ORG Project Details

Award Year 2008

3 Research Projects

PROJECT INDEX

Whole Farm-level Evaluation of Field Border Vegetation on Organic Management of Insect Pests and Weed Seed Banks, and on Farmland Wildlife

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Subfile	CRIS
Project No.	NC09746
Agency	NIFA NC.
Project Type	OTHER GRANTS
Project Status	TERMINATED
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Proposal No.	2008-01265
Start Date	01 JUL 2008
Term Date	30 JUN 2013
Fiscal Year	2009
Grant Amount	$347,815
Grant Year	2008
Investigator(s)	Orr, D. B.; Reberg-Horton, S. C.; Moorman, C. E.; Cardoza, Y. J.
Performing Institution	ENTOMOLOGY, NORTH CAROLINA STATE UNIV, RALEIGH, NORTH CAROLINA 27695

NON-TECHNICAL SUMMARY

The purpose of this project is to evaluate a range of field border habitat types for their value to insect and weed pest management within crop fields, as well as their value to on-farm wildlife. The objectives of this proposal help to fill gaps in our knowledge about how best to implement field border habitats to enhance beneficial insects, wildlife, and management of pest insects and weeds by making use of on-farm populations of beneficial organisms (both insects and birds). We will examine the effect of different types of border habitat plantings on the beneficial insect communities they harbor, and the effect of these communities on insect as well as weed management in adjacent crops. We will assess the value of the border habitats as cover and a food resource for quail. In addition, we will examine the arthropod diets of songbirds that move between the borders and crop fields to assess the value of these habitats, and the potential contribution of early successional songbirds to insect management in adjacent crops. An advisory group of organic growers, extension personnel, and a crop consultant has been assembled in order to direct this project from the beginning towards a practical product that growers will use on their farms. Although we are using an organic farming production system for this project, the outcomes should be applicable to a wider array of cropping, because we are targeting field border vegetation outside of crop fields.

OBJECTIVES

Goals. The project goal is to develop and deliver to farmers a practical plan to improve insect and weed pest management as well as farmland wildlife populations in organic agricultural systems through strategic use of planted field border habitat. This proposal seeks to build on the results of a current USDA-NRCS-CIG funded project assessing planting and management strategies for native prairie plant habitats as an alternative to the traditional fallow CP33 (NRCS Upland Bird Habitat Buffer Conservation Reserve Program 33) habitats for quail population restoration that are currently being deployed. Under provisions of CP33, growers are paid to leave strips of volunteer vegetation around field borders as habitat for quail and early-successional songbirds that benefit from this practice. However, traditional fallow borders do not enhance populations or activity of beneficial insects in adjacent crop fields. Native prairie plants have been shown in small scale studies to enhance beneficial insects, in addition to providing habitat for wildlife. As a result of the above NRCS-funded study, NRCS jobsheets are currently being revised to allow planting of these native plants into CP33 buffers. For organic growers, the modified CP33 program could provide financing to allow for establishment of beneficial borders to improve insect and weed pest management on their fields, while at the same time enhancing farmland wildlife. However, many organic farmers have concerns over these vegetated borders serving as refuges for weeds and other pest organisms. This project will determine whether positive pest impacts of these borders outweigh those concerns and single out which type of border is most beneficial. The project will also explore how deeply these border effects are able to penetrate production areas. Project results will be used to educate farmers on impacts of non-cultivated areas on their crops and how management must extend beyond the field edge for organic to reach its maximum potential. Objectives. Objective 1: Compare population dynamics of key beneficial and pest insect species and weed seed predators in habitat borders and adjacent crops. Objective 2: Estimate effect of parasitism and predation on crop insect pest species in fields bordered by various habitats. Objective 3: Determine how much of annual weed seed rain on adjoining fields is consumed by weed seed predators and discern whether habitat type affects this predation. Objective 4: Define how beneficial habitats affect spatial distribution of weed seed banks. Objective 5: Determine quality and quantity of arthropod and seed foods available to quail in various habitat borders. Quail are indicator species for early successional birds, and results from objectives 5 and 6 can be extrapolated to songbird species. Objective 6: Determine structural quality of various habitat borders as nesting and foraging habitat for quail. Objective 7: Assess arthropod types consumed by songbirds utilizing habitat borders. Objective 8: Extension and education program to deliver project results to organic growers. Evaluate project impact using independent evaluator.

APPROACH

Efforts. This study will take place on a 100 acre area of the Organic Research Unit of The Center for Environmental Farming Systems (CEFS; www.cefs.ncsu.edu). The study area is transitioning to organic agriculture. Activities will take place in 16 crop fields, of approx 4-10 acres. Each field will be in either soybeans, corn, hay year 1, or hay year 2 in equal proportions for each year of the project. Each field will be partly surrounded by 1200 ft of experimental habitat, made up of four randomly assigned 300 ft sections of four habitat types. Habitat types were selected based on preliminary data and literature presented in the Introduction section that represent a range of values to beneficial insects and wildlife. The habitats are: 1) Control 1, mowed grass/weeds 2) Control2, fallow habitat to represent traditional CP33 habitat; 3) flowering herbaceous species only; 4) herbaceous species plus warm season grasses promoted for wildlife habitat in the southeast. Fallow areas in habitat 2 will remain undisturbed for the three year project. Habitats 3 and 4 will be kept mowed to maintain vegetation between 6 and 15 inches for the first year of the project, in order to promote good stand development (determined from preliminary data and literature). One 100 ft. transect line will be established perpendicular to field edges in the middle of each habitat plot, with sampling points in habitat and varying distances from the field edges to suit each activity in the proposal. Evaluation. OSullivan & Associates will address evaluation concerns for this project. They will focus on outcomes and impacts of the project in terms of dissemination. They will work with the PIs to develop an evaluation plan and identify data sources to monitor and report impacts from this project. They will meet with the project team and advisory group to develop an evaluation plan based on a program logic model. This will specify impacts expected from activities to achieve the project objectives. This plan will identify data collection methods in a collaborative evaluation model since the budget does not allow extensive travel or time for actual evaluation data collection. (Month 1 of project). Data collection tools (surveys, forms, and other data collection instruments) and steps (such as focus groups or email, conference call surveys will be selected and designed for the project team. They will be shared with the project team for review and implementation. (Month 3). Data collection will be monitored. Data will be assembled and analyzed. An evaluation report will be submitted to project leader for use in annual report (Months 9-12). Project process and evaluation steps will be reviewed and adjusted in collaboration with project team (Month 13). The cycle will repeat itself in subsequent years with modifications based on flow of the project. A goal of the evaluation process will be to build collaboration and understanding among project participants and stakeholders. (Subsequent months to end of project).

PROGRESS

2008/07 TO 2013/06 Target Audience: Farmers (especially organic farmers), Landowners, Extension agents, Graduate students, Undergraduate students, Academics, State and Federal Government employees, Extension Master Gardener programs, General public. Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided? Many opportunities for training and professional development were provided by this project and are detailed in the \"Other Products/Outputs\" and \"Products\" sections of this report. Two graduate students were trained and received degrees working on this project. Over 100 Center for Environmental Farming Systems interns and apprentices were offered training that included results from this project. NC State University courses and guest lectures have included material from this project, directed at both undergaduate and graduate students. Professional training and knowledge of all the investigators on this project were also extended through hands on experience and analysis of results. Other members of the target audience benefited from the various workshops, training sessions, and technical presentations offered through this project. How have the results been disseminated to communities of interest? Journal articles and other technical products (see Products sections of report) were produced and presented at technical meetings to disseminate results to the academic, government and extension members of the target audience. Workshops, training sessions and other outreach efforts were conducted for farmers, landowners, extension personnel, government employees, students, and the general public. Extension articles and web-based materials related to this project were produced to support efforts to disseminate results. Material related to this project was incorporated into classroom materials for courses on organic agriculture, biological control of insects, and agroecology. What do you plan to do during the next reporting period to accomplish the goals? Nothing Reported

2011/07/01 TO 2012/06/30 OUTPUTS: High resolution video monitoring demonstrated that field crickets (Gryllus sp.) and house mice (Mus musculus) were the predominant weed seed predators in eastern North Carolina crop fields. Carabid beetles, such as Harpalus pennsylvanicus, which are common weed seed predators in temperate areas, were rarely seen in the videos or in pitfall traps. House mice were especially common in plots where ants had been removed. These results show that while Solenopsis invicta has become a dominant insect in the Southeast United States, they do not contribute to weed seed predation ecosystem services in agricultural settings. Instead, they may weaken this service by displacing other seed eating organisms such as mice and beetles. Field border treatments had no effect on seed removal rates but that crop species heavily influenced both weed seed predation and invertebrate seed predator activity density. Weed seed predation was highest in the dense, perennial hay fields and lowest in the more open corn fields. Activity densities for field crickets (Gryllus sp.) and the ground beetle Harpalus pennsylvanicus were also high in the hay fields and low in the corn fields while the red imported fire ant seemed to prefer the open corn fields. These results show that increasing vegetative diversity in field borders is not an effective method for conserving weed seed predators, but that higher quality habitat inside the crop field can be achieved by increasing ground cover. Cotton rat density was higher in borders planted for beneficial insect habitat, which likely was influenced by greater vegetation density and availability of preferred foods in these border types. Total small mammal density was lower in mowed borders, emphasizing the importance of available non-crop vegetation for supporting small mammal communities within intensive agricultural areas. Foraging rate of bobwhite quail chicks did not differ among treatments. Total arthropod prey densities calculated from blower-vac samples also did not differ among border treatments. However, quail chicks in mowed borders experienced heat stress, and were exposed to predators. Sparrow densities were 5-10 times lower in mowed borders than in other border treatments, but did not differ among planted and fallow borders. Field borders planted to promote beneficial insects may be a useful tool for maximizing the ecological services provided by non-crop vegetation. PARTICIPANTS: Individuals David Orr, Department of Entomology, North Carolina State University, Raleigh, NC (PI on project; directed graduate students, designed experiments, presented training and professional development). Chris Reberg-Horton, Department of Crop Science, North Carolina State University, Raleigh, NC Chris Moorman, Department of Forestry and Environmental Resources, North Carolina State University, Raleigh, NC. Yasmin Cardoza, Department of Entomology, North Carolina State University, Raleigh, NC Partner Organizations: Center For Environmental Farming Systems. The Earthwise Company, LLC Collaborators: Tony Kleese, The Earthwise Company, LLC, PO Box 2093, Wake Forest NC. Mary Wilks, Carolina Precision Consulting, Inc., 5664 Fieldstream Dr., Rocky Mount, NC. Debbie Roos, Chatham County Extension Center, North Carolina State University, Pittsboro, NC. Training or Professional Development: Advisory panels, field demonstrations, workshop, web-based publication, scientific publication, conferences, formal classroom instruction, laboratory instruction, CEFS internship, outreach activities. TARGET AUDIENCES: Farmers, Extension agents, Graduate students, Academics, Government workers, Master Gardeners, General public. PROJECT MODIFICATIONS: Not relevant to this project.

