risk factors, the survey documented that the major challenges to intermediaries sourcing local and organic produce from Midwestern farms were the short and variable growing season, and the perceived high potential for pest damage. Further, many larger-scale producers still do not accept organic as a viable alternative that could enhance their livelihoods. Despite the marketing challenges organic production faces, students are signing up with enthusiasm and a new generation of organic farmers is being nurtured by our project through a new Organic Farming certificate program in the department of

Horticulture at MSU. Supported by this project, the curriculum was approved, and the program initiated with 7 full time students in 2007 and 15 enrolled for 2008. Participatory learning addresses organic farming principles and practice, and unique courses such as passive solar greenhouse organic production and the experiential Study A Farm. Further, organic certification training materials were developed and farmers are using this information to certify ground. PARTICIPANTS: Graduate and post-graduate training has been conducted as part of this project, including support for two thesis and one post-doc in organic vegetable production. Extension educators have participated in training about organic certification sponsored by this project. Jim Bingen (Professor, lead on the marketing component) visited organic research and extension projects in Eastern Europe, providing new perspectives to our organic partners team. TARGET AUDIENCES: Six field days were conducted, reaching 325 people. A survey documented that seventy percent of participants said the information would change their farming practices in the future. The New Ag Network (NAN) has 92 sites linking to the web page and 352 people subscribed to the listserve. Over the past four years 190 articles on organic agriculture and management practices for alternative farmers of the upper Midwest have been published. Twenty presentations have been made on project findings by organic partners at Michigan and Upper Midwest farm conferences, including the Great Lakes Expo where organic programming has been markedly expanded

2005/09/15 TO 2006/09/15 The organic partnership for Michigan and the Upper Midwest has started strong, with considerable progress in the first year of the grant. An advisory group was formed of farmers (vegetable and field crop, transitioning and certified), extension staff, researchers, a representative of the Michigan Department of Agriculture and a produce marketer. The group met three times to develop priorities, plan activities and review progress. The four project areas were developed in a participatory manner: organic research on vegetable and field crops, curriculum, marketing and outreach. To support current organic farmers, two long-term research trials are underway on the East Lansing farms and at the W.K. Kellogg Biological station. The research trials focus on organic pest management strategies and biodiversity in vegetable systems (initiated 2005), and nutrient management and productivity in field crop systems (initiated 2000). Nematodes, cucumber beetles and aphid dynamics were monitored in soybeans, cucumbers and tomatoes, to improve understanding of organic integrated pest management strategies. Soil nutrient dynamics, organic input management and transitioning strategies were evaluated in row crops. Outreach activities include three farm tours with over 100 people and over 60,000 hits to the New Agriculture Network (NAN) website. The NAN website is linked to biweekly conference calls with participants from 4 states and seeks to integrate on-farm concerns to research and extension. Farmers (15) participated regularly in NAN, including organic, transitioning field crop and vegetable producers; 10 specialists and four state leaders were on each call. A new listserv was started as a sounding board and information exchange for organic farmers, educators, researchers, and those considering transitioning to organic. An organic soil and market building field day with workshops involved over 90 farmers and agricultural entrepreneurs through a collaborative effort of MSU and family businesses that produce compost and sell farming equipment. Expanded educational programming for organic production will be conducted at the Great Lakes Fruit, Vegetable and Farm Market 2006 Expo. The key role of marketing channels as drivers of organic transition is recognized by this project. An interview guide was developed and 29 farmers surveyed in-depth; results will be discussed with growers and are being used to design retail and wholesale market surveys. The next generation of organic farmers is nurtured by this project through a new Organic Farming certificate program in the department of Horticulture. The curriculum for the program was revised and approved at MSU, supported by a project-sponsored academic specialist for curriculum development. Ten students have been accepted to date in this new program. Participatory learning is integrated in the program, which includes organic farming principles and practice, and unique courses such as passive solar greenhouse organic production. Organic certification was supported by the project through development of training materials, and farmers are using this information to certify ground for the first time.

IMPACT

2005/09 TO 2009/09 There are unique challenges to growing and marketing organic in the Midwest, where a risky climate and undeveloped markets act as barriers. Our interdisciplinary project involved social and biological dimensions of organic production and supported new farmers certifying as organic. The project provided expanded educational programs at MSU in organic market gardening and farming. A new organic research reporting session was initiated in conjunction with the Michigan Organic Conference held each spring, where over twenty faculty and extension educators and two farmers have presented, with about 75 attendees each year. Sixteen students graduated from the new organic certificate program at MSU. In addition trainings were conducted on certification - which means that more farmers are starting the organic transition process. We documented barriers to intermediaries sourcing local and organic produce from Midwestern farms (short and