2010/07/01 TO 2011/06/30 OUTPUTS: An approach to increase adoption of beneficial insect habitats for IPM is to incorporate habitats providing multiple ecological services into existing CRP programs that provide growers financial and other incentives (e.g. hunting). Research was continued comparing habitats (both planted and fallow) that could potentially be incorporated into existing CRP programs (e.g. CP33 which is intended to enhance quail populations in agricultural landscapes), with standard mowed field borders. Habitats were evaluated for their value to parasitoids and predators of crop pests, predators of weed seeds, and farmland wildlife such as bobwhite quail and songbirds. Plots were established that included four early successional habitat types around 9 fields (3 fields each of soybeans, corn, hay) on 110 acres of the Organic Research Unit at the Center for Environmental Farming Systems, near Goldsboro, NC. Data were collected from the 3 crops and 4 habitats on density and activity of: 1) Pest insects ; 2) Parasitoids and parasitism of selected pests; 3) Foliage-dwelling as well as soil-dwelling arthropod predators; 4) Weed seed predators and predation; 5) Weed seed banks; 6) Songbird use of field border habitats; 7) Small mammals; 8) Resource use by quail chicks in field border habitats. Several meetings were conducted with advisory groups for their input into this project. Development work was conducted on a website and web-based materials related to this project. Workshops and outreach efforts were conducted for the target audiences. Presentations were also made at professional meetings. Material related to this project was incorporated into classroom materials for two courses on organic agriculture and biological control of insects. PARTICIPANTS: Individuals David Orr, Department of Entomology, North Carolina State University, Raleigh, NC (PI on project; directed graduate students, designed experiments, presented training and professional development). Chris Reberg-Horton, Department of Crop Science, North Carolina State University, Raleigh, NC Chris Moorman, Department of Forestry and Environmental Resources, North Carolina State University, Raleigh, NC. Yasmin Cardoza, Department of Entomology, North Carolina State University, Raleigh, NC Partner Organizations: Center For Environmental Farming Systems. The Earthwise Company, LLC Collaborators: Tony Kleese, The Earthwise Company, LLC, PO Box 2093, Wake Forest NC. Mary Wilks, Carolina Precision Consulting, Inc., 5664 Fieldstream Dr., Rocky Mount, NC. Debbie Roos, Chatham County Extension Center, North Carolina State University, Pittsboro, NC. Training or Professional Development: Advisory panels, field demonstrations, workshop, web-based publication, scientific publication, conferences, formal classroom instruction, laboratory instruction, CEFS internship, outreach activities. TARGET AUDIENCES: Target audiences: Farmers, Extension agents, Graduate students, Academics, Government workers, Master Gardeners, General public. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2009/07/01 TO 2010/06/30 OUTPUTS: One approach to increase adoption of beneficial insect habitats for IPM is to incorporate habitats providing multiple ecological services into existing CRP programs that provide growers financial and other incentives (e.g. hunting). Research was conducted to compare habitats (both planted and fallow) that could potentially be incorporated into existing CRP programs (e.g. CP33 which is intended to enhance quail populations in agricultural landscapes), with standard mowed field borders. Habitats were evaluated for their value to parasitoids and predators of crop pests, predators of weed seeds, and farmland wildlife such as bobwhite quail and songbirds. Plots were established that included four early successional habitat types around 9 fields (3 fields each of soybeans, corn, hay) on 110 acres of the Organic Research Unit at the Center for Environmental Farming Systems, near Goldsboro, NC. Data were collected from the 3 crops and 4 habitats on density and activity of: 1) Pest insects ; 2) Parasitoids and parasitism of selected pests; 3) Foliage-dwelling as well as soil-dwelling arthropod predators; 4) Weed seed predators and predation; 5) Weed seed banks; 6) Songbird use of field border habitats; 7) Small mammals; 8) Resource use by quail chicks in field border habitats. Several meetings were conducted with advisory groups for their input into this project. Development work was conducted on a website and web-based materials related to this project. Workshops and outreach efforts were conducted for the target audiences. Presentations were also made at professional meetings. Material related to this project was incorporated into classroom materials for two courses on organic agriculture and biological control of insects. PARTICIPANTS: David Orr, Department of Entomology, North Carolina State University, Raleigh, NC (PI on project; directed graduate students, designed experiments, presented training and professional development). Chris Reberg-Horton, Department of Crop Science, North Carolina State University, Raleigh, NC Chris Moorman, Department of Forestry and Environmental Resources, North Carolina State University, Raleigh, NC. Yasmin Cardoza, Department of Entomology, North Carolina State University, Raleigh, NC Partner Organizations: Center For Environmental Farming Systems. The Earthwise Company, LLC Collaborators: Tony Kleese, The Earthwise Company, LLC, PO Box 2093, Wake Forest NC. Mary Wilks, Carolina Precision Consulting, Inc., 5664 Fieldstream Dr., Rocky Mount, NC. Debbie Roos, Chatham County Extension Center, North Carolina State University, Pittsboro, NC. Training or Professional Development: Advisory panels, field demonstrations, workshop, web-based publication, scientific publication, conferences, formal classroom instruction, laboratory instruction, CEFS internship, outreach activities. TARGET AUDIENCES: Farmers, Extension agents, Graduate students, Academics, Government workers, Master Gardeners, General public. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2008/07/01 TO 2009/06/30 OUTPUTS: Challenges for adoption of beneficial insect habitats for IPM in agricultural landscapes include logistics, cost and priorities. One approach to increase adoption is to incorporate habitats providing multiple ecological services into existing CRP programs that provide growers financial and other incentives (e.g. hunting). Research was conducted to evaluate habitats (both planted and fallow) that have been approved for use in an existing CRP program (CP33) which is intended to enhance quail populations in agricultural landscapes. The plants selected for planted habitats are all prairie plants native to North Carolina that are easily established, provide resources season-long, are competitive with weeds, and are readily available from commercial sources. Species included are Little bluestem (Schizachyrium scoparium); Indiangrass (Sorghastrum nutans); Butterflyweed (Asclepias tuberosa); Common milkweed (Asclepias syriaca); Black-eyed Susan (Rudbeckia hirta); Purple Coneflower (Echinacea purpurea); Lance leafed coreopsis (Coreopsis lanceolata); Swamp sunflower (Helianthus angustifolia); Showy Goldenrod (Solidago speciosa); and Heath Aster (Aster pilosus). A second study was begun that seeks to evaluate CP33-appropriate field borders for their value to parasitoids and predators of crop pests, predators of weed seeds, and farmland wildlife such as bobwhite quail and songbirds. Plots were established that included four early successional habitat types around 9 fields (3 fields each of soybeans, corn, hay) on 110 acres of the Organic Research Unit at the Center for Environmental Farming Systems, near Goldsboro, NC. Data were collected from the 3 crops and 4 habitats on density and activity of: 1) Pest insects (including herbivores, hyperparasitoids and intraguild predators); 2) Parasitoids and parasitism of selected pests; 3) Foliage-dwelling as well as soil-dwelling arthropod predators; 4) Weed seed predators and predation; 5) Weed seed banks; 6) Songbird use of field border habitats; 7) Small mammals; 8) Resource use by quail chicks in field border habitats. Several meetings were conducted with advisory groups for their input into this project. Development work was conducted on a website and web-based materials related to this project. Workshops and outreach efforts were conducted for the target audiences. Material related to this project was incorporated into classroom materials for two courses on organic agriculture and biological control of insects. PARTICIPANTS: Individuals David Orr, Department of Entomology, North Carolina State University, Raleigh, NC (PI on project; directed graduate students, designed experiments, presented training and professional development). Chris Reberg-Horton, Department of Crop Science, North Carolina State University, Raleigh, NC Chris Moorman, Department of Forestry and Environmental Resources, North Carolina State University, Raleigh, NC. Yasmin Cardoza, Department of Entomology, North Carolina State University, Raleigh, NC Partner Organizations: Center For Environmental Farming Systems. The Earthwise Company, LLC Collaborators: Tony Kleese, The Earthwise Company, LLC, PO Box 2093, Wake Forest NC. Mary Wilks, Carolina Precision Consulting, Inc., 5664 Fieldstream Dr., Rocky Mount, NC. Debbie Roos, Chatham County Extension Center, North Carolina State University, Pittsboro, NC. Training or Professional Development: Advisory panels, field demonstrations, workshop, web-based publication, scientific publication, conferences, formal classroom instruction, laboratory instruction, CEFS internship, outreach activities. TARGET AUDIENCES: Target audiences: Farmers, Extension agents, Graduate students, Academics, Government workers, Master Gardeners, General public. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

IMPACT

2008/07 TO 2013/06 What was accomplished under these goals? 1) major activities completed: Conservation buffers, areas of non-crop vegetation integrated into agricultural landscapes, enhance many agroecosystem services. Among other benefits, these buffers also provide habitat for wildlife and beneficial organisms such as pollinators and pest enemies. However, non-crop vegetation in agricultural settings can also be a source for crop pests. One buffer strategy, fallowing strips of land adjacent to crop fields, provides critical habitat for threatened wildlife species, but this strategy may increase in-field weed pressure by developing a reservoir of weed seeds that spreads into the neighboring crop field. Fallow buffers also offer few resources for beneficial organisms that provide important pest management services. It has been suggested conservation buffer practitioners move away from fallowing towards plantings of native forbs and grasses. It is not clear whether these planted buffers augment or diminish insect, weed and wildlife dynamics in agricultural landscapes. Two studies examined multiple field edge strategies to determine whether they have an impact on ecological weed management in organic cropping systems. Ecological weed management, an integration of many indirect weed management strategies, can be of critical importance to organic growers who are restricted from using conventional weed management tools. The first study investigated how the bank of weed seeds in the soil (the 'weed seedbank') changed over time in relation to field buffer management, distance away from the field edge, and crop type. Results showed planted buffers, especially those with native warm season grasses, can reduce the number of weed seeds that enter the seedbank. The second study examines the response of ground dwelling, seed eating organisms ('weed seed predators') respond to the different field buffer management schemes. The results from this study showed field buffers had little to no influence on weed seed predators or the seed predation services they provide. However, crop type did heavily influence these organisms as well as seed predation . Fields with crops that provide dense cover, such as hay, saw more weed seed predation than fields that were more open with less vegetative cover, such as harvested maize fields. The results from this weed seed predation experiment, however, may reflect conditions that are specific to our system and to the southeastern United States. One important aspect of the Southeast in relation to weed seed predators is the recent introduction of the invasive red imported fire ant, Solenopsis invicta. Although this ant is now present in high numbers inside southeastern U.S. agricultural fields, it is not clear if they are contributing to weed seed predation services. A third study used video monitoring in an agricultural field to collect direct evidence of Solenopsis invicta and their impact on summer annual weeds. The video data suggest this ant is not contributing to weed seed predation services. It is not clear from the video data, however, what impact these invasive ants have on native weed seed predators. The value of 4 different field border treatments (planted native grass and prairie flowers, planted prairie flowers only, fallow vegetation, or mowed vegetation) was compared by conducting northern bobwhite foraging trials, arthropod sampling, overwintering sparrow surveys, and small mammal trapping. In spring 2008, field border treatments were established randomly around 9 organic crop fields, and all borders were approximately 0.084 hectares. Groups of 6 human-imprinted bobwhite chicks were led through 30-minute foraging trials in all border treatments from June-August 2009 and 2010. Following trials, chicks were immediately euthanized, and their crops and gizzards were later dissected. Eaten arthropods were identified to family, measured with digital calipers, and counted. Allometric equations were used to calculate a mean foraging rate for each border treatment (grams of arthropods consumed/ chick/ 30 min). Arthropod prey availability was determined within each border treatment using a modified blower-vac to sample arthropods at the vegetation strata where chicks foraged. Foraging rate did not differ among treatments in 2009 or 2010. Total arthropod prey densities calculated from blower-vac samples did not differ among border treatments in 2009 or 2010. From November-March 2009-2010 and 2010-2011, single-observer transect surveys were conducted to determine overwintering sparrow use in the different field border treatments. During surveys, the total number of sparrows was counted in each field border, and individual species were identified only if easily visible with binoculars. A majority of birds observed were sparrows (96.4%), of which we were able to positively indentify 1424 (51%) to species. The most common sparrow species observed within field borders were savannah sparrow (Passerculus sandwichensis) (61.5%), song sparrow (Melospiza melodia) (22.8%), and swamp sparrow (Melospiza georgiana) (6.8%). Total sparrow densities were 5-10 times lower in mowed borders than in other border treatments in 2009-2010 and 2010-2011, but did not differ among planted and fallow borders in either year. In October-November 2009, small mammals were trapped over a 6-day period in each field border using Sherman live-traps. Captured individuals were marked with individually numbered ear tags, and released. Over all trapping periods, 512 individuals of only two species, the hispid cotton rat (Sigmodon hispidus) and house mouse (Mus musculus), were captured. Using the mark-recapture data, closed population models were created in Program MARK to estimate the density (number of individuals/hectare) of each species in each border. Cotton rat density was higher in borders planted for beneficial insect habitat, which likely was influenced by greater vegetation density and availability of preferred foods in these border types. Total small mammal density was lower in mowed borders, emphasizing the importance of available non-crop vegetation for supporting small mammal communities within intensive agricultural areas. Results of these studies suggest that field borders planted as beneficial insect habitats provide quality wildlife habitat comparable to traditional fallow field borders. 2) specific objectives met: Objectives 1-8 were all met. However, even though the data was collected and analyzed for objective 2, it has not yet been published. so publication products do not appear in this report. 3) significant results achieved, including major findings, developments, or conclusions (both positive and negative): Overall, results of this study indicate that planted borders may maximize the biodiversity potential of field border establishment by providing suitable habitat for both beneficial insect and wildlife populations. However, some beneficial organisms, such as weed seed predators, may not be enhanced by the presence of field border habitat 4) key outcomes or other accomplishments realized. The investigators, graduate students and technical personnel on this project all learned both the practical value and limitations of field border habitats for farmland insect and wildlife management. This learning is evident in the products resulting from this project. The investigators on this project were directly involved with farmers that changed practices to include diverse field borders on their farms. Peer-to-peer training in farm-based workshops has resulted in an undetermined number of other farmers that have also changed behavior. **PUBLICATIONS (not previously reported):** 2008/07 TO 2013/06 1. Type: Journal Articles Status: Published Year Published: 2013 Citation: Fox, A.F., Reberg-Horton, S.C., Orr, D.B., Moorman, C.E. and Frank, S.D. 2013. Crop and field border effects on weed seed predation in the southeastern U.S. coastal plain. Agriculture, Ecosystems and Environment, 177: 58-62. 2. Type: Journal Articles Status: Published Year Published: 2013 Citation: Moorman, C. E., C. J. Plush, D. Orr, C. Reberg-Horton, and B. Gardner. 2013. Small mammal use of field borders planted as beneficial insect habitat. Wildlife Society Bulletin. DOI: 10.1002/wsb.226 3. Type: Journal Articles Status: Published Year Published: 2013 Citation: Plush, C. J., C. E. Moorman, D. Orr, and C. Reberg-Horton. 2013. Overwintering sparrow use of field borders planted as beneficial insect habitat. Journal of Wildlife Management 77:200-206 4. Type: Journal Articles Status: Published Year Published: 2013

Citation: Plush, C. J., C. E. Moorman, D. Orr, and C. Reberg-Horton. 2013. Do beneficial insect habitats also provide quality brood habitat for northern bobwhite? Proceedings of Quail VII Symposium, Tucson, AZ, Jan. 10-12, 2012. 5. Type: Theses/Dissertations Status: Published Year Published: 2011 Citation: Plush, C.J. 2011. Wildlife Use of Field Borders Planted as Beneficial Insect Habitat. M.S. Thesis, North Carolina State University, Raleigh, NC. 6. Type: Theses/Dissertations Status: Published Year Published: 2013 Citation: Fox, A.F. 2013. Conservation Buffers and Ecological Weed Management in Southeast Organic Cropping Systems: Weed Seedbanks and Weed Seed Predators. Ph.D. Dissertation, North Carolina State University, Raleigh, NC. 7. Type: Conference Papers and Presentations Status: Published Year Published: 2012 Citation: Orr, D.B. 2012. Whole farm-level evaluation of field border vegetation on organic management of insect pests and weed seed banks, and on farmland wildlife. Proceedings, NIFA Organic Programs Project Director Meeting October 3-4, 2012, Washington, DC. 8. Type: Book Chapters Status: Published Year Published: 2012 Citation: Orr, D. B. and A.A. Fox. 2012. Augmentation and Conservation Biological Control. In: Abrol, D.P. and Shankar, U. (ed.s), Integrated Pest Management Principles and Practice. CABI International, Wallingford, UK. 9. Type: Other Status: Published Year Published: 2011 Citation: G. Balme, D. Orr, A Fox. 2011. The Ground Beetles of Eastern North Carolina Agriculture. North Carolina State University AG-735-1 10. Type: Other Status: Published Year Published: 2011 Citation: G. Balme, D. Orr. 2011. Identification of Common Ground Beetles North Carolina Coastal Plain Agricultural Fields. North Carolina State University AG-735-2. 11. Type: Other Status: Published Year Published: 2009 Citation: D.B. Orr, H.M Linker, and L.M. Forehand. 2009. Using Beneficial Insect Habitat On the Farm: An Introduction. (AG-676-02W). 12. Type: Other Status: Published Year Published: 2012 Citation: Orr, D. and T. Kleese. 2012. Beneficial Habitats. Carolina Farm Stewardship Association, Stewardship News. Vol. 32 issue 3, pp. 1, 11. 13. Type: Other Status: Published Year Published: 2012 Citation: Plush, C., C. Moorman, D. Orr, and C. Reberg-Horton. 2012. Farmland Field Borders?The Relationships between Beneficial Insects and Wildlife. The Upland Gazette, Spring 2012. Vol. 17, issue 1, pp. 11-13. 14. Type: Websites Status: Published Year Published: 2012 Citation: Orr, D. 2012. Native Plants for Beneficial Insects in the Southeast. (http://www.beneficialbugblog.blogspot.com/) 15. Type: Websites Status: Published Year Published: 2012 Citation: Orr, D. 2012. Why Provide Habitat. (http://www4.ncsu.edu/\~dorr/Habitat%20Information/Introduction/why provide habi 16. Type: Websites Status: Published Year Published: 2012 Citation: Orr, D. 2012. Habitat Principles. (http://www4.ncsu.edu/\~dorr/Habitat%20Information/Principles/habitat principles 17. Type: Other Status: Published Year Published: 2008 Citation: Orr, D.B. 2008 Beneficial Insects and Wildlife Buffers. The Upland Gazette, Fall 2008, Volume 13, issue 2. pp. 4-5. 18. Type: Websites Status: Published Year Published: 2012 Citation: Orr, D. 2012. Habitat Example. (http://www4.ncsu.edu/\~dorr/Habitat%20Information/Example/habitat example.html)

2011/07/01 TO 2012/06/30 Organic methods for establishing and maintaining habitat for multiple ecological services were presented to growers, agents, and students through two on-farm field days, a field demonstration, two workshops, several powerpoint presentations, blog and web site entries. Data are still being analyzed and published, but will provide organic growers guidance on how CRP habitats relate to management of insects, weeds and farmland wildlife.