variable growing season, and the perceived high potential for pest damage), while developing innovative organic production approaches to address these challenges. We found that biodiversity can provide buffered, pest-resilience, including organic polyculture (intercropped tomatoes and cumpers), row covers and judicious combinations of compost and cover in soybean row crop systems to address weed and nutrient limitations. Overall our team approach is helping Michigan farms stay economically viable, with more organic production to supply organic markets throughout the Midwest, and these in turn will provide more opportunities for farmers. Forty presentations have been made on project findings at Michigan, Midwest (Illinois, Iowa and Ohio) and Upper Midwest farm conferences, including the MOSES Organic Farming Conference in LaCrosse Wisconsin, and the Great Lakes Expo where organic programming has been markedly expanded. **PUBLICATIONS (not previously reported):** 2005/09 TO 2009/09 1. Bird, G. W., M. Grieshop, P. Hepperly and J. Moyer. 2009. Climbing Mt. Organic: An Ecosystem Approach to Pest Management (pp. 191-208) in Organic Farming: The Ecological System, C. Francis (ed). Agronomy Monograph No. 54. ASA/CSSA/SSA/ASF Publishing. Madison, WI. 353 pp. 2. Martinez, L., Jim Bingen, David Conner. 2009. Handlers Perspectives on Sourcing Organic Produce from Michigan and the Great Lakes Region. Choices. 24:3. <http://www.choicesmagazine.org/magazine/article.phparticle=88>. 3. Martinez, L. David Conner, Jim Bingen. 2009. Great Lakes Organic Produce in Wholesale and Retail Grocery Markets: Opportunities and Challenges from Michigan. Journal of Food Distribution Research. 15,1: 118-122. 4. Morrone, V.L. 2009. Transitioning to Certified Organic in Michigan: Where to start MSU Extension Bulletin 3067 5. Osborne, C.. 2009. Getting to Organic: Profiles of How Michigan Farmers Made Their Transition to Organic Agriculture. Michigan Organic Food and Farming Association (MOFFA). August 2008. Working paper. 6. Nair, A. and M. Ngouajio. 2009. Cover Crop, Nutrient Amendment, and Crop Cultivar Affect Organic Cucumber and Tomato Production Systems in the Great Lakes Region. HortScience 44:1039-1040. Abstract

2007/09/15 TO 2008/09/14 There are unique challenges to growing and marketing organic in the Midwest, where a risky climate and undeveloped markets act as barriers. Integrated development in four project areas addresses the social and biological dimensions of supporting organic production and farmers, including greatly expanded educational programs at MSU. A new organic research reporting session has been initiated in conjunction with the Michigan Organic Conference held each spring, twenty faculty and extension educators and two farmers presented, with about 75 attendees. Twenty-two students have graduated from the new organic certificate program at MSU, and 13 courses have been developed which are used for farmer training and curriculum. Four farmers have transitioned towards to organic certification for tomato, cucumber and vegetable production working with the project, and 40 trainings were conducted on certification, marketing and organic greenhouse production - which means that more farmers are starting the organic transition process. We documented barriers to intermediaries sourcing local and organic produce from Midwestern farms (short and variable growing season, and the perceived high potential for pest damage), while developing innovative organic production approaches to address these challenges. We found that biodiversity can provide buffered, pest-resilience, including organic polyculture (intercropped tomatoes and cumpers), row covers and judicious combinations of compost and cover in soybean row crop systems to address weed and nutrient limitations. Overall our team approach is helping Michigan farms stay economically viable, with more organic production to supply organic markets throughout the Midwest, and these in turn will provide more opportunities for farmers. Forty presentations have been made on project findings at Michigan, Midwest (Illinois, Iowa and Ohio) and Upper Midwest farm conferences, including the MOSES Organic Farming Conference in LaCrosse Wisconsin, and the Great Lakes Expo where organic programming has been markedly expanded.

2006/09/15 TO 2007/09/14 There are unique challenges to growing and marketing organic in the Midwest, where a risky climate and undeveloped markets act as barriers. Integrated development in four project areas addresses the social and biological dimensions of developing appropriate risk mitigation systems and educational programs. Seven students have graduated from the organic certificate program at MSU, and in addition four new farmers transitioned towards to organic certification for tomato, cucumber and vegetable production working with the project, and trainings were conducted on certification - which means that more farmers are starting the organic transition process. We documented barriers to intermediaries sourcing local and organic produce from Midwestern farms (short and variable growing season, and the perceived high potential for pest damage), while developing innovative organic production approaches to address these challenges. We found that biodiversity can provide buffered, pest-resilience, including organic polyculture (intercropped tomatoes and cumpers), row covers and judicious combinations of compost and cover in soybean row crop systems to address weed and nutrient limitations. Overall our team approach is helping Michigan farms stay economically viable, with more organic production to supply organic markets throughout the Midwest, and these in turn will provide more opportunities for farmers.

2005/09/15 TO 2006/09/15 There are unique challenges to growing and marketing organic in the Midwest. Integrated development in four project areas addresses the social and biological dimensions of developing new organic systems. This includes organic production research, farming curriculum, marketing channel analysis and innovative outreach. During the project's first year, six new acres of organic certified ground for tomato and cucumber production on two farms were established, and with new certification training materials more farmers are starting the transition process. This means that more Michigan farms will stay economically viable, more organic production will supply expanding organic markets throughout the Midwest, and these in turn will provide more opportunities for farmers. Outreach activities included a field day with workshops on soil quality and market development, and three farm tours reaching over 200 people. Over 60,000 hits occurred at the New Agriculture Network (NAN) website in 2006. This project-supported site links together farmers, educators and researchers from four Upper Midwest states to support organic and sustainable farmers of field crops and vegetables. The next generation of organic farmers is also being supported through the approval by Michigan State University of a new Organic Farming certificate program in the department of Horticulture. Ten students have already been accepted into the program which will start in 2007.

PUBLICATIONS

2007/09/15 TO 2008/09/14 1. Nair, A., M. Ngouajio, and J. Biernbaum. 2008. Characterizing the Contribution of Bradfield Organics (Tasty Tomato TM 3-3-3) in Growing Media for Organic Transplant Production of Tomato. Research Report presented to Land O'Lakes Purina Feed, LLC 22P. 2. Snapp, S.S. and B. Pound Eds. 2008. Agricultural Systems: Agroecology and Rural Innovation for Development. Academic Press. 380 pp. 3. Mutch, D. S.A. Thalman, T. Martin and D. Baas. 2008 Flaming as a Method of Weed Control in Organic Farming Systems MSU Extension bulletin E-3038 <http://www.emdc.msue.msu.edu/Bulletin/PDF/E3038.pdf> 4. Baributsa, D N, E F Foster, K D Thelen, D. Mutch and M. Ngouajio. 2008. Corn and Cover Crop Response to Corn Density in an Interseeding System. Agron J 100, no. 4: 981-987. 5. Bingen, Jim, Carol Osborne, Emily Reardon. 2007. Organic Agriculture in Michigan. 2006 Survey Report. East Lansing: MSU and MOFFA. <https://www.msu.edu/~bingen/CommFoodAgPage.htm> 6. Morrone, V.L. 2008. Transitioning to Certified Organic in Michigan: Where to start MSU Extension Bulletin 3067

2006/09/15 TO 2007/09/14 1. Mutch, D.R., Thalman, S.A., Martin, T.E. and Baas, D.G. 2007. Flaming as a method of weed control in organic farming systems. MSUE Bulletin 2. Bingen, J., Osborne, C. and Reardon, E. 2007. Organic agriculture in Michigan. 2006 Survey Report. East Lansing, MI. Michigan State University and MOFFA. 3. DeLind, L.B. and Bingen, J. 2007. Be careful what you wish for: Democratic challenges and political opportunities for the Michigan organic community. Culture and Agriculture 27:131-143.

2005/09/15 TO 2006/09/15 No publications reported this period

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Improving Organic Farming Systems Across Nebraska Agroecoregions

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| Accession No. | 0204958 |
| Subfile | CRIS |
| Project No. | NEB-42-031 |
| Agency | NIFA NEB |
| Project Type | OTHER GRANTS |
| Project Status | TERMINATED |
| Contract / Grant No. | 2005-51300-02374 |
| Proposal No. | 2005-04497 |
| Start Date | 15 SEP 2005 |
| Term Date | 31 AUG 2010 |
| Fiscal Year | 2009 |
| Grant Amount | \$762,949 |
| Grant Year | 2005 |
| Investigator(s) | Shapiro, C. A.; Brandle, J. R.; Francis, C. A.; Knezevic, S. Z.; Lyon, D. J.; Wright, R. J.; Johnson, R. J. |
| Performing Institution | NORTHEAST RES & EXTENSION CNTR, UNIVERSITY OF NEBRASKA, LINCOLN, NEBRASKA 68583 |

NON-TECHNICAL SUMMARY

The organic farming community needs research based solutions to their production problems and the educational efforts by the University of Nebraska need to include organic farming concepts in its curriculum. This project seeks to establish a land base to conduct research to solve the agronomic and pest problems found on organic farms. The project also seeks to establish an index to evaluate the impact of farming methods on wildlife. Specific technical solutions will be developed to improve variety selection and weed control in organic production systems. The outcome of this project should include organic farming education in resident instruction and extension offerings.

OBJECTIVES

1. Create a network of organically, certified areas at four research farms: We will certify land at four major research stations, and work with cooperating farmers to identify key issues that must be addressed to increase productivity. We will also develop methods to quickly assess environmental concerns using indicators of wildlife diversity.
2. Improve organic production through focused research: Three sub-objectives will address the most pressing production problems in the four agroecozones where University of Nebraska currently conducts field research.
 - a. Evaluate crop cultivars for adaptation to organic production systems, through the use of selection criteria, screening techniques, and final testing procedures for cultivars in organic systems.
 - b. Develop enhanced organic methods for weed management, especially during the conversion from conventional to organic crop production, to address one of the most critical concerns voiced by organic farmers.
 - c. Test alternative crops, management options, and soil fertility strategies for organic production systems across the state, including the evaluation of available organic products such as bio-stimulants, and disease and insect control treatments.
3. Extend results to farmers, stakeholders, life-long learners and institutionalize organic farming principles in

resident instruction. These activities will improve research procedures, integrate results from organic farming research into classroom teaching, and move results quickly to field demonstrations and publications that are available to farmers. a. Integrate results from on-station and on-farm organic research into classroom teaching programs, and enhance classroom education programs to extend principles and practical knowledge to students and help them envision future systems that are different from current, conventional agriculture. b. Summarize and demonstrate results in the field through producer participation and guidance to Cooperative Extension and their statewide offices, programs, and publications.

APPROACH

Four certified organic areas of about 25 acres each will be established at four Research Centers. A committee of faculty, organic farmers, and representatives from the certifying agency (OCIA) will plan the transition practices. A farmer advisory group will help develop research that addresses the most pressing production challenges facing organic producers in Nebraska. The transition and certification process will be documented for use in future educational programs. Each research center will address specific transitional issues that take into consideration their resource base. At the Centers and on cooperating farms, we will collect and analyze data on target biota, using field, farm, and landscape scales and including measures of soil, vegetation, invertebrate, and vertebrate (birds initially) life forms in order to develop indexes of non-crop impacts on organic farms. Data will be analyzed using an information-theoretic approach suited to comparisons of habitat variables to bird field data. These analyses are expected to identify the more important habitat components at field, farm, and landscape scales for sustaining bird populations on the study farms, and will allow us to provide management options to benefit desirable bird populations in relation to other farm goals. Development of selection criteria, screening techniques and improved germplasm for organic systems will use variety testing to determine traits critical to plant competitive success under organic production. Cultivars will be solicited that meet organic standards. End users of organic products will advise on their needs so that the trials are relevant to an evolving market. Development of enhanced organic methods for weed management will be achieved by rotations of cover crops with economic crops, summer and winter crop sequences, innovative technologies such as flame weeding, controlled fallow, and planting alternative crops. Visual rating of weed species composition and overall density will be reported at each site. Results from on-station and on-farm organic research will be integrated into classroom teaching programs, and enhance classroom education programs to extend principles and practical knowledge to students and help them envision future systems that are different from current, conventional agriculture. The important aspect for students is to challenge their beliefs about how to raise present crops, prepare them to try new crops and practices. Demonstration of results in the field and incorporation of information into extension programs will be achieved by integration of results and recommendations into the presentations and publications offered by the University of Nebraska. A 4-H project on healthy land and food will be developed to reach both youth and adults through the present Extension educator network. The economic evaluation of organic crop productions will be evaluated in two parts. First, costs of production will be evaluated using standard enterprise budget methodology. Second, the market opportunities for these organic crops will be explored.