2010/07/01 TO 2011/06/30 Organic methods for establishing and maintaining habitat for multiple ecological services were presented to growers, agents, and students through one field demonstration, two workshops, several powerpoint presentations, three Advisory Panel meetings, and a web-based article. As a result, twenty growers have committed to establishing habitat plots on their farms. The types of data being collected were determined at least in part from input by growers, based on advisory group input, individual interactions, and survey results. Samples are still being processed from 2010, and data are being analyzed so it is too early to present anything definitive. However, these ongoing studies will provide organic growers guidance on how CRP habitats relate to management of insects, weeds and farmland wildlife.

2009/07/01 TO 2010/06/30 Organic methods for establishing and maintaining habitat for multiple ecological services were presented to growers, agents, and students through two field demonstrations, two workshops, multiple powerpoint presentations, three Advisory Panel meetings, and a web-based article. As a result, twenty growers have committed to establishing habitat plots on their farms. The types of data being collected were determined at least in part from input by growers, based on advisory group input, individual interactions, and survey results. Samples are still being processed from 2010, and data are being analyzed so it is too early to present anything definitive. However, these ongoing studies will provide organic growers guidance on how CRP habitats relate to management of insects, weeds and farmland wildlife.

2008/07/01 TO 2009/06/30 Habitat plots in the main study established very well, and the various habitat types were remarkably distinct. Organic methods for establishing habitat were presented to growers, agents, and students through two field demonstrations, one workshop, multiple powerpoint presentations, three Advisory Panel meetings, and a web-based article. As a result, five growers have committed to establishing habitat plots on their farms. The types of data being collected were determined at least in part from input by growers, based on advisory group input, individual interactions, and survey results. Data are still being collected, samples still being processed, and data analyzed so it is too early to present anything definitive. However, these ongoing studies will provide organic growers guidance on how CRP habitats relate to management of insects, weeds and farmland wildlife.

PUBLICATIONS

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2009/07/01 TO 2010/06/30 Orr, D. B. and A.A. Fox. 2010. Augmentation and Conservation Biological Control. In: Abrol, D.P. and Shankar, U. (ed.s), Integrated Pest Management Principles and Practice. CABI International, Wallingford, UK. (In Press)

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Developing Carbon-positive Organic Systems Through Reduced Tillage and Cover Crop-intensive Crop Rotation Schemes

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Performing Institution	AGRONOMY, IOWA STATE UNIVERSITY, 2229 Lincoln Way

NON-TECHNICAL SUMMARY

Of the issues faced by row crop producers those resulting from soil erosion and compaction and fertility loss remain the most challenging. In an effort to address these issues of soil quality, at least in part, many producers have successfully adopted a system that limits the number of field operations required to produce a crop. This system is commonly referred to as no-till or reduced-till and relies on pesticides and synthetic fertilizers that are not allowed in a certified organic production system. The goal of this project is to design and execute a multistate, multisite, multiuser no-till system that will allow the organic row crop producer to forego a suite of tillage operations that may reduce soil quality and drive up the cost of production. Over the past few years the Rodale Institute has designed and experimented with a roller/crimper field tool capable of killing a weed-suppressing cover crop. When the roll/crimper is mounted on the front of a tractor with adequate horsepower, a planter can be mounted on the rear allowing planting to be accomplished at the same time as the cover crop is crushed. If the crushing of the cover crop results in a residual mat sufficient to suppress between row weeds, then the only remaining field operation is harvest. Integrating the roller/crimper tool with weed suppressing and soil-building cover crops into an organic rotation, soil quality will be enhanced by maximizing soil cover, minimizing erosion, and improving soil organisms and biological processes and reduce ecological and economic costs and optimize yield stability. Improvement in soil health will be measured by tracking nutrient cycling and biological processes, microbial populations and nitrogen mineralization rates. Enhanced ecosystem services on organic farms will be determined by measuring carbon sequestration, soil moisture and crop microclimates, weed suppression and biological controls through cover crop-intensive systems. Economic benefits will be measured by accounting for returns to organic farmers resulting from the reduction in costs of production through reduced tillage, specifically in field operation labor, reduced dependence on external sources of applied fertility, and lower energy costs. The information will be disseminated at field days and conferences, publications, appropriate and a guidebook of Best Management Practices for Organic Soil Management that utilize a farmer-centered approach to improve soil quality in organic systems. The expected primary impact resulting from this project will be a reliable determination of whether the roller/crimper field tool combined with cover crops can reduce the number of field operations now common among organic row crop producers and provide a significant contribution of soil quality and fertility. If this

result is positive, it could reasonably be expected that the otherwise static organic grower base would increase. More producers would be willing to consider organic production because crops could be grown without excess weeds and tillage, soil quality would increase and they could receive premium pricing while reducing their overall economic and ecologic cost of production.

OBJECTIVES

Organic row crop and small grain producers rely on a suite of tillage operations to control weeds thought to lead to soil degradation. Further, many organic producers require off-farm inputs to maintain fertility. Thus, the long-term goal of this project is to provide a regional range of models of organic compliant no-till production systems to row crop and small grain producers that will avoid much if not all tillage operations and decrease the dependence on off-farm fertility inputs through the use of leguminous cover crops. To reach this goal, over the course of 3 years, experiments in 6 states will be conducted and analyzed. All the experiments will demonstrate the use of an experimental roller/crimper field tool and integrate weed suppressing and soil building cover crops in an organic crop rotation. The objective of each experiment will be to determine the effectiveness of the individual system in terms of soil quality by maximizing soil cover, minimizing erosion, and improving soil biological processes, increasing fertility, reducing ecological and economic costs and optimizing yield stability. The experiments will be conducted at university and on-farm sites to provide analysis of system performance over a wide range of field and operator conditions. As the analysis of the experiments proceed a data base of field operations, weather conditions, soil health parameters, fertility profiles, crop performance, equipment effectiveness and weed suppression will be compiled. This data base will be used in compiling the yearly reports on the experiments. Yearly reports will be presented to producers during annual field days at 6 university sites and 6 on farm sites. Additionally the reports will be presented to producers at regional organic conferences at Iowa State University in November and in February at the Upper Midwest Organic Conference in La Crosse, Wisconsin. The 3 year result of the experiments will also be analyzed and presented to a peer reviewed journal for publication and for oral presentation at the annual conference of the American Society of Agronomy. Other outputs will be extension publications from each participating university and additional presentations to local groups, such as the Neely-Kinyon Association in Greenfield, Iowa. A guidebook of Best Management Practices for Organic Soil Management will be published within 6 months of the end of the project to serve as a reference to all producers who seek to improve soil quality.

APPROACH

Organic crop rotations to examine the effect of tillage and crop sequence on soil quality, yields, weed populations and economic performance in spring 2008. Tillage and crop sequence treatments will be a randomized complete block design as a 2 X 2 factorial experiment: tilled (disking) versus no-till (rolling/crimping) and wheat-rye/bean-oat-vetch/corn versus wheat-hairy vetch/corn-oat-rye/bean and will be replicated 4 times at each location. Minimum plot size is 30 X 50 ft. Spring wheat will be the rotation baseline, followed by rye and hairy vetch to be terminated in the spring by disking or by roller/crimper. Pinto beans (western ND) and soybeans (all others) will be drilled into the cover crop treatments in 2009. Corn will be seeded into disked or rolled/crimped hairy vetch at all sites. In the no-till plots, a front-mounted roller/crimper and rear-mounted seeder will plant the corn and bean plots. Those same crops will be seeded in the tilled plots. Oats will be drilled in March 2010 in all plots and followed by rye and hairy vetch. In 2011, pinto beans (ND) and soybeans will be seeded directly into the disked or rolled/crimped rye and corn will be seeded into disked or rolled/crimped, hairy vetch. Soil samples will be collected from each plot in fall 2008 and 2010. Cover crop density will be determined by counting hairy vetch and rye plants in 3 areas in fall 2008, 2010 and spring 2009 and 2011. Fall and spring plant densities will be compared to determine winter hardiness and biomass. Disking or rolling/crimping effectiveness in terminating cover crop growth will be assessed 14 days after the operation. Stand establishment of corn and beans will be assessed 21 days after seeding by counting randomly selected plants in 17-ft of three 30-inch rows. Oat stand will be determined by counting plants within three 1-m2-quadrat areas in each plot. N fertility in corn plots will be evaluated in each treatment in the corn and bean years (2009 and 2011) through the Late-Spring Nitrate Test and the Corn Stalk Nitrate test. Bean and corn yields will be determined. Above-ground weed biomass will be determined prior to terminating cover crop treatments and when subsequent crops reach maturity. Light penetration will be used to assess weed suppressive potential of cover crops. From April to November monthly soil moisture will be measured at a sampling depth of 6, 12 inches and 36 inches in semi-arid sites. Weather conditions will be recorded at station sites. Data collected on-farm will include field histories, planting dates, equipment settings, field operations, crop conditions, weed pressure, weather and yields. Economic analysis will account for costs, yields, revenue and carbon inputs and outputs to calculate financial and energy budgets. Data will be analyzed by either repeated measures (between-subjects) ANOVA using the generalized linear models:

REPEATED subroutine of SAS 8.1, or by the standard generalized linear model (PROC GLM) of SAS. Technology transfer techniques will include Field Days, conference and classroom presentations, websites and publications, including a guidebook on Best Management Practices for Organic Soil Management.

PROGRESS

2008/06 TO 2013/05 OUTPUTS: This multi-state, long-term organic experiment was established in six states in 2008 as a comprehensive study of organic no-till production\'s effect on crop productivity, yields, soil quality, and economic performance. Wheat was grown on all plots in 2008, creating a uniform rotation history in Iowa (IA), Minnesota (MN), Michigan (MI), Wisconsin (WI), North Dakota (ND), and Pennsylvania (PA). Cover crops (CC) of hairy vetch (HV), at 25-30 lb per ac, or rye at 200-225 lb per ac, were planted in Fall 2008 and again in 2010. Treatments, in a 2 x 2 factorial randomized complete block design with treatment combinations replicated 4 times, included conventional tillage (CT) (CC disked) and no-till (NT) (CC rolled-crimped: RC) with corn (following HV) and soybean (following rye) planted the following spring. Oats were planted in all plots in Spring 2010 and 2012 to create a three-crop rotation in each system. Oat yields in previous NT corn and bean plots averaged 26.4 bu per ac compared to 71 bu per ac in previous CT plots. In NT plots where oats did not mature, oatlage yields averaged 6,249 lbs per ac. Lower yields in NT plots were associated with excessive perennial weeds, such as Canada thistle, dandelion, quackgrass and clovers, and resurgence of previously planted (2008, 2010, 2012) HV and rye. An advisory committee decision was reached to till all plots in Fall 2010 before drilling CC. In 2011, HV and rye biomass averaged 3,758 and 5,536 lbs per ac, respectively. After RC-NT or disking CC and planting cash crops in May-June 2011, corn and bean plant populations were similar between treatments; NT and CT corn populations averaged 25,690 and 24,904 plants per ac, respectively. CT and NT soybean stands averaged 136,356 and 132,658 plants per ac. A cold, wet spring in 2011 with slow seed germination led to NT soybean yields ranging from 15 to 30 bu per ac, averaging 25 bu per ac across all sites (CT yielding 36), similar to 2009\'s yields of 26 (NT) and 33 (CT) bu per ac. In IA, NT and CT soybean yields were statistically equivalent at 30 bu per ac. In 2011, NT corn suffered from winter-kill of HV and insufficient HV biomass in some cases, heavy early rains, failure of HV termination, mid-season drought (PA), excessive weeds, and lack of N, leading to an average yield of 40 bu per ac in the NT system (108 bu per ac in CT), similar to 2008, where the 5-state average was 33 bu per ac with only one (PA) site yielding 117 bu per ac. These results suggest that Midwest conditions do not support successful organic NT corn with only HV as the source of external N. Weeds were more persistent in NT than CT corn and bean plots. Only in 2 sites were annual grasses and broadleaves greater in CT over NT systems. Oats with an underseeding of alfalfa were planted in 2012 to determine if this rotation would assist in perennial weed management. NT oat yields in 2012 averaged 54 bu per ac compared to CT yields of 73 bu per ac, but weeds continued to be significantly greater in NT. Soil analysis revealed equivalent pre-experiment soil quality in Fall 2008 between treatments, but greater soil quality in NT over CT over the course of the experiment. PARTICIPANTS: Kathleen Delate, Iowa State University; Cynthia Cambardella, USDA, ARS, Ames, IA; Dale Mutch, Michigan State University; Jeff Moyer, Rodale Institute; Patt Carr, North Dakota State University; Lee Klossner, University of Minnesota; Erin Silva, University of Wisconsin; Sharon Weyers, USDA-ARS, Morris, MN. TARGET AUDIENCES: Target audiences primarily include organic farmers, but conventional farmers with an interest in transitioning to organic production are also included. Agricultural professionals, including Extension, USDA, NRCS, and Resource, Conservation and Development staff, have participated in trainings and conferences related to the Organic No-Till Project. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2011/06/01 TO 2012/05/31 OUTPUTS: This multi-state, long-term organic experiment was established in six states in 2008 as a comprehensive study of organic no-till production\'s effect on crop productivity, yields, soil quality, and economic performance. Wheat was grown on all plots in 2008, creating a uniform rotation history in Iowa (IA), Minnesota (MN), Michigan (MI), Wisconsin (WI), North Dakota (ND), and Pennsylvania (PA). Cover crops (CC) of hairy vetch (HV), at 25-30 lb per ac, or rye at 200-225 lb per ac, were planted in Fall 2008 and again in 2010. Treatments, in a 2 x 2 factorial randomized complete block design with treatment combinations replicated 4 times, included conventional tillage (CT) (CC disked) and no-till (NT) (CC rolled-crimped: RC) with corn (following HV) and soybean (following rye) planted the following spring. Oats were planted in all plots in Spring 2010 and 2012 to create a three-crop rotation in each system. Oat yields in previous NT corn and bean plots averaged 26.4 bu per ac compared to 71 bu per ac in previous CT plots. In NT plots where oats did not mature, oatlage yields averaged 6,249 lbs per ac. Lower yields in NT plots were associated with excessive perennial weeds, such as Canada thistle, dandelion, quackgrass and clovers, and resurgence of previously planted (2008 and 2010) HV and rye. An advisory committee decision was reached to till all plots in Fall 2010 before drilling CC. In 2011, HV and rye biomass averaged averaged 3,758 and 5,536 lbs per ac, respectively. After RC-NT or disking CC and planting cash crops in May-June 2011, corn and bean plant populations were similar between treatments; NT and CT corn populations averaged 25,690 and 24,904 plants per ac, respectively. CT and NT soybean stands averaged 136,356 and 132,658 plants per ac. A cold, wet spring in 2011 with slow seed germination led to NT soybean yields ranging from 15 to 30 bu per ac, averaging 25 bu per ac across all sites (CT yielding 36), similar to 2009\'s yields of 26 (NT) and 33 (CT) bu per ac. In IA, NT and CT soybean yields were statistically equivalent at 30 bu per ac. In 2011, NT corn suffered from winter-kill of HV and insufficient HV biomass in some cases, heavy early rains, failure of HV termination, mid-season drought (PA), excessive weeds, and lack of N, leading to an average yield of 40 bu per ac in the NT system (108 bu per ac in CT), similar to 2008, where the 5-state average was 33 bu per ac with only one (PA) site yielding 117 bu per ac. These results suggest that Midwest conditions do not support successful organic NT corn with only HV as the source of external N. Weeds were more persistent in NT than CT corn and bean plots. Only in 2 sites were annual grasses and broadleaves greater in CT over NT systems. Oats with an underseeding of alfalfa were planted in 2012 to determine if this rotation would assist in perennial weed management. Soil analysis revealed equivalent pre-experiment soil quality in Fall 2008, but greater soil quality in NT over CT in IA, MI, MN, PA and WI in Fall 2009 and Fall 2011. PARTICIPANTS: Kathleen Delate, Iowa State University; Cynthia Cambardella, USDA, ARS, Ames, IA; Dale Mutch, Michigan State University; Jeff Moyer, Rodale Institute; Patt Carr, North Dakota State University; Lee Klossner, University of Minnesota; Erin Silva, University of Wisconsin; Sharon Weyers, USDA-ARS, Morris, MN. TARGET AUDIENCES: Target audiences primarily include organic farmers, but conventional farmers with an interest in transitioning to organic production are also included. Agricultural professionals, including Extension, USDA, NRCS, and Resource, Conservation and Development staff, have participated in trainings and conferences related to the Organic No-Till Project. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2010/06/01 TO 2011/05/31 OUTPUTS: This multi-state, long-term organic experiment was established in six states in 2008 as a comprehensive study of organic no-till production\'s effect on crop productivity, yields, soil quality, and economic performance. Wheat was grown on all plots in 2008, creating a uniform rotation history in Iowa (IA), Minnesota (MN), Michigan (MI), Wisconsin (WI), North Dakota (ND), and Pennsylvania (PA). Cover crops (CC) of hairy vetch (HV), at 25-30 lb per ac, or rye at 200-225 lb per ac, were planted in Fall 2008 and again in 2010. Treatments, in a 2 x 2 factorial randomized complete block design with treatment combinations replicated 4 times, included conventional tillage (CT) (CC disked) and no-till (NT) (CC rolled-crimped: RC) with corn (following HV) and soybean (following rye) planted the following spring. Oats were planted in all plots in Spring 2010 to create a three-crop rotation in each system. Oat yields in previous NT corn and bean plots, averaged 26.4 bu per ac, compared to 71 bu per ac in previous CT plots. Lower yields were associated with excessive perennial weeds, including Canada thistle, dandelion, quackgrass and clovers, and resurgence of HV and rye. At one site (PA), CT perennial broadleaf (BL) weeds averaged 11 lb per ac and 52 lb per ac in NT. In 2011, HV and rye biomass averaged 3,758 and 5,536 lbs per ac, respectively. After RC-NT or disking CC and planting cash crops in May-June 2011, corn and bean plant populations were similar between treatments; NT and CT corn populations averaged 25,690 and 24,904 plants per ac, respectively. CT and NT soybean stands averaged 136,356 and 132,658 plants per ac. A cold, wet spring led to slow seed germination, but soybean yields similar to 2009\'s NT and CT yields of 26 and 33 bu per ac, respectively, are expected in 2011. In 2011, NT corn suffered from various causes, leading to low expected yields in the NT system, similar to 2008, where a 5-state average was 33 bu per ac with only one (PA) site yielding 117 bu per ac. In the renewal project, we will add N from compost or manure in NT corn, and consider a rye-vetch mixture to increase biomass. Weeds were more persistent in NT than CT corn and bean plots. The average ratios of NT to CT soybean and corn BL weeds were 85 to 1 and 1.22 to 1, respectively, although larger ratios were reported. The annual and perennial grass weed NT to CT ratio was smaller, suggesting grain crops are competitive with grass weeds in the NT system. Soil analysis revealed equivalent pre-experiment soil quality in Fall 2008, with greater soil microbial biomass carbon (MBC) in NT over CT in IA, MI, MN, PA and WI in Fall 2009. In Fall 2010, NT soil quality enhancement was seen in 5 of 6 sites in moist Midwest and PA ecosystems. In IA, MI and MN, NT residual soil nitrate-N, pH and EC were greater than in CT. Bulk density was similar at 50% of sites and higher in CT (MN, PA), indicating NT had differential soil compaction effects. Total soil N and potentially mineralizable N were higher under NT (WI), demonstrating enhanced N cycling and storage. Soil quality differences were not as apparent at the semi-arid North Dakota site. PARTICIPANTS: Kathleen Delate, Iowa State University; Cynthia Cambardella, USDA, ARS, Ames, IA; Dale Mutch, Michigan State University; Jeff Moyer, Rodale Institute; Pat Carr, North Dakota State University; Lee Klossner, University of Minnesota; Erin Silva, University of Wisconsin; Sharon Weyers, USDA-ARS, Morris, MN. TARGET AUDIENCES: Target audiences primarily include organic farmers, but conventional farmers with an interest in transitioning to organic production are also included. Agricultural professionals, including Extension, USDA, NRCS, and Resource, Conservation and Development staff, have participated in trainings and conferences related to the Organic No Till Project. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2009/06/01 TO 2010/05/31 OUTPUTS: This multi-state, long-term organic experiment was established in six states in 2008 as a comprehensive examination of the effects of organic no-till production on crop productivity, yields, soil quality, and economic performance. In order to create a uniform study background (rotation history) in Iowa, Minnesota, Michigan, Wisconsin, North Dakota, and Pennsylvania, wheat was grown on all IOP (Integrated Organic Program) experimental plots in the spring of 2008. Following wheat harvest, cover crops were seeded at all sites in Fall 2008 (September) to prepare for the initiation of the no-till segment of the study. Hairy vetch (HV) was seeded at 25 to 30 pounds per acre and rye (Aroostock) was seeded at 200 to 225 pounds per acre. Tillage treatments in Spring 2009 included conventional tillage (CT) and no-till (NT), with cover crop planted in the future NT plots as either hairy vetch (HV) or rye. Cash crops to be planted the following spring were corn (following HV) and soybean (following rye). Treatments were arranged in a randomized complete block design as a 2 x 2 factorial with treatment combinations replicated four times. In Spring 2009 (May to June, weather-dependent), cover crops were either disked in the conventional till treatment (CT) or rolled/crimped in a one-pass organic no-till system (NT) with the goal of the crushed cover crops serving as a dried mulch between corn and soybean rows throughout the season. The NT system worked well for soybean in the crushed rye in all states where soybean was grown, when rye was rolled at or post-anthesis. In general, organic soybean yields were acceptable in the NT system, averaging 26 bushels per acre compared to 33 in the CT system. The NT corn system was much more difficult, however. There was only one state (Pennsylvania) where NT organic corn yields were greater than 100 bushels per acre. The average corn yield over the remaining 5 states was only 33 bushels per acre, compared to 73 with CT. The low corn yields overall were associated with poor overwintering of the HV cover crop; a wet, cool season; high weed populations; and a corn crop relying strictly on N from the HV, with no compost, which is atypical for organic corn production. Across 6 states, HV biomass averaged 4,118 pounds per acre, with 2 of the northernmost states (MN and ND) reporting 0 and 1,800 pounds per acre, respectively. Rye biomass averaged 8,952 pounds per acre across 5 sites. In general (5 of 6 states), weeds were greater in the HV-corn NT system than the CT system. Perennial weeds were particularly problematic in the organic NT system after one full season of no tillage. Although weeds appeared to be less of a problem in the early season NT soybean plots, presumably from the rye\'s allelopathy and high density creating a thick, weed-free mulch, the rolling/crimping appeared to stimulate reproductive growth of secondary tillers, and by the end of the season, NT soybean plots had many rye plants in between soybean rows. While not critically impacting soybean yield, the presence of the rye plants at the end of 2009 led to interference with the growth of the oat crop, which followed soybean in the rotation in 2010. PARTICIPANTS: Kathleen Delate, Iowa State University; Cynthia Cambardella, USDA, ARS, Ames, IA; Dale Mutch, Michigan State University; Jeff Moyer, Rodale Institute; Patt Carr, North Dakota State University; Lee Klossner, University of Minnesota; Erin Silva, University of Wisconsin. TARGET AUDIENCES: Target audiences primarily include organic farmers, but conventional farmers with an interest in transitioning to organic production are also included. Agricultural professionals, including Extension, USDA, NRCS, and Resource, Conservation and Development staff, have participated in trainings and conferences related to the Organic No-Till Project. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2008/06/01 TO 2009/05/31 OUTPUTS: Sustainable fruit, vegetable, grain and turfgrass production systems continued to be developed for Iowa conditions from 2006 to 2009. Effective pest management practices and new cultivars will be necessary for the continued viability of sustainable/organic agriculture in Iowa. Research developed through this project included organically-approved spray treatments for codling moth in organic apples, with a multi-pronged approach of mating disruption, a spinosad-based natural insecticide, and codling moth granulosis virus affording the best control. Interest in commercial grape plantings, including organic grapes, continues to increase in Iowa. The identification of grape cultivars adapted for Iowa winters and humid summer conditions will allow growers to avoid significant losses associated with planting non-adapted cultivars. A grape cultivar by management system trial comparing straw mulch to herbicides for weed control was established at two sites representing different climatic and soil conditions in 2002. Lower pruning weights and cordon establishment were associated with the use of the straw mulch at the colder site, but not at the warmer site. At both sites, vines with a straw mulch had lower yields and smaller clusters that vines treated with herbicides. Work continues on the development of the sprayable corn gluten hydrolysate for use as a natural herbicide. Patent #5,290,749 was licensed by the Iowa State Research foundation in 2006 to a company in Ontario Canada on this technology. Production techniques were being refined in 2008 and plans are being expanded for marketing in the United States and Europe. Work continues on the use of dry corn gluten meal as a natural herbicide. That technology has been licensed to more than twenty companies in the US under patent \# 5,030,268. High tunnel production of primocane raspberries and blackberries can be profitable as the result of an expanded harvest season and high yields. However, control measures for Botrytis blossom blight and fruit rot must be taken to maintain productivity. In other grain and vegetable research projects across Iowa, organic crops fertilized with compost produced similar yields to conventional crops, and where organic corn followed alfalfa in a four-year rotation, yields were greater than the three-year rotation. Soil health parameters, including organic carbon pools and microbial biomass, remained high in organic systems, even under multiple tillage operations. Organic tomato and pepper yields were outstanding in 2008, as were organic soybeans, yielding 54 bushels/acre, even under flooded conditions. Corn yields were reduced due to floods and competition with excess weeds. PARTICIPANTS: Nothing significant to report during this reporting period. TARGET AUDIENCES: Nothing significant to report during this reporting period. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