PROGRESS

2005/09 TO 2010/08 OUTPUTS: Crop research land was transitioned to organic and certified at four UNL sites: Agricultural Research and Development Center near Mead-45 acres; Haskell Agricultural Laboratory near Concord-25 acres; South Central Agricultural Laboratory near Clay Center-17 acres; and High Plains Agricultural Laboratory near Sidney-76 acres. Farmer advisory groups were formed for each site to identify key research issues to help establish organic cropping systems and increase productivity. Their recommendations were not uniform because of the unique nature of each site, as intended in order to fit the existing environment and agroecoregion. Research included: soil fertility strategies and fertility amendments; weed management, including flaming weed control; crop establishment and management options and cover crops; crop cultivar evaluation and crop breeding trials for corn, soybeans and wheat in organic systems; alternative crop testing; and identify future organic farming research needs. A Healthy Farm Index (HFI) was developed based on data collected on cooperating organic farms through research, feedback from farmer advisory groups, evidence of beneficial organic farming practices, and satisfactory farm productivity and income. The HFI provides a mechanism for integrating and communicating interdisciplinary data toward farm practices and policy that optimize food production, biodiversity, and ecosystem services, and can be used to guide the decision making process in such a way that the multiple goals of the farmer and society are included. Organic research results were extended to farmers, stakeholders, life-long learners and students in resident instruction courses. Field days were held at the research sites and on cooperating organic farms (2008-30 attendees, 2009-57 attendees) involving researchers, extension personnel, organic and conventional farmers, consumers and students, and organizations such as