IMPACT

2008/06 TO 2013/05 Significant outreach occurred in 2012 when investigators published 12 reports and presented 61 talks to an audience of 4,667 producers and ag professionals. Methods for enhancing soil quality in organic systems continue as the main outreach focus. In general, soil quality continues to be greater under organic NT conditions compared to CT. In 2012, soil quality differences were observed for NT treatments compared to CT, but observed differences varied among the research station sites. Soil quality enhancement under reduced tillage was particularly evident in parameters related to C cycling and storage. Particulate organic matter C (POC) was greater under no-till than conventional till in Iowa and Pennsylvania; microbial biomass C (MBC) was higher at the Wisconsin site; and macroaggregates comprised a greater proportion of the total soil mass at the Pennsylvania and Wisconsin NT sites. Macroaggregation is an integral indicator of soil dynamic change, where enhancement is also related to changes in soil structural stability and water infiltration and storage. Previously, soil quality differences were observed for NT over CT in Fall 2011 at five research sites, all of which were located in relatively moist ecosystems located in the upper and central mid-west and eastern Pennsylvania. At the MI and PA sites, residual soil nitrate nitrogen and electrical conductivity were greater under NT than CT. Extractable soil K was greater under NT in IA, MI (SD) and WI sites (SD). NT soil had more potentially mineralizable N than CT soil for 5 of the research sites with SDs at the IA, MI, and WI sites. These results demonstrate that after 4 years of organic NT management, the NT soils had greater capacity to supply N for crop growth than CT soils. Microbial biomass under NT management was increased at 7 of 11 sites in 2011 (4 showings SDs). At 2 of 11 sites, microbial biomass was greater under the rotation beginning with corn. Tillage by rotation effects were not significant. Cover crop residues in NT most likely contributed to the increases in microbial biomass, particularly for the rye cover crop, which may have persisted longer as surface cover and organic resource on which the microbiota could thrive compared to HV residues. The microbial community analysis (fatty acid methyl esters: FAME) showed substantial differences in diversity among locations, but not within a location and field site in 2011. Some profiles showed that tillage more than crop rotation had an effect on microbial diversity. Although total FAMEs within the identifiable categories were not statistically significant, slightly higher total FAMEs within gram-bacteria and fungal groups occurred in NT plots. This occurrence suggests that the build-up of surface residue under NT conditions contributed to microbial community change. These results demonstrate that after 4 years of organic NT management at three research sites in the upper Midwest and Pennsylvania, NT soils had greater capacity to retain biologically active forms of soil C and greater structural stability than CT soils. **PUBLICATIONS (not previously reported):** 2008/06 TO 2013/05 1. Carr, P.M., K. Delate, X. Zhao, C. Cambardella, P.L. Carr, and J. Heckman. 2012. Organic farming: Impacts on soil, food, and human health. In: Soils and Human Health, E.C. Brevik and L.C. Burgess (eds.), pp. 241-254, Taylor and Francis, New York. 2. Delate, K., C. Cambardella and X. Zhao. 2012. Effect of cover crops, soil amendments and reduced tillage on carbon sequestration and soil health in a long term organic vegetable system. p. 22-26. In: S. Smith, M. Peet and M. O Reilly (eds.). Proceedings of Organic Programs Project Directors Meeting, October 2012. USDA NIFA, Washington, D.C. 3. Delate, K. 2012. Environmental Benefits of Organic Farming. 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2011/06/01 TO 2012/05/31 Significant outreach occurred during this reporting period when investigators published 10 reports and presented talks to an audience of 2,839 producers and ag professionals. Methods for enhancing soil quality in organic systems continue as the main outreach focus. In general, soil quality continues to be greater under organic NT conditions compared to CT. Soil quality differences were observed for NT over CT in Fall 2011, but observed differences varied among research station sites. Soil quality enhancement under NT was observed at five research sites, all of which were located in relatively moist ecosystems located in the upper and central mid-west and eastern Pennsylvania. At the MI and PA sites, residual soil nitrate nitrogen and electrical conductivity were greater under NT than CT. Extractable soil K was greater under NT in IA, MI (SD) and WI sites (SD). NT soil had more potentially mineralizable N than CT soil for 5 of the research sites with SDs at the IA, MI, and WI sites. These results demonstrate that after 4 years of organic NT management, the NT soils had greater capacity to supply N for crop growth than CT soils. Microbial biomass under NT management was increased at 7 of 11 sites in 2011 (4 showings SDs). At 2 of 11 sites, microbial biomass was greater under the rotation beginning with corn. Tillage by rotation effects were not significant. Cover crop residues in NT most likely contributed to the increases in microbial biomass, particularly for the rye cover crop, which may have persisted longer as surface cover and organic resource on which the microbiota could thrive compared to HV residues. The microbial community analysis (fatty acid methyl esters: FAME) showed substantial differences in diversity among locations, but not within a location and field site in 2011. Some profiles showed that tillage more than crop rotation had an effect on microbial diversity. Although total FAMEs within the identifiable categories were not statistically significant, slightly higher total FAMEs within gram- bacteria and fungal groups occurred in NT plots. This occurrence suggests that the build-up of surface residue under NT conditions contributed to microbial community change. We plan to continue this long-term experiment to verify long-term changes induced by the different soil management strategies (i.e., NT and CT).

2010/06/01 TO 2011/05/31 Tremendous outreach occurred during the third year of this project when investigators wrote a total of 23 refereed or extension publications and presented 225 talks to an audience of 7,694 producers and ag professionals. Methods for enhancing soil quality in organic systems continue as the main outreach focus. In general, soil quality continues to be greater under organic NT conditions compared to CT. In Fall 2010 soil samples after the oat crop, MBC quantity ranged from statistical greater to numerically larger in organic NT over CT plots at 5 of 7 research station sites. MBC data included: IA: NT-194 mg/g, CT-185; MN: NT-218 (Significantly Different: SD), CT-191; PA: NT-190, CT-170; WI: NT-174, CT-162; MI: NT-173, CT-166; ND1: NT-273, CT-264; and ND2: NT-99; CT-102. Microbial biomass nitrogen (MBN) followed a similar trend, with significantly greater MBN in organic NT over CT at two sites (IA and PA). Rotation effects over all sites were not as consistent as tillage effects. MBN data included: IA: NT-48 mg/g (SD), CT-35; MN: NT-69, CT-65; PA: NT-66 (SD), CT-51; WI: NT-49, CT-47; MI: NT-36, CT-36; ND1: NT-42, CT-38; and ND2: NT-23; CT-23. These findings could be explained by noting that MBC and MBN quickly react to soil management changes as experienced with the NT treatment, as reduced soil disturbance from NT and higher available C and N concentration in the top soil layer has been shown to lead to increased microbial populations. In addition, higher microbial biomass content is generally considered as one of the indicators of soil fertility. On-farm soils did not reflect as clear a trend as on-station, with no significant differences in MBC or MBN between NT and CT plots. Fatty acid methyl esters (FAMEs), an indicator of the community composition of soil microbes, have been extracted and analyzed for all sites through 2009. Over seventy different FAMEs have been identified, with the majority common to all locations, and an average of 35-40 different FAMEs occurring at each location, but few differences were noted between treatments. An example of FAME richness data includes: IA: NT-39, CT-40; PA: NT-39, CT-37; and WI: NT-29, CT-34. Because all plots at each site have been under organic production, differences may not be as extensive as could be expected when comparing organic to conventional systems. The majority of shifts in FAME peaks occurred by year and did not seem to change with different tillage or rotation practices. Although most FAMEs were indicative of bacteria, the fungal peak was higher under NT management at two locations, as fungi are known to be dominant components of the microbial community under NT management. We are expecting greater distinctions between NT and CT over time. We plan to continue this long-term experiment in the renewal phase of this project to verify long-term changes induced by the different soil management strategies (i.e., NT and CT). A complete economic and energy analysis of systems across all 6 states is currently underway, including an examination of organic NT benefits in carbon-offset programs.

2009/06/01 TO 2010/05/31 Prior to cash crop planting in Spring 2009, soil quality analysis revealed no significant differences in any parameters between the NT and the CT treatments in samples taken in Fall 2008 at all sites. After the first corn and soybean season, in Fall 2009, soil microbial biomass carbon (C) values were significantly greater in NT than in CT plots at the Iowa, Michigan, Minnesota, Pennsylvania and Wisconsin research station sites. All other soil quality indicators in the study did not present any significant differences. These findings could be explained by noting that microbial biomass C quickly reacts to soil management changes as experienced with the NT treatment, as reduced soil disturbance from NT and higher available C concentration in the top soil layer has been shown to lead to increased microbial populations. In addition, higher microbial biomass content is generally considered as one of the indicators of soil fertility, despite lower yields in the NT treatment. Further research will be conducted to verify long-term changes induced by the different soil management strategies (i.e., NT and CT). A complete analysis of soil and weather properties will be conducted in 2010 to determine why the HV-corn NT system is more successful in the sandier soils in the more temperate climate of Pennsylvania. All co-PIs presented information on the No-Till project at 50 venues to more than 1,200 participants over the reporting period.

2008/06/01 TO 2009/05/31 Grape cultivars and low-input grape management systems adapted for Iowa winters and humid summer conditions have been reported through horticultural Field Days, publications and the ISU Viticulture webpage. The Turf Field Day also attracts over 1,000 people each year. Three organic Field Days were held in 2008, covering topics ranging from organic crop rotations to no-till vegetable production, reaching over 300 people. A Transitioning to Organic workshop was held in September 2008 for 60 producers from three states. The ISU Organic Ag webpage hosts all research reports and organic information covered in this project. The Iowa Organic Conference had 236 people in attendance from five states in the Midwest. For farmers utilizing organic practices, savings from avoiding petroleum-based fertilizers and pesticides in growing organic crops will result in input cost savings of \$300/acre, in addition to countless environmental benefits, such as reduced nitrate leaching from the use of compost in place of highly mobile synthetic nitrogen. The patent on the corn gluten meal material has brought in more than \$1,200,000 in royalties, which are used to further the educational capacities of ISU.

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Impact of Organic Management on Dairy Animal Health and Well-being

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NON-TECHNICAL SUMMARY

The number of certified organic dairy herds in the U.S. has been rapidly increasing to supply the needs of consumers seeking to purchase organic dairy products. The U.S. National Organic Standards contain stringent provisions regarding management of animal health and organic dairy farmers utilize a variety of management strategies to maintain animal health and produce high quality dairy products. The overall objectives of this 48 month integrated project are to 1) [assess cow health and well-being on farms that use organic management systems and 2) to evaluate, develop, and disseminate recommendations for cost-effective, preventative, health mangement programs]{.mark}. Farm visits will be conducted on 200 organic & 100 conventional dairy farms located in WI, NY and OR. A variety of data collection methods (structured questionnaire, animal observation, collection of biological samples and review of herd records) will be used to acquire animal health and management data for a 120 day period in each dairy (60 days before and 60 days after each farm visit). Management factors that influence animal well-being and farm profitability will be identified by [comparison of risk factors and disease prevalence among participating organic herds and between organic and conventional herds.]{.mark} This data will then be used to [develop cost-effective, preventative, health management programs]{.mark}. [Indicators of herd health and milk quality will be identified and used to create herd performance benchmarks]{.mark} that will be provided to participating farms. The [economic, social and management impacts of this project will be evaluated]{.mark} in the final year of the project.

Of the issues faced by row crop producers [those resulting from soil erosion and compaction and fertility loss remain the most challenging. In an effort to address these issues of soil quality,]{.mark} at least in part, many producers have successfully adopted a system that limits the number of field operations required to produce a crop. This system is commonly referred to as [no-till or reduced-till and relies on pesticides and synthetic fertilizers]{.mark} that are not allowed in a certified organic production system. The goal of this project is to design and execute a multistate, multisite, multiuser [no-till system that will allow the organic row crop producer to forego a suite of tillage]{.mark} operations that may reduce soil quality and drive up the cost of production. Over the past few years the Rodale Institute has designed and experimented with a roller/crimper field tool capable of killing a weed-suppressing cover crop. [When the roll/crimper is mounted on the front of a tractor with adequate horsepower, a planter can be mounted on the rear allowing planting to be accomplished at the same time as the cover crop is crushed. If the crushing of the cover crop results in a residual mat sufficient to suppress between row weeds, then the only remaining field operation is harvest]{.mark}. Integrating the roller/crimper tool with weed suppressing and soil-building cover crops into an organic rotation, soil quality will be enhanced by maximizing soil cover, minimizing erosion, and [improving soil organisms and biological processes and reduce ecological and economic costs and optimize yield stability]{.mark}. Improvement in soil health will be measured by tracking [nutrient cycling and biological processes, microbial populations and nitrogen mineralization rates.]{.mark} Enhanced ecosystem services on organic farms will be determined by measuring carbon sequestration, soil moisture and crop microclimates, weed suppression and biological controls through cover crop-intensive systems. Economic benefits will be measured by [accounting for returns to organic farmers resulting from the

reduction in costs of production through reduced tillage, specifically in field operation labor, reduced dependence on external sources of applied fertility, and lower energy costs]{.mark}. The information will be [disseminated at field days and conferences, publications, appropriate and a guidebook of Best Management Practices for Organic Soil Management]{.mark} that utilize a farmer-centered approach to improve soil quality in organic systems. The expected primary impact resulting from this project will be a [reliable determination of whether the roller/crimper field tool combined with cover crops can reduce the number of field operations now common among organic row crop producers and provide a significant contribution of soil quality and fertility]{.mark}. If this result is positive, it could reasonably be expected that the otherwise static organic grower base would increase. More producers would be willing to consider organic production because crops could be grown without excess weeds and tillage, soil quality would increase and they could receive premium pricing while reducing their overall economic and ecologic cost of production.

Although there has been substantial growth in scientific studies of organic production systems in the U.S. (Stinner 2007), organic livestock research is in its infancy as are studies on environmental impacts of organic animal production systems on water quality. Our proposed project represents a pioneering assessment of [effects of organic dairy and transitioning organic beef production systems on diverse aspects of water quality in the Midwest]{.mark}. Our approach will allow us to measure impacts within a controlled experiment on instrumented watersheds and on working farms within a \"living\" watershed. The organic livestock industry also is in its infancy in the U. S. (Greene et al. 2009). Consumer demand for organic meats is greater than supply (Greene et al. 2009). As this sector of the organic industry grows it is important for agricultural and environ-mental scientists, policy makers, farmers, consumers and society at large to understand environ-mental impacts of organic animal production systems on water quality. Data from our project will be especially important for NRCS personnel, as they implement 2008 Farm Bill provisions for transitioning organic and organic farmers.

U.S. agriculture is facing worldwide competition for petroleum and increased costs for fertility inputs, leaving producers to compete within the larger system or re-align their farming practices to allow participation in alternative markets, such as organic agriculture, to garner greater economic returns. Non-point source contamination from [leaching of nitrates in synthetic fertilizers is a major water quality concern in the upper Midwest, where extensive subsurface tiling drains the highly productive soils]{.mark}. Surface-water nitrate concentrations routinely have been reported in excess of the 10 mg L-1 drinking water standard. This multi-disciplinary, multi-agency project, with over 50 years combined experience in water quality and organic agriculture research, aims to assist producers in developing systems that would facilitate access to the growing organic market while improving water quality on their farms. This is a long-term, integrated project encompassing research, extension and education, targeted at meeting Program Goals to improve water quality on organic and conventional farms through the development of [science-based management practices identified as a result of state-of-the art water quantity and quality monitoring in replicated organic and conventional research station and on-farm sites.]{.mark} The [hypothesis is that the use of integrated organic crop rotations with legume and grass crops will result in improved water retention and water quality by enhancing nutrient and water cycling in the soil-plant system]{.mark}. Our objectives include the development of nitrogen budget and water balance estimates from research sites and the identification of relationships between individual/integrative indicators of soil quality and water balance/environmental/productivity endpoints. Additionally, research results will be used to calibrate and validate the Root Zone Water Quality Model (RZWQM) for organic grain cropping systems. Results will be presented in classroom and Extension programs and publications to facilitate producer involvement in self-development of water quality enhancement techniques. National environmental benefits include the reduction of crop nutrient losses, soil erosion, and pesticide transport; and improved security and quality of the food system.

Organic production of foods has grown dramatically over the last 20 years. However, few studies have been conducted to demonstrate the benefits or risk of organic production to water quality relative to conventional systems of food production. This experiment will compare a conventional system with an organic system. Information on water quality and yields will be collected. We will grow continuous corn with separate covers (crimson clover - organic production and wheat - conventional production) under conventional and conservation tillage conditions. Sediment and nutrient data will be collected from runoff waters and we will also measure the nutrients in the groundwater under the plots. Yields will be compared to determine if one system outproduces the other. Based on the information we receive, we will work with farm organizations in North Carolina and throughout the southeast to convey these results. In addition, we work with undergraduate students to link water quality and different types of production.

This research compares [organic farming to reduced-tillage and conventional approaches, both in transition and in long-term use]{.mark}, in agroecosystems of eastern semiarid Wyoming and western Nebraska. We propose to evaluate the [relative impact of these systems on soil quality, C sequestration, and greenhouse gas (GHG) emissions]{.mark}. Rising costs of fuel, fertilizer, and related inputs, along with [declining and unreliable sources of irrigation water, threaten the economic viability of agriculture]{.mark} in this semiarid region. In response to pressures that squeeze profit margins, producers are seeking alternatives that decrease costs, increase yields, or increase value while conserving water. [Organic production that incorporates reduced-tillage and crop-forage components may achieve these goals, while at the same time providing important environmental services of sequestering carbon (C) and offsetting GHG emissions]{.mark}. It is known that similar services provide alternative income streams via C markets or incentive payments in other parts of the US, but the magnitude of these services relative to conventional practices is not well documented for the Northern High Plains region. Our approach utilizes established frameworks of on-station research trials in transition from conventional to reduced tillage and organic practices, and [on-farm]{.mark} organic and reduced-tillage systems in long-term use by area producers. This three-year project integrates four research components in both transitional (on-station) and long-term (on-farm) settings under irrigated and dryland production. Research components include [measurement and modeling of: 1) soil C processes, including sequestration and GHG emissions to quantify performance of organic production relative to conventional and reduced tillage systems; 2) water use efficiency to determine short- to long-term feasibility of both irrigated and non-irrigated production in this moisture-deficient environment; 3) field- and farm scale economics to determine the need, timeframe, and level of possible incentives for transition to sequester C in organic production; and 4) energy input:output and C footprint impacts to determine true environmental impacts or services resulting from the practices.]{.mark} On-station research (transitional impacts) will take place within the framework of a long term study comparing the three approaches established at the University of Wyoming James C. Hageman Sustainable Agriculture Research and Extension Center (SAREC) in 2009. On-farm research (long term impacts) will take place on the farms of producers in Wyoming and Nebraska who are actively collaborating in studies of conventional, reduced-input, and organic approaches to irrigated crop and forage production and dryland winter wheat production. The proposed project builds upon the on-going on-station research and established relationships with farmers. It will benefit from research data currently being collected that are critical to complement the proposed set of measurements to validate biochemical and economic models we are proposing and will strengthen the quality of data inventories we are to build.

[Conversion from conventional to organic dairy farming in Northeast United States will result in enhanced ecosystem services and improved environmental benefits through the reduction in nitrate leaching and greenhouse gas emissions and increases in soil organic matter]{.mark}. Through an integrated research and education approach we plan to measure and model the greenhouse gas emission inventory of traditional and organic dairy practices at the University of New Hampshire. Field measurements of greenhouse gas emission from all components of the dairy farms will be completed. Manure-DNDC, a biogeochemical model, will be calibrated and validated for the UNH sites then applied to other organic dairy sites throughout the region. [A decision support tool will be developed to in collaboration with stakeholders, Organic Valley and Stonyfield Farms, to provide farmers training in using the tool, assistance with accessing data and information regarding the ecosystems services and environmental benefits from organic farming]{.mark}. We will engage not only with stakeholders in the dairy industry but with the K-12 community in an effort to educate both the users and the public about greenhouse gas emission inventories, organic farming and sustainable agriculture. A graduate student will work with science teachers to develop and implement inquiry based authentic research in their classrooms.

This project quantifies the [C sequestration potential and, thus, opportunities for participation in carbon trading markets of Midwestern organic grain production systems, in comparisons with their conventional and no-till counterparts, and critically assesses and validates the tools used by NRCS to rank applications for enrollment in the CSP]{.mark}. The results generated from farm surveys for the Conservation Measurement Tool (CMT) and Soil Conditioning Index (SCI) out of RUSLE2 will be compared against direct measures of soil performance in organic, conventional, and no-till management systems. The education and outreach components of this project will deliver research results and address basic questions identified by our group of stakeholders. In addition, a conference on Organic and Carbon Sequestration and the development of training modules for Certified Crop Advisors, Extension educators, and other service providers will set the stage for other activities designed to promote awareness and increase stakeholder knowledge of C sequestration and other conservation goals, C markets, and their benefits.

In this proposal we plan to integrate and teach community college students agricultural activities through organic farming production; and second, [guide organic transitional farmers in the acquisition of technology for sustainable growth in horticulture practices and pest management in South Texas]{.mark}. Texas AgriLIFe Extension service and South Texas College (STC) in the Rio Grande Valley will be partners in this project. [Students of STC will apply and compete for scholarship funds presenting a project in organic farming]{.mark}. [A panel composed by STC faculty, invited experts, and local organic growers will judge the projects]{.mark}. We will develop [two organic demonstration sites]{.mark} located in San Juan and Weslaco. These sites will be used for student\'s studies and public visits. Also, we will [conduct studies in organic farms of local growers; these studies will deal with horticultural practices such as the use of cover crops, and manure applications]{.mark}. We plan to [develop an organic pest management program for local growers. The latter will be completed in large organic and conventional farms, there we will compare control strategies of pests, natural enemy abundance, and evaluate costs under these two management programs]{.mark}. Finally, we propose to develop, along with comparison of production practices and crop enterprise budgets, [carbon sequestration/emission analysis of different organic production practices]{.mark}. All findings in this proposal will be delivered to growers, students and researchers in print form, on the web, and/or at conferences throughout the three year program.

The [relationship of organic practices with soil properties, crop performance, and resistance to pests has been identified as one of the most important research needs by organic farmers.]{.mark} This multi-disciplinary, multi-state project addresses critical stakeholder needs for [improving organic vegetable farming practices to optimize pest management, crop quality, and profitability, while enhancing soil quality to help mitigate global climate change]{.mark}. The long-term goal of the proposed project is to provide organic producers with science-based information they can use to make decisions affecting the sustainability of their operations. This multi-region study will be conducted across two contrasting soil types (low vs. high fertility) and climatic conditions (sub-tropical vs. temperate) to yield widely applicable results. [On-farm trials will be conducted with cooperating farmers to strengthen the on-station research and contribute to more effective outreach]{.mark}. Results from this project will be disseminated to a broad audience involving organic producers, researchers, extension agents, policy makers, and students, through a variety of methods including field days, conference and classroom presentations, focus groups, publications, and e-Organics. [Potential economic, social and environmental benefits will include an accurate assessment of the effect of compost, cover crops, and reduced tillage, on soil indicators related to soil and water quality, vegetable crop yields, pest status, quality attributes of vegetables, and economic performance]{.mark}. Annual C budgets for each phase of the 3-yr rotation will be used to calculate C budgets for entire rotation, along with a quantification of changes in soil profile C storage and in C distribution within the soil profile. Surface samples will be used to evaluate soil biological, chemical, and physical properties related to soil quality and mathematical relationships will be developed between individual soil quality indicator variables or the integrative index and environmental (i.e., [leached NO3-N concentrations and CO2 flux]{.mark}) and productivity (i.e., vegetable yield) endpoints. Stakeholder engagement has been key throughout proposal development, as organic vegetable growers in each state are considered peers with researchers. An advisory panel will be established to provide suggestions and feedback throughout the project, ensuring successful generation of applicable outcomes that place direct benefits in the organic agriculture community.

Soil conditioning is a core tenet of successful organic production. [Rotational systems]{.mark} for this purpose have been successfully implemented nation-wide contributing to the 15% annual increase in organic production for the last decade. However, [comparatively few systems have been utilized within the Southern Coastal Plain of Florida, Georgia and Alabama which provides the majority of fall/winter vegetables for much of the US. These states have less than 0.3% of the national acreage for organic production. Poor soils, high temperatures and humidity pose unique regional problems]{.mark}. Over the last decade we have developed and tested rotational and tillage systems that are highly amenable to incorporation into organic production. Sod rotations including 2-year plantings of bahiagrass have repeatedly been shown to increase soil carbon and water retention, reduce fertilizer and irrigation inputs, and produce higher yields for a variety of crops. We have also shown that strip tillage coupled with cover crops further enhances soil carbon sequestration, organic matter and moisture retention. Our [long growing seasons allow year-round conditioning of the soil, and potentially expedite transition from conventional to organic systems. Moreover, the high ability of bahiagrass to sequester both carbon and water are in concert with responsible land stewardship]{.mark}. We will test the effects of these rotational and tillage systems for organic vegetable production in the Southern Coastal Plain. Crop rotations and tillage will be [evaluated on an ecological level (carbon sequestration, plant biomass, and carbon, nitrogen and nutrient partitioning, water usage), plant (yield, fruit quality, etc.) and economic level]{.mark}.

OBJECTIVES

The overall objective of this long-term project is to assess dairy cattle health and well-being on farms that use organic management systems and develop and disseminate recommendations for cost-effective, preventive health management programs for dairy cattle on organic farms. Specific aims are: (1) Identify and address unique methods used by organic dairy farmers to define, detect, monitor the severity, treat, and judge the efficacy of disease treatment interventions. (2) [Compare disease prevalence, severity, economic consequences, and management-related risk factors among organic dairy farms]{.mark} with the aim of identifying management factors that influence animal well-being and farm profitability. (3) Use indicators of herd health & milk quality identified in participating organic and conventional dairy farms to create benchmarks that can be used to help farmers recognize and diagnose problems and optimize animal well-being and farm profitability. (4) Provide participating farmers with diagnostic animal health and milk quality data on their farms, coupled with comparisons to benchmarking data for other conventional and organic herds participating in the study. (5) Use our data and analytical results to develop & disseminate information and extension recommendations for preventive health management of organic dairy cattle, consistent with maximizing milk quality and net farm income.

Organic row crop and small grain producers rely on a suite of tillage operations to control weeds thought to lead to soil degradation. Further, many organic producers require off-farm inputs to maintain fertility. Thus, the long-term goal of this project is to provide a regional range of models of organic compliant no-till production systems to row crop and small grain producers that will avoid much if not all tillage operations and decrease the dependence on off-farm fertility inputs through the use of [leguminous cover crops]{.mark}. To reach this goal, over the course of 3 years, [experiments in 6 states]{.mark} will be conducted and analyzed. All the experiments will demonstrate the use of an experimental roller/crimper field tool and integrate weed suppressing and soil building cover crops in an organic crop rotation. The objective of each experiment will be to determine the effectiveness of the individual system in terms of soil quality by maximizing soil cover, minimizing erosion, and improving soil biological processes, increasing fertility, reducing ecological and economic costs and optimizing yield stability. The experiments will be conducted at university and on-farm sites to provide analysis of system performance over a wide range of field and operator conditions. As the analysis of the experiments proceed a data base of field operations, weather conditions, soil health parameters, fertility profiles, crop performance, equipment effectiveness and weed suppression will be compiled. This data base will be used in compiling the yearly reports on the experiments. Yearly reports will be presented to producers during [annual field days at 6 university sites and 6 on farm sites.]{.mark} Additionally the reports will be presented to producers at regional organic conferences at Iowa State University in November and in February at the Upper Midwest Organic Conference in La Crosse, Wisconsin. The 3 year result of the experiments will also be analyzed and presented to a peer reviewed journal for publication and for oral presentation at the annual conference of the American Society of Agronomy. Other outputs will be extension publications from each participating university and additional presentations to local groups, such as the Neely-Kinyon Association in Greenfield, Iowa. A guidebook of Best Management Practices for Organic Soil Management will be published within 6 months of the end of the project to serve as a reference to all producers who seek to improve soil quality.

A multi-disciplinary and multi-institutional team from The Ohio State University (OSU) and USDA-ARS Northern Appalachian Experimental Watershed (NAEW) will investigate the impact of organic and conventional grazing practices on water quality and quantity on headwater tributaries of the Muskingum River in NE Ohio. This project has the [long-term goal providing science-based information to organic dairy and beef farmers to enhance profitability, competitiveness, and water quality.]{.mark} Specific goals are: 1. Determine effects of transition of beef cattle, intensively and continuously grazed pastures to certified organic management practices on surface and subsurface water quality and quantity on experimental gauged watersheds at the USDA-Agricultural Research Service (ARS), Northern Appalachian Experimental Watershed. 2. Compare effects of organic and conventional dairy production systems on Headwater Habitat Evaluation Index (HHEI) and water chemistry in headwater streams of the Mill Creek and Sugar Creek watersheds in NE Ohio. 3. Conduct extension programming for organic and transitioning organic dairy and beef pro-ducers that will enhance their competitiveness and enhance water quality. 4. Conduct educational summer internship programs for secondary and university students and integrate information from objectives 1 and 2 into Ohio State University classes.

1. Design [integrated, multi-functional organic crop rotations that include legume and grass crops for improved water retention and water quality enhancement, based on stakeholder input in focus groups prior to the establishment of research site]{.mark}s; 2. [Establish experimental systems at University and on-farm sites]{.mark}, including extensive instrumentation to monitor water quantity and water quality; 3. Develop recommendations for methods to improve water quality based on results derived from agronomic and soil data, tile drain water flux and water quality, and simulation models: a. Develop nitrogen budget and water balance estimates; b. Develop relationships between [individual/integrative indicators of soil quality and water

balance/environmental/productivity endpoints]{.mark}; c. Calibrate and validate the [Root Zone Water Quality Model (RZWQM) for organic grain cropping systems]{.mark}; 4. [Enhance economic performance of farms that develop Best Management Practices (BMPs) for managing water resources;]{.mark} and 5. Develop and offer educational projects through specific class modules taught at Iowa State University, and technology transfer techniques with farmer networks, that enhance understanding of water quality and organic farming connections for undergraduate/graduate students, farmers, Extension, and policymakers. Expected outputs from Objectives 1, 2, and 3 of this project include the development of a new site for tile drainage water quality research in certified organic systems at the ISU Agronomy Research Farm. Once the infrastructure for tile drain water monitoring has been installed, the site will provide the opportunity for long-term studies to accurately assess water quality for the extended cropping rotations typically used in organic agriculture. The project will provide unique data, including model calibration and validation of the RZWQM for organic systems, that quantifies the impact of extended organic cropping rotations and pasture systems on subsurface tile drain water quantity and quality. Possible limitations include similar potential limitations for any water quality study: difficulty in calibrating drainage flow from each plot or failure of some plots to drain adequately due to differences in soil type at the site. Expected outcomes from Objectives 4 and 5 include a better understanding of water quality parameters and BMPs by local communities resulting from the demonstrations and educational modules; more efficient organic crop and animal production systems; and more vibrant local communities resulting from additional economic activities associated with diversified farming and marketing systems.