Nebraska Sustainable Agriculture Society and OCIA Nebraska Chapters 1 & 2. Presentations at conferences/meetings& number of attendees: UNL/NSAS "Healthy Farm-Rural Advantage Conference 2008-15, 2009-20; 2007 Natural Livestock Marketing-36; 2008 Grow Your Own Nitrogen-53, Biological Control of Insects-20, Sustainable Crops & Livestock Systems-45; 2009 Organic Wheat Conference-53, Western Sustainable Ag Crops & Livestock-82. The project coordinator created a video presentation on transitioning to organic, and conducted workshops, presentations and gave information packets on organic production practices, cover crops, biological insect control, and the Healthy Farm Index to NRCS staff, farmers, students and others, and presented at state, regional and national conferences. Extension personnel gave presentations to high school vocational agriculture teachers. Researchers conducted outreach programs on flaming for weed control to conventional and organic farmers and on organic soil fertility at crop production clinics. The UNL Organic Work Group developed a web site, and created electronic service accounts on Facebook and Twitter to disseminate organic research news. An internal listserv goes to 38 grant decision-makers. PARTICIPANTS: Individuals: PIs: Project Director-Charles Shapiro; Co-Project Directors-James Brandle, David Baltensperger, Charles Francis, Ron Johnson, Stevan Knezevic, Drew Lyon, Robert Wright; Project Coordinator/Ext. Educator-Elizabeth Sarno; Technical Staff: Mike Cieslik, Logan Dana, Vernon Florke, Ryan Gerloff, Mike Mainz, Tom Nightingale, J. E. Scott, Richard Zbasnik. Partner Organizations: Center for Rural Affairs-Lyons, The Grain Place-Marquette, Nebr. Indian Community College-Macy, Nebr. NRCS-Lincoln, Nebr. Sustainable Agriculture Society-Hartington, OCIA Nebr. Chapter 1-Lincoln, OCIA Nebr. Chapter 2-Dalton, OCIA Research and Education-Lincoln. Collaborators: UNL: Bruce Anderson-Forage Specialist, Timothy Arkebauer-Crop Physiology, Stephen Baenziger-Small Grains Breeding, Aaron Berger-Ext. Educator, Erin Blankenship-Statistics, Paul Burgener-Ext. Ag Economics, Karen DeBoer, Ext. Educator, Terry Devries-Rsch. Analyst, Richard Ferguson-Soil Fertility, Loren Giesler-Plant Pathology, George Gogos-Mechanical Engineering, Robert Harveson-Plant Pathology, DeLynn Hay-Coop Ext., Gary Hein-Entomology, Gary Hergert-Soil Science, Thomas Hunt-Ext. Entomology, Georgia Jones-Nutrition & Food Literacy, James Kalisch-Ext. Entomology, Robert Klein-Ext. Cropping Systems, James Krall-Crops Specialist, Gary Lesoing-Ext. Educator, SARE Coordinator, NE, Richard Little-Small Grains Breeding, Lenis Nelson-Crop Variety Testing, Alexander Pavlista-Plant Physiology, Jim Peterson-Nebr. SARE, Paul Read-Specialty Crops, Teshome Regassa-Biological Systems Engineering, Ivan Rush- Animal Science, Dipak Santra-Alternative Crops Breeding, Ken Russell-Nebr. Tech Ag College, Vicki Schlegel-Food Science & Technology, Jerry Volesky-Forage Specialist, Stephen Wegulo-Plant Pathology, Roger Wilson-Ag Economics, Charles Wortmann-Soil Science; U.S.: James Krall-Crops Specialist-U.WY, Erin Taylor-Weed Flaming, MI State U.; International: Sidnel Cavaliere-Sao Paulo State U., Brazil, Mario Lesnik-U. Maribor, Slovenia, Goran Malidza, Inst. Field & Vegetable Crops, Serbia; Organic Farmers: Ken Brauer, Dennis Demmel, Ken Disney, Rick Gubbels, Todd Halle, Mike Heimes, Mike Herman, Marva Holt-OCIA#2, Paul Huenfeld, Mark Jones, Martin Kleinschmit, Tom Larson, Doug Lockwood, Rich Mazour, Terry Mosel, Tim Nissen, Joe Roberts, Paul Rohrbaugh, Larry Stanislav, Joel Starr, Paul Swanson, Mike Tiensvold; Others: Steve Chick-NRCS, Tami Highstreet-OCIA#1, Henry Hank Miller-NICC, Angie Tunink-OCIA R&E, David Vetter-The Grain Place. Professional Development: Post-Docs: Avishek Datta-Weed Flaming, Peter Skelton-Resident Instruction; Ph.D. Candidates: Christopher Bruening-Weed Flaming, John Quinn-Healthy Farm Index, Santiago Ulloa-Weed Flaming; UNL Grad & Undergrad Students: Danielle Ahrens, Ashley Colglazier, Jared Miller, Brian Neilson, Justin Van Wart; International Students: Claudio Costa-Brazil, Andre Domingues-Brazil, Robert Leskovsek-Slovenia, Jaime Neto-Brazil, Heverton Teixeira-Brazil. TARGET AUDIENCES: Organic, transitioning and conventional farmers, organic and conventional production researchers, college agricultural faculty, extension personnel and crop advisors, agriculture research technician staff, university, community college and high school students, community college faculty, high school vocational agriculture teachers, Natural Resources Conservation Service staff, Natural Resources Districts, Nebraska Game and Parks, county weed control personnel, consumers and consumer groups, agriculture product suppliers, grain buyers and processors, non-profit groups such as OCIA International, Nebraska Sustainable Agriculture Society and the Center for Rural Affairs, news media and the general public. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2008/09/15 TO 2009/09/14 OUTPUTS: Final year of avian and vegetation sampling completed on the 27 participating organic farms. Discussions on the Healthy Farm Index held with local NRCS office. A mail survey was distributed to the organic farmers in the state as part of the Healthy Farm Index and the larger organic effort. Organic website is now better linked with the University Cropwatch page allowing results to reach a broader audience. Improved website that includes a section for farmer feedback and research suggestions. Establishment of Facebook and Twitter accounts, broadening our outreach efforts. Studies at the South Central Ag Laboratory focused on the performance of a corn-soybeans-winter wheat-corn-alfalfa-corn rotation on certified organic land. A hairy vetch cover crop/green manure was added after wheat harvest in 2008, and in 2009 corn after hairy vetch had significantly fewer weeds. An additional 7 acre strip to the north of the certified organic plots uses the same rotation and is in the second year of transition. At the HPAL, the third year of certified organic winter wheat and proso millet were harvested. Dry peas were grown and disked under in July prior to winter wheat seeding in

September. Winter wheat and proso millet variety trials continued to be conducted in 2009. Three organic wheat nurseries (F6, F7, and F8 generations) were also tested at the HPAL as part of a USDA-funded project on winter wheat variety development for organic systems and promising materials are being advanced for further evaluation. Also as part of the wheat variety development project, the first year of an organic fertility trial was completed in 2009 and the second year of the study was initiated. Beginning in 2010 and continuing through 2012, sunflowers will replace proso millet in the rotation and composted cattle manure applied in fallow will replace the dry pea green manure at the HPAL. At the Haskell Ag Lab two trials that featured winter wheat were partially completed. One focused on determining the effect of manure rate and timing, previous crop of alfalfa or corn and top dressing nitrogen on wheat late in the season. Manure increased winter wheat yields, but alfalfa as a previous crop did not increase yields. This was due to incomplete kill of the alfalfa, and the competitive effect of alfalfa for moisture and other nutrients with the winter wheat. Top dressing nitrogen late in the season had a slight effect on grain protein, less than 0.5 %. In a cover crop trial, several cover crops were grown before corn and soybeans. The cover crops were killed by winter cold, flaming, crimping or disking. For both soybeans and corn, following cover crops that winter killed produced the highest yields, followed by cover crops killed by spring disking. Cover crops killed by winter cold weather were berseem clover, soybean, sudangrass, buckwheat, and oats. The other cover crops were rye, hairy vetch, triticale, red-yellow clover mix and a control. The roller crimper corn yields were 36% of the winter kill corn, and 70% of the winter kill soybeans. These yield losses were due to later planting, incomplete cover crop kill, and subsequent competition for moisture. PARTICIPANTS: Nebraska Sustainable Agriculture Society Organic Crop Improvement Association TARGET AUDIENCES: Emphasis has been on providing educational experiences for organic producers, and for agronomists and crop advisors who work with this clientele. Field days at research sites and at farmer fields are used to show the varied skills needed to farm organically. PROJECT MODIFICATIONS: Not relevant to this project.