The goal of this project is to measure and model [nonpoint source pollution (nitrogen (N), phosphorus (P) and sediment) associated with organic and conventional vegetable farming systems under different tillage practices in the Appalachian Mountains of North Carolina]{.mark}. The objectives of the proposal are seven fold: 1) evaluate nutrient and sediment concentrations and loads in surface runoff, and groundwater nutrient concentrations from long-term conventional and organic systems, 2) evaluate nutrient and sediment concentrations and loads from surface runoff and groundwater nutrient concentrations from long-term tillage (conservation and conventional) under conventional and organic systems, 3) evaluate [soil organic matter (total and particulate), cover crop biomass and N in order to relate changes in soil properties to nutrient and sediment runoff,]{.mark} 4) [evaluate crop yield, nitrogen uptake and calculate nitrogen use efficiency of the different treatments]{.mark}, 5) evaluate the predictive performance of the Agricultural Policy Environmental Extender (APEX) model, 6) transmit study results to organic and conventional producers, state agency personnel, regional and national audiences (extension), and 7) transmit study results to undergraduate students and interns (students), and the agricultural community as a whole (education). Extension outputs include: Stakeholder involvement through a board that will communicate yearly through Elluminate Live! conferencing software supported by NC State University. Using eOrganic, we will create information-rich summaries of our and additional water quality related data that will be disseminated throughout the organic agriculture community quickly and efficiently. [We will provide information about 1) cover crops, 2) no-till and reduced tillage in organic agriculture, and 3) policies farmers should be aware of related to water quality in agricultural systems at the annual Carolina Farm Stewardship workshop and to the organic grain producers at the annual North Carolina Corn Growers Association.]{.mark} Additional presentations will occur in North and South Carolina to vegetable growers, at the annual meeting of the American Society of Horticultural Science, at the Summer Vegetable Field Day at Mountain Horticultural Crops Research Station, the NC Crop Protection Association, and the NC Plant Food Association. State-based fact sheet will be produced for North Carolina Producers and distributed at field days and grower meetings. Information from this project will be incorporated into information on conservation effectiveness derived from the national CSREES-CEAP project. A workshop will be organized for small and limited resource farmers to promote adoption of the appropriate tillage system. Teaching outputs include: We will provide a 1-credit course on water quality to graduate students who are working in the realm of organic farming systems or agroecology to enhance their understanding of the relationship between agricultural production and nonpoint source pollution. In addition a one hour lecture will be delivered, Soil Agroecology (SSC 495).

This research compares organic farming to reduced-tillage and conventional approaches, both in transition and in long-term use, in agroecosystems of eastern semiarid Wyoming and western Nebraska. We assess the relative impact of these systems on soil quality, C sequestration and greenhouse gas (GHG) emissions. Our approach utilizes established frameworks of on-station research trials in transition from conventional to reduced tillage and organic practices, and on-farm organic and reduced-tillage systems in long-term use by area producers. Results will provide much needed inventory of GHG emissions and C storage and will support development and improvement of predictive biogeochemical, water use, and economic models for irrigated and dryland cropping systems. These outcomes will support producer decision making and government planning for possible incentive programs. They will also highlight specific needs for development of practices and technologies for improvement of environmental services with organic practices. We believe it is important to evaluate organic practices side by side with both conventional and reduced-tillage approaches for two reasons: 1) to determine [whether organic production practices achieve environmental services provided by reduced-tillage practices already incentivized under USDA conservation programs]{.mark} and the CCX, and 2) to investigate [possibilities for better integrating reduced-tillage practices into organic production]{.mark}. Research components include measurement and modeling of: 1) soil C processes, including sequestration and GHG emissions to quantify performance of organic production relative to conventional and reduced tillage systems; 2) [water use efficiency to determine short- to long-term feasibility of both irrigated and non-irrigated production in this moisture-deficient environment]{.mark}; 3) field- and farm scale economics to determine the need, timeframe, and level of possible incentives for transition to sequester C in organic production; and 4) energy input:output and C footprint impacts to determine true environmental impacts or services resulting from the practices. On-station research (transitional impacts) will take place within the framework of a long-term study comparing the three approaches established at the University of Wyoming James C. Hageman Sustainable Agriculture Research and Extension Center (SAREC) in 2009. On-farm research (long term impacts) will take place on the farms of producers in Wyoming and Nebraska who are actively collaborating in studies of conventional, reduced-input, and organic approaches to irrigated crop and forage production and dryland winter wheat production. The proposed project builds upon the on-going on-station research and established relationships with farmers. It will benefit from research data currently being collected that are critical to complement the proposed set of measurements to validate biochemical and economic models we are proposing and will strengthen the quality of data inventories we are to build.

The goal of our proposed research is to [develop a decision support tool for quantitatively evaluating the best management practices (BMPs) to enhance the ecosystem services produced by livestock systems at the site and regional scale for the Northeast U.S.]{.mark} Our specific objectives are: 1. Test and improve Manure-DNDC using farm-level observational data. A suite of research farms at UNH will be used as primary sites for testing the applicability of Manure-DNDC for the Northeastern livestock farms. Some additional sampling and chemical analysis will be conducted to quantify the primary of [C and N biogeochemical stocks and flows across farm facility components]{.mark}. Data will be utilized for modifying, calibrating, and validating Manure-DNDC. 2. Quantify the impacts of baseline and alternative management practices on the ecosystem services of the selected farm with Manure-DNDC. A baseline scenario and a group of alternative management scenarios will be designed based on the current and prospective management practices for the UNH farms. BMP scenarios will be identified and evaluated based on their ecosystem service and economic incentives for the farm. 3. Develop Northeastern U.S. GIS database to support Manure-DNDC applications at regional scale. To make Manure-DNDC useful for dairy farms in the Northeast, we will create a GIS database containing necessary input information of climate/weather data, soil properties, livestock and crop parameters, and default management practices required to run Manure-DNDC for the region. The data will be collected from a variety of sources and stored in a geo-referenced database in the Manure-DNDC required format. 4. Develop a decision support tool by developing a user-friendly interface to link Manure-DNDC to regional database. The interface will [allow the user to select a specific location or a region, automatically extracting the required information from the database, allow the user to modify the default data to their own site specific conditions, execute Manure-DNDC, and provide modeled results in graphical and tabular form.]{.mark} 5. Evaluate the decision support tool. A two-day workshop will be held during the third year of the project to teach interested parties to use the decision support tool and to get their assessment of its usefulness and potential improvements. After reviewing the feedback from the users, the decision support tool will be modified and finalized. 6. Integrate the research objectives with an educational initiative that partners a graduate student with science teachers and their students. A partnership between middle and high school science teachers and a Ph.D. level graduate student will be established to enable the graduate student to build communication skills around greenhouse gas inventories, organic farming and sustainable agriculture and promote authentic inquiry-based research projects with middle and high school teachers and students.

The long-term goal of this project is to [provide individual organic growers with research-based tools and recommendations to guide them in selecting practices to optimize the conservation, greenhouse gas (GHG) mitigation, and soil quality benefits of]{.mark} their production systems (ORG Priority 1); and to provide metrics relevant to organic production systems that allow growers to quantify environmental services, qualify for current cost-share programs or potential carbon credit programs, and predict optimal practices (ORG Priority 2). The specific objectives proposed in support of this long-term goal are as follows: Research Objectives: 1. Evaluate the [carbon sequestration potential of organic farming systems in comparison to their no-till and conventional counterparts in a variety of regions within the state of Illinois]{.mark}. 2. Use [on-farm research to critically assess and/or validate tools farmers can use to improve management of soil organic matter, soil and water quality, and nutrient use efficiency and to reduce their carbon footprint]{.mark}. 3. Identify and refine tools or protocols that help a diverse array of organic farmers achieve their stewardship goals in a socially and economically viable manner. Education and Extension Objectives: 4. Hold a conference to raise awareness among organic farmers and other conservation-minded growers about the potential for farming practices to contribute to carbon sequestration and other conservation goals, and about opportunities to benefit from conservation programs and carbon markets; and to develop contacts between farmers and agency/service providers. 5. Provide online educational resources for organic and other conservation-minded growers about farming practices and their relationship to carbon sequestration and other conservation goals, and about supporting programs and markets. 6. Develop a training module and supporting educational materials to train certified crop advisors, Extension educators, and other service providers about the role of organic and other conservation practices in promoting carbon sequestration and other environmental services, and about conservation programs, tools, and markets that can reward farmers for adopting these practices. Furthermore, an outreach effort will be implemented to make this information more available and accessible to farmers, Extension educators, and decision makers wishing to apply and improve organic soil management practices in order to achieve both conservation and production goals. Outreach objectives will be met through delivery of educational materials to raise awareness of C sequestration and other conservation practices by using conference settings, factsheets, webinars, and other web related resources.

The main goal of this project will be to teach community college students about organic agricultural farming, and advice large and small organic farmers the production of sustainable farming systems through demonstrations, in situ tests and publication of educational material through the web and print in Spanish and English. We will accomplish this with the following objectives: 1.To promote organic farming development through scholarships programs for STC and student participation in demonstration farming sites. 2.To establish demonstration sites for organic vegetable producers. 3.To [evaluate horticultural practices to improve soil fertility and reduce erosion]{.mark} 4.To evaluate organic arthropod pest management in demonstration sites and large plot farms. 5.To evaluate carbon sequestration and study the feasibility for organic production 6.To deliver all sections included in this project using diverse media and delivery systems

In this project, we will be addressing the goal of investigating the environmental services provided by organic farming systems that support soil conservation and contribute to climate change mitigation. The Objectives to achieve project goals are: 1. [Encourage organic transition by developing and establishing organic vegetable cropping systems that maximize soil quality, foster carbon sequestration, and minimize nutrient loss through cover crops, composting, and reduced tillage]{.mark}; 2. Develop [recommendations for methods to enhance ecosystem services and improve soil quality on organic vegetable farms based on results derived from horticultural, soil, gas flux, and soil water data]{.mark} in experimental sites a. Develop annual and full-rotation carbon (C) budgets from sites b. Develop relationships between [individual/integrative indicators of soil quality and environmental/productivity endpoints]{.mark}; 3. Determine how [product quality and shelf life are affected by different management practices in organic systems and identify relationships among soil properties, crop health, and postharvest quality]{.mark}; 4. [Increase economic returns for organic vegetable growers by reducing costs of production in field operations and labor, decreasing dependence on external sources of applied fertility, lowering energy costs, and obtaining carbon/emission credits]{.mark}; and 5. Develop and offer educational programs on organic vegetable production and postharvest handling for [farmers, students, and agricultural professionals]{.mark} to facilitate the transition to organic production.

Our primary objective is to integrate the advances that we have made on sod-based rotation and strip tillage into organic systems for vegetable production in the Southern Coastal Plain. Our methodologies are based on the long term enrichment of soil characteristics, which is also a requirement for any successful, sustainable organic system. Experiments will be designed so [that these technologies can be compared directly to alternative techniques]{.mark} currently being used for organic production in the Southern Coastal Plain. We will assess each of these techniques from a production, as well as an environmental standpoint. Adoption of these systems will promote land stewardship practices designed to rejuvenate depauperate soils. Objective 1. Experimental Design. To develop and implement a system of organic vegetable production based on: 1) [sod-rotation (2 year rotations of bahiagrass), and; 2) strip-tillage for vegetable crops in the Southern Coastal Plain. A 2 x 2 split plot design will be used so that each technique (sod-rotation and tillage) can be compared]{.mark}. Objective 2. Production and Profitability. To evaluate each component (sod-based rotation and tillage) of the system in terms of [productivity]{.mark} (plant biomass, yield, fruit quality, plant physiology), and [pest impacts (arthropods, pathogens, nematodes and weeds).]{.mark} [Enterprise budget]{.mark} will be constructed. Objective 3. [Ecological Impacts. To evaluate each component (sod-based rotation and tillage) of the system in terms of ecological impact with emphasis on soil conditioning (soil carbon sequestration, soil organic matter, and soil moisture retention), and water quality.]{.mark} Chemical analyses of plant material and ground water will also be conducted and budgets can be constructed to fully examine the effects of treatments on [carbon, nitrogen, and water budgets in these syste]{.mark}ms. Objective 4. Outreach. We will establish an effective outreach program to disseminate knowledge about these techniques to those interested in organic production. The proposed project activities are intended to have the following anticipated outcomes: 1) Conventional and limited resource farmers will gain knowledge and skills to incorporate organic production and marketing as viable alternatives to farm operations; 2) Development of an effective outreach and education model for introducing organic production and marketing to limited-resource audiences; 3) Use of Farmers\' markets by all targeted sectors will increase; 4) Acreages of organic production will increase; 5) Local availability of organic produce will increase; 6) New markets for limited resource farmers will be developed; 7) New organizations of organic growers of all types will be implemented, and; 8) Publicity of the accomplishments and the application of the results will be presented, and extramural funding leveraged by the strategic rotations will increase dramatically.

APPROACH

This study is designed as a prospective cross-sectional study using stratified random sampling to enroll a representative sample of dairy herds. A total of 200 organic and 100 conventional dairy farms located in New York, Oregon and Wisconsin will be enrolled in the study. Trained study personnel in each state will collect retrospective and demographic data during a single scheduled farm visit that will occur within an 18 month data collection window. Prospective data will be collected and submitted by farmers using specified data collection forms for the 60 days following the farm visit. Data on the incidence, severity and economic consequences of [selected diseases]{.mark} will be collected. Extensive data will be collected for [mastitis.]{.mark} To identify pathogens responsible for clinical mastitis, the farmer will be instructed to submit single quarter milk samples from all cases of clinical mastitis that occur in the 60 day post-visit surveillance period. Additional disease data will be collected for each of the following diseases that occur in adult cows: [Respiratory disease, metabolic disease, foot disorders and reproductive disorders]{.mark}. Data (symptoms, clinical diagnosis, usage of veterinarian, methods & cost of treatment, duration of treatment, mortality and culling within 60 days of diagnosis) will be collected on selected diseases that occur in [calves: pneumonia, diarrhea, other non-specified disorders]{.mark}. Indicators of overall herd health will be collected by retrieval of farm records and selected observations during the farm visit. [Food safety risks will be evaluated by using the bulk tank milk sample to screen herds for Listeria monocytogenes, Salmonella DT104 and Shiga toxin producing E.coli.]{.mark} In year 4, data will be collected from the herds using a mail survey to assess the impact of the extension materials developed and disseminated as a result of data collected in this study. The collected data will be analyzed to establish distributions and measures of variation for herd performance. A number of key performance indicators (KPI) will be determined so that farms can understand how their farm performance compared to their peer farms. A report will be generated that will include a visual display that includes comparative indices for each key performance indicator. As part of the extension component of the project, in the third & fourth years of the project, farmers will be given an opportunity to send in updated information for selected KPI and receive an updated annual benchmarking report. Evaluation of impacts will occur in the 4th year of the project. [All participating farms will be surveyed to determine changes made as a result of this project. Farm representatives will be asked to estimate the economic, social, and environmental value of these changes using a scale of -5 to +5 for each category]{.mark}.

Organic crop rotations to examine the effect of tillage and crop sequence on soil quality, yields, weed populations and economic performance in spring 2008. Tillage and crop sequence treatments will be a randomized complete block design as a 2 X 2 factorial experiment: tilled (disking) versus no-till (rolling/crimping) and [wheat-rye/bean-oat-vetch/corn versus wheat-hairy vetch/corn-oat-rye/bean]{.mark} and will be replicated 4 times at each location. Minimum plot size is 30 X 50 ft. Spring wheat will be the rotation baseline, followed by rye and hairy vetch to be terminated in the spring by disking or by roller/crimper. Pinto beans (western ND) and soybeans (all others) will be drilled into the cover crop treatments in 2009. Corn will be seeded into disked or rolled/crimped hairy vetch at all sites. In the no-till plots, a front-mounted roller/crimper and rear-mounted seeder will plant the corn and bean plots. Those same crops will be seeded in the tilled plots. Oats will be drilled in March 2010 in all plots and followed by rye and hairy vetch. In 2011, pinto beans (ND) and soybeans will be seeded directly into the disked or rolled/crimped rye and corn will be seeded into disked or rolled/crimped, hairy vetch. Soil samples will be collected from each plot in fall 2008 and 2010. Cover crop density will be determined by counting hairy vetch and rye plants in 3 areas in fall 2008, 2010 and spring 2009 and 2011. Fall and spring plant densities will be compared to determine winter hardiness and biomass. Disking or rolling/crimping effectiveness in terminating cover crop growth will be assessed 14 days after the operation. Stand establishment of corn and beans will be assessed 21 days after seeding by counting randomly selected plants in 17-ft of three 30-inch rows. Oat stand will be determined by counting plants within three 1-m2-quadrat areas in each plot. N fertility in corn plots will be evaluated in each treatment in the corn and bean years (2009 and 2011) through the Late-Spring Nitrate Test and the Corn Stalk Nitrate test. Bean and corn yields will be determined. Above-ground weed biomass will be determined prior to terminating cover crop treatments and when subsequent crops reach maturity. Light penetration will be used to assess weed suppressive potential of cover crops. From April to November monthly soil moisture will be measured at a sampling depth of 6, 12 inches and 36 inches in semi-arid sites. Weather conditions will be recorded at station sites. Data collected on-farm will include field histories, planting dates, equipment settings, field operations, crop conditions, weed pressure, weather and yields. Economic analysis will account for costs, yields, revenue and carbon inputs and outputs to calculate financial and energy budgets. Data will be analyzed by either repeated measures (between-subjects) ANOVA using the generalized linear models: REPEATED subroutine of SAS 8.1, or by the standard generalized linear model (PROC GLM) of SAS. Technology transfer techniques will include Field Days, conference and classroom presentations, websites and publications, including a guidebook on Best Management Practices for Organic Soil Management.

We will determine effects of transitioning intensively and continuously grazed beef cattle to certified organic management on surface and subsurface water quality and quantity using replicated gauged watersheds at NAEW; compare water chemistry and Headwaters Habitat Evaluation Index (HHEI) on paired organic and conventional dairy farms in headwater streams of the Muskingum watershed; conduct extension programming for organic and transitioning organic dairy and beef producers to enhance their competitiveness and enhance water quality; and conduct educational summer internship programs for secondary and university students and integrate research output into OSU classes. The experimental and on-farm data will be integrated and extrapolated into the future using the ArcAPEX modeling system. One unique feature is use of the HHEI developed by the OhioEPA to assess the biological health of headwater streams. Another is the participation at all stages in the research and outreach of the Small Farm Institute, a grassroots stakeholder organization specializing in grazing agriculture. The scale of this research, \~200 km2, and the integration of research and outreach from the start will ensure that the outreach, both extension and education, will be widely applicable.

Research will be conducted at a field site located on the Iowa State University Research Farm near Boone, IA. The field was transitioned to organic management in 2006 and will remain in oats/alfalfa through 2010. Thirty field plots (30.5 m by 32 m) will be established in spring 2010. The plots will be arranged in three tiers along the long axis of the field. Each tier will be separated by a 12.2 m grass alleyway. Installation of the tile drainage tubes and water-monitoring infrastructure will occur in August 2010 after stakeholder input and extensive site analysis to isolate the near subsurface drainage in order to obtain tile water flow (water quantity) and tile water nutrient concentrations (quality) from each plot. A 20.3-cm diameter drainage pipe will be installed to a depth of 1.2 m around the entire perimeter of the field to isolate the site drainage from surrounding field drainage. A perforated, 10.2-cm diameter corrugated drainage pipe will be installed 1.2 m below the surface lengthwise down the center of each plot. Drainage from each plot will be conducted by solid plastic pipe to one of five sump pits. Within each sump pit, drainage from six plots will be collected into dedicated sumps for measurement of flow volume and flow-weighted sampling for nitrate analysis. A hydrologic barrier will be buried to a depth of 1.2 m on the east and west border of each plot to prevent subsurface lateral flow of water between the plots. To prevent subsurface lateral flow between the plots at the north and south plot border, a 10.2-cm drainage pipe will be installed within the grass alleyways to a depth of 1.2 m. Water from the perimeter tile and the horizontal tiles will be diverted to a county tile located close to the field site. Ultimately, after the tile water is sampled under each plot, the excess water will be also diverted to the county tile. Tile drainage from each plot will be collected in dedicated sumps with a pump that empties the sump whenever the water level exceeds a preset level. Only the center drainage line will be monitored for drainage volume and NO3-N concentration. Flow from each pump will be monitored through a combination electrical and mechanical totalizing flow meter with flow volume versus time recorded with a data logger. Flow proportional water samples are composited over approximately weekly intervals via a capillary tube connected to each sump pump outlet. Water samples will be taken to the laboratory, refrigerated, and analyzed for (NO3+NO2)-N using a colorimetric method and flow injection technology. Nitrate-N loads will be calculated by multiplying the NO3-N concentration for the composite sample by the total volume of drainage during the compositing. Water and nutrient balances will be calculated from this system, along with agronomic parameters, including crop growth and yield.

Agricultural treatments include [1) organic management + conservation tillage, 2) organic management + conventional tillage, 3) conventional management + conservation tillage, 4) conventional management + conventional tillage, and 5) control - treatment is plowed, disked, and planted and there are no additional inputs of fertilizer or pesticides. Only cover crops and source of nutrients will differ in the organic and conventional systems in order to minimize confounding of water quality data with crops cropping systems. Crimson clover is the cover of choice for organic producers and wheat is the cover crop of choice by producers of conventional systems]{.mark}. We will apply the same amount of N to both treatments: 200 lb N ac-1, either as NH4NO3 (conventional system) or dairy manure (manure + urine+ water) and N derived from crimson clover (organic system). We will count sweet corn populations and take two recorded harvests to remove all marketable fruit. We will also measure biomass production of the stover. Tissue sample from both the stover and fruit will be harvested and analyzed for total N. We will obtain total soil C measurements at the outset of the experiment and once annually for the duration of the project using the dry combustion. Standard soil tests will also be carried out at this time including all major soil macro- and micro-nutrients, cation exchange capacity, base saturation and pH. We will also determine levels of particulate organic matter leaving the treatment plots in each rain event in sediment. The proposed monitoring will characterize total loads of N, P, and sediment. Plots will be delineated via landscape edging with one end buried at least 2 inches underground in order to isolate the surface water hydrology of each plot. At the downslope end of each plot, a diversion or collection trough will be installed to funnel the runoff to a central outlet point. A monitoring station will be established at the outlet point of each plot and collected samples will be analyzed for TN, NO3-N, and NH4-N. Dissolved organic N will be calculated as the difference between TN and NO3-N + NH4-N. The nonacidified sample will be analyzed for total suspended solids and PO4-P. Based on initial data, one groundwater monitoring well will be established in each plot that is screened from the top of the groundwater to at least 0.6m below and samples will be analyzed for NO3-N, PO4-P, Cl, TN and DOC. The data will be analyzed to determine if management activities directly impacted water quality. Statistical analysis for the water quality and yield data will be performed using the SAS software program. PROC MIXED will probably be used and we will determine the normality of the data to determine if transformations are required.

1. Document and model soil quality, C sequestration, and GHG associated with organic production practices. This work combines monitoring of soil GHG emissions and SOM dynamics in irrigated and dryland agriculture. Data from organic transition comes from plots established in 2009 at SAREC. Data from long-term organic management comes from fields of collaborating farmers in both states. Some data on soil quality and economics will be supplied by current or recently completed projects, while GHG, water use, and energy ratio/C footprint data will be collected under this proposed work. Data will contribute to documentation of effects of both irrigated and dryland organic production practices on soil quality and C sequestration, and will be used to validate DayCent biogeochemical model for predicting C storage and GHG emissions in the northern High Plains region. 2. Document and model the soil water dynamics, water use, and water use efficiency associated with organic production practices. This study monitors soil moisture in dryland and irrigated cropping systems. Data will be collected from on-station experiments established in 2009 at SAREC and from on-farm of collaborating farmers in Wyoming and Nebraska. The information will contribute to documenting the effects of different cropping systems on soil water dynamics and water use and water use efficiency. 3. Document and model economic and energetic parameters of organic production. This work analyzes the overall profitability and efficiency of organic, reduced-tillage and conventional systems for the study area. Economic performance will be measured both long term and during the period of transition. The economic analyses will include scenarios that include revenues for trading C based on the existing market and empirical data on C sequestration obtained in Objective 1. In order to better understand the full environmental impacts of these systems, the overall energy budget (C footprint and energy input-to-energy output ratio) will also be estimated. Policy makers can use this information to help create economic incentives that are able to offset the upfront conversion costs in order to elicit more producers to engage in organic and conservation tillage practices. 4. Develop extension materials. We will develop extension and outreach activities and materials for many learning styles. In year three, researchers and extension specialists on the team will work with the Cooperative Extension publications offices at the Universities of Wyoming and Nebraska to joint bulletins reporting research results. In project year three, team members with extension appointments will develop training workshops targeted at extension educators, producers, and consultants. 5. Develop curriculum modules for the agroecology courses. Capstone Agroecology Seminar is a required course in the interdepartmental agroecology major at the University of Wyoming. Students take the course during their last semester and the research activities and results will provide a framework for a class activity. In a semester-long site-study activity students will develop a projection of what will happen in their plots.

The University of New Hampshire (UNH) offers [two very different livestock-crop systems which cover the range of current systems in the region]{.mark} and provide a rigorous test for the generality of the model to be produced. The UNH Organic Dairy Research Farm (ODRF) encompasses the adjacent Burley-Demerrit and Bartlett-Dudley farms in Lee, NH, about 7 km from the UNH campus. The two holdings include 40 hectares of certified organic pastures, and 65 hectares of woodlands. The farm currently supports a herd of 43 milking cows and 18 heifers, all Jerseys (http://www.organicdairy.unh.edu/). UNH also supports an advanced, conventional dairy system. The Fairchild Dairy Teaching and Research Center (DTRC, http://www.colsa.unh.edu/aes/facilities.html) houses about 125 milking-age Holsteins and approximately 70 growing, replacement animals. These two facilities offer a diverse set of feed/manure systems for development and testing of the Manure-DNDC model, and will be utilized in the following way. Firstly, systematic sampling and chemical analysis will be conducted across all the farm facility components to establish a relatively complete framework of the N biogeochemical cycle for the prototype ecosystems. Secondly, contributions to ecosystem services of each of the farm facility components (feed, housing, compost, lagoon, anaerobic digester or crop field) will be quantified by identifying its efficiency and leaks within the N cycling framework. Some of the ecosystem N cycling or individual components studies have been carried out within the on-going projects. The results from the on-going projects will be used to calibrate and validate Manure-DNDC for the livestock-crop ecosystem. Data gaps will be identified, and additional sampling and analysis will be conducted to complete the description of the manure life cycle for the entire livestock-crop ecosystems. To allow the farmers or resource managers to utilize Manure-DNDC without having to acquire and organize necessary input data, we will collect and organize all necessary input data for the domain region and link them to the model in advance. For our selected domain, the livestock-crop ecosystems in the Northeast US, we will develop a georeferenced database containing relevant data on climate and soil properties, as well as necessary parameterizations characterizing Northeastern U.S. livestock, crop and farm management. The decision support tool will extract relevant data for a specific user (daily weather for one or more years from station data which we will have acquired from the National Climate Data Center database, soil properties which we will have acquired from the USDA NRCS soil STATSGO2 and SSURGO databases, and default or characteristic farm management information - herd size, housing, manure management, etc., which we will have prescribed in consultation with UNH agronomists). The user can then review this information and make any adjustments needed to match their own soils and livestock operation through the model interface.

[Farm fields will be selected]{.mark} that are areas in which the [Delta Institute has farmers enrolled in the Illinois Conservation and Climate Initiative, which is a voluntary C trading program]{.mark}, for the adoption of non-tilled management practices. Neighbor farmers working with organic and conventional management practices will be identified and asked to participate in the project. Soil samples from working farms will be taken in the spring before crop establishment. Samples will be used to 1) determine C sequestration, and 2) determine dynamic soil properties that can be linked to the soil and water concerns defined in the Natural Resources Conservation Services\' Conservation Management Tool (CMT). Measures of organic matter and dynamic soil properties will be assessed in multiple soil depths. Samples will be taken in two consecutive years (first two years of the project) to allow us to capture information about field-to-field and yearly variability within farms as fields progress through their rotations. Participating farmers or field managers will be interviewed to gather data about their farming inputs, practices and infrastructure that are needed to run simple computational tools using NRCS tools for different habitats and farms. [Surveys will capture data on field location, climatic information, drainage class, topography, tillage use, crop rotations (length, diversity, inclusion of cover crop within the rotation), water conservation, residue, nutrient, salinity, and irrigation]{.mark}. Associated outreach efforts will include organization of a conference on Organic and Carbon Sequestration, and development of internet resources posted through the eOrganic CoP. Materials will highlight research results and practical applications for producers and introduce guidelines for interactive use and interpretation of farm assessment tools and field indicators of soil resource conditions.

1.- Scholarship funding rules for student awards will be publish every semester during the three-year period of this project. Decisions on the adjudication of scholarships will be made by a panel formed with members of STC faculty, invited experts in organic farming and organic farmers of south Texas. 2.- A research associate will be hired to coordinate activities in demonstration sites. In these sites, awarded