2007/09/15 TO 2008/09/14 OUTPUTS: At ARDC, a 4-year study of corn hybrids and soybean varieties from the Blue River Seed Company to assess the genotype by system interaction and determine if specific cultivars are needed for organic systems was completed. Results show similar rankings in organic and conventional dryland systems. This suggests that cultivars developed in conventional systems are likely to do well when tested in organic systems. Organic regulations require that seed be produced under certified organic conditions. Also at ARDC, 32 acres were certified and winter wheat (16 ac) was harvested and sold. Certified soybeans were harvested (16 ac). Corn on ground in the final year of transition was harvested and sold. These acres will be certified in the spring. Cover crops were planted (soybean and berseem clover); dairy manure was used as the control. A preliminary study on additional cover crops (cow peas, winter peas, vetch, soybean, and berseem clover) was planted. At the HPAL, the second year of certified organic winter wheat and proso millet was harvested. Both will be marketed for the first time as organic grain. Winter wheat and proso millet variety trials continue to be conducted. The first organic fertility trial using dry pea as a green manure, composted manure, and Crystal Springs 10-0-0 was initiated in 2008. A 17 acre irrigated block at SCAL is in the third year of organic transition. The rotational system includes corn, soybeans, winter wheat and alfalfa. In 2008, small-plot replicated variety trials for wheat and soybeans were conducted. At HAL, in addition to organic certification to be completed in 2008, a propane flaming experiment was conducted to determine the responses of corn and soybean to broadcast flaming at 6 propane rates. Five-leaf corn (V5, plant height 25 cm) and V3 soybean (plant height 8 cm) were flamed with 0, 12, 31, 48, 69 and 87 kg propane/ha. Crop response was described by logistic models. Soybean was more susceptible to propane flaming than corn; 20% injury was achieved with 21 kg/ha in soybean compared with 46 kg/ha in corn. Dose response curves of propane for soybean were similar among evaluation dates. Propane dose(ED) causing injury levels of 5% (ED5), 10% (ED10) and 20% (ED20) 3 hours after treatment were 11, 13, and 17 kg propane/ha, respectively. These rates did not change over time. Dose response curves were different over time for corn. The ED20 values for 3 hours, 7, and 14 days after treatment were 14, 22, and 46 kg/ha, respectively, suggesting that the corn crop was able to recover after flaming. This is likely because the growing point at time of flaming was below the ground level and thus remained unaffected. Broadcast flaming for weed control has more potential for use in corn than soybean. Progress on the Healthy Farm Index continued with collection of avian, insect, and vegetation data on 17 more farms across Nebraska's four agroecoregions. During 2008, 102 bird species were observed. Twelve indicators have been selected for the index and development of other indicators. Funding was obtained to survey participating farmers and other organic farmers in the state. PARTICIPANTS: Natural Resources Conservation Service, Weed Control Authority, Organic Crop Improvement Association, Nebraska Sustainable Agricultural Society, NC-SARE, Several Water Workshops for K-12 students, All PIs remain the same. TARGET AUDIENCES: Covered in previous sections PROJECT MODIFICATIONS: Not relevant to this project.

2006/09/15 TO 2007/09/14 OUTPUTS: Research: At South Central Agricultural Laboratory, Clay Center, 2nd year of conversion, replicated cropping systems trials were begun at this irrigated 17 acre site. The site will

compare a three year and four year rotation with four replications. Agricultural Research and Development Center - Mead, 2nd year of conversion. Forty-five acres will be available when the conversion is complete, all of which are protected by mature shelterbelts. Farm rotation: corn, soybeans and winter wheat rotation, with clovers and dairy manure as plow-down. Haskell Agricultural Laboratory - Concord, 2nd year of conversion. Twenty-five acres of farm ground in oats/alfalfa, corn, soybeans, and oats/clovers were planted and harvested. Cattle were fall grazed for approximately four weeks to clean up residue and to utilize forage in terraces. Weed flaming study to develop response curves for propane \based on usage rate (gal/acre)\ needed for safe and economical weed control. High Plains Agricultural Laboratory - Sidney, 76 acres of land is NOP certified by OCIA International. The 1st certified organic crops were harvested: winter wheat and proso millet. A green manure crop of dry pea was plowed down at flowering in the summer fallow field and the field seeded to winter wheat in early September. Healthy Farm Index Project. Initial sampling in May, for the Healthy Farm Index commenced. Measures of avian, vegetation, and insect diversity were collected at nineteen organic farms within the state's four agroecozones. Landcover classes are being delineated to facilitate analysis of potential relationships between land use and avian abundance and diversity. Field level vegetation patterns are being analyzed for a finer scale analysis of relationship between vegetation and avian diversity. A microscope has been purchased with funds from a companion grant to aid in the identification of collected insects. At each farm we talked with farmers, discussed the overall project, development of the index, and birds seen on their farm. The response from farmers was very positive. Teaching: Resident Instruction: Natural Resources 211, Introduction to Conservation Biology with information on organic and sustainable farming. Field Days: ARDC, HAL and HPAL, organic farms near Lodgepole, Sidney, and Marquette. Workshops: Integrated Weed Management Workshop, Dr. Knezevic, "Organic and Natural Livestock Marketing" Information Meeting. Organic Farmer Advisory groups were formed at each research site to discuss issues. Priority research areas were identified. Liz Sarno, extension educator consulted individual farmers considering organic production, trained farm technicians working on the project. Collaborations: Propane Research and Education Council -Nebraska Propane Association Grant, Dr. Knezevic research on flaming to control weeds in an organic system. Outreach: Several talks to general public and HS students about organic farming, marketing, livestock production and gardening and careers in organic agriculture. Website: UNL organic website: <http://organic.unl.edu/> PARTICIPANTS: Graduate Student- Santiago Ulloa under Dr. Knezevic Graduate Student- John Quinn under Jim Brandle/Ron Johnson Dr. Drew Lyon replaced Dr. David Baltensperger (who left the University) Dr. Ron Johnson left the University, but maintains contact from his new position. TARGET AUDIENCES: Transitional farmers interested in organic farming. Dorm residents at UNL. Consumers interested in buying locally grown food. General public. Conventional farmers.

2005/09/15 TO 2006/09/15 Four certified organic sites are in varied stages of establishment across four agroecozones that cover Nebraska. A project coordinator was hired and technical support identified at all locations. A graduate student was hired for the Healthy Farm Index component of the project. Initial baseline soil sampling and on-the-go soil electrical conductivity measurements have been taken from each site. At High Plains Agricultural Laboratory (Sidney, NE) 76 acres of land completed their 3rd year of conversion into organic production. This site received organic certification and now qualifies for organic research studies. The site is set up with three fields with each having a rotation of two three-year rotations. A field day was held at a cooperators farm near Lodgepole, NE. At South Central Agricultural Laboratory (Clay Center, NE). potential cropping systems were identified for this irrigated 17 acre site. The site will compare a three year and four year rotation with four replications. At Agricultural Research and Development Center (Mead, NE) 45 acres will be available when the conversion is complete, all of which are protected by mature shelterbelts. Land was planted to alfalfa, corn and wheat. At the Haskell Agricultural Laboratory (Concord, NE) 25 acres of land was identified for the organic project. The target area is in terraces. Oats/alfalfa, corn, soybeans, and oats/clovers were planted and harvested. Cattle were fall grazed for approximately four weeks to clean up residue and to utilize forage in terraces that would otherwise be unused. Resident Instruction: Natural Resources 211, Introduction to Conservation Biology was taught with the inclusion of information on organic and sustainable farming. A second course, Science-based Organic Farming AGRO496/896 included three modules: Introduction to Organic Farming, Organic Farming Practices, and Contemporary Issues in Organic Farming. Project Coordination: Organic Farmer Advisory groups have formed at each research site. Priority research areas were identified for each location. A professional development workshop called- Field to Table- was organized for the PIs and field technicians associated with the project. The workshop was held at the Grain Place (a project collaborator). During the workshop, various organic methods to control weeds were discussed; there was a tour of the processing plant which emphasized the importance of the audit trail and paperwork needed in the certification process. Extension: The project coordinator has established an Internet home page with relevant contact information about the grant and organic production for clients to use (<http://nerec.unl.edu/faculty/sarno.html>). The intent and purpose of the grant has been highlighted in statewide media including public radio, farm magazines, and University publications. One organic farmer initiated a replicated on-farm organic corn variety test plot trial. A SARE Prof. Dev. grant has been

received to implement organic farming workshops in four states in 2007. Charles Francis and colleagues maintain the web site Science-Based Organic Farming 2006: Toward Local and Secure Food Systems.

IMPACT

2005/09 TO 2010/08 Establishing the four organic research sites allowed the Principal Investigators to collaborate with researchers to write, conduct and collaborate on related organic research grants: 1. Avian Ecology-involving School of Natural Resources to study bird populations, breeding and habitat conservation on 27 cooperating organic farms in Nebraska and Kansas. Rather than compare organic and conventional agroecosystems, this project investigated how avian communities respond to land use and land cover patterns associated with organic production. The research suggests that a heterogeneous mosaic of habitat is needed to maintain current Great Plains farmland bird communities; 2. Weed Flaming-involving College of Engineering, Propane Research and Education Council/Nebraska Propane Association, to develop response curves for propane (based on usage rate (gal/acre)) needed for safe and economical weed control in wheat, corn, sorghum, soybeans, sunflower red clover, alfalfa and several weed species; 3. Small Grains Breeding Trials-expansion of wheat breeding research program to evaluation of varieties for organic production and cover crops. Based on discussions with organic small grains producers, an initial list of ideal winter wheat cultivar traits was used as the basis for screening: competitive grain yield, excellent end use quality, excellent disease and insect resistance, ability to extract soil nutrients, and ability to provide early season ground cover to suppress or tolerate weeds; 4. Wheat Antioxidant Properties-involving Food Science and Technology to evaluate organic wheat nutrient properties to enhance human health. This work is significant in that information will be forthcoming on the impact on the health promoting components present in organic crops grown in different regions and under different farming practices. As an outcome, farming practices can be developed that not only enhance productivity but also the health promoting properties in organic foods; and 5. Regional Extension Workshops-multi-state, cooperative organic production education sessions in Nebraska, South Dakota, North Dakota and Kansas, involving Extension Specialists, NRCS leaders and multiple cooperating groups for more than 350 participants, including farmers, educators, students and commercial reps. Response surveys following other Extension organic workshops and information meetings were generally favorable: 1. Natural Livestock Marketing-43% responses said their previous knowledge of organic and natural livestock marketing was Intermediate, 87% responses rated the marketing panel 4 or 5 (5=useful and informative), 10% responses said the information is very likely to influence their farming operation; 2. Grow Your Own Nitrogen- 26% responses indicated they were likely to adopt green manure/cover crop practices as a result of the presentation; 3. Organic Farming Basics-Organic Crop Farming Basics 93% of people presented information stated they had a moderate to significant improvement in knowledge afterward, 78% indicated they were already using organic farming practices, would modify current organic farming practices or planned to start farming organically in the future. **PUBLICATIONS (not previously reported):** 2005/09 TO 2010/08 1. Bruening C. A., G. Gogos, S.M. Ulloa, S. Z. Knezevic. 2009. Performance advantages of a flaming hood. 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2008/09/15 TO 2009/09/14 Talks given: Restoring Biodiversity to Agricultural Landscapes. Wachiska Audubon Society, Lincoln NE. The Healthy Farm Index. Nebraska NRCS The Healthy Farm Index. UNL Extension & Nebraska Sustainable Agriculture Society Rural Advantage Conference, Grand Island, NE. Biodiversity in Organic Farm Systems and the Healthy Farm Index. Izaak Walton League Annual Meeting. Lincoln, NE. Media Coverage of HFI: "Healthy Farm Index Will Help Farmers See the Big Picture" (Lincoln Journal Star, Grand Island Independent, High Plains/Midwest Ag Journal, Forbes.com, Presszoom.com, eXtension, Charleston Daily Mail, Farms.com, Agweek.com, Organic Food news today, ATTRA, KMEG, Gothenburg Times, Greeley Citizen, UNL School of Natural Resources, NE State Paper, Omaha World Tribune, Organic Home UK, MSN Money, CNBC) The Organic Project has influenced Nebraska Sustainable Agriculture Society and the Organic Crop Improvement Association to take a more research based examination of production issues. Flaming for weed control has been highlighted in many extension outlets with conventional and organic farmers. Nutrient in-out balances have been emphasized with particular emphasis on phosphorus.

2007/09/15 TO 2008/09/14 The established experiments were used for outreach activities at the four district stations, providing credibility to organics and UNL. Extension organic workshops were held in four states and the results from the program have been used in planning and presentations in a four-state SARE professional development program in North and South Dakota, Nebraska, and Kansas in 2008. These workshops included more than 350 participants, who heard about organic farming systems and certification as well as touring field areas where organic systems are well established. Audiences included farmers, extension specialists, NRCS

personnel, commercial representatives, and academics. Presentations to high school voc-ag teachers: in 2008 there were presentations and literature provided to most of the ag teachers in Nebraska (Kearney, NE, 85 teachers) and in South Dakota (Pierre, SD, 79 teachers). The reference materials included data and web sites for more details, including reference to the UNL Organic Web Site (<http://cari.unl.edu/Presentations/organic-farming-2008.doc> and <http://organic.unl.edu>). During 2008 more than 300 packets of information were handed out to people interested in organic farming. Extension Educator and Organic Project Coordinator 1) provided information about UNL organic research projects: Healthy Farm Index, Weed Flaming Project, Winter Wheat Variety Study and general resource and marketing information to consumers groups and farmers (including several organic workshops in transitioning and production), 2) conducted several workshops for NRCS staff about organic production practices so they can help farmers apply for EQIP organic transition program fund, 3) developed and planned 2nd Sustainable Crops and Livestock Systems for High Plains Agriculture, 4) organized with Organic Crop Improvement Association "Grow Your Own Nitrogen" Utilizing Cover Crops workshop, 5) presented the principles of organic farming at University of Nebraska's class "Overview of Organic Farming," 6) organized workshop at Clay Center organic site for farmers on "Promoting Biological Control of Insects in Organic Systems", "Organic Winter Wheat Variety Study," and an update of "The Healthy Farm Index", 7) presented program on "Organic Farming" to the Nebraska County Weed Control superintendents at their annual state meeting. Informed weed superintendents how to work with organic farmers in their area, 8) organized inspections for organic certification for all four UNL research sites: ARDC, HAL, HPAL and SCAL, 9) organized the annual state advisory meeting, facilitated farmer and researcher interaction and discussion of results, 10) attended "All Things Organic" trade show in Chicago participated in a research panel discuss: "Emerging Issues for Consumers: Certifications, Locavores and Competing Claims Procurement and Market Positioning in the Supply Chain", 11, attended COSA: <http://www.cosagroup.org/> meeting in Houston, Texas and presented paper on Healthy Farm Index and lead a roundtable discussion on "Developing Science Based Metrics that Measure; How to make science more useful/What about benefit to farmers"

2006/09/15 TO 2007/09/14 At the Organic and Natural Livestock Marketing Meeting when asked "How would you rate the information presented by the marketing panel?" On a scale of 1 (Not useful or Informative) to 5 (Useful and Informative) 87% rated the panel 4 or 5. Farmers were given information to encourage them to integrate livestock in their farming operations and also where they could find organic and natural livestock markets. Video products: Breeze presentation "Organic Transitioning" for acreage owners. Presented information in four workshops at Lincoln, Omaha, Fremont and Sidney. Good discussion followed on how to transition to organic farming or gardening. Participants felt they had better knowledge on getting information about organics.

2005/09/15 TO 2006/09/15 Excellent relationship with the organic farming community is being pursued. The Project Coordinator is meeting with established organic groups and helping them implement their plans. The four sites are in process of being certified. The major accomplishment is that the High Plains Agricultural Laboratory has been certified. Two additional sites implemented new rotations and successfully harvested respectable yields. Based on farmer input, cattle grazed one site. The Healthy Index concept has been well received by producers and many farmers have stepped forward to volunteer their land. Through public meetings, the need for more organic horticultural emphasis has been identified. Resident instruction has now has two courses that study organic agriculture.

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2006/09/15 TO 2007/09/14 No publications reported this period

2005/09/15 TO 2006/09/15 No publications reported this period

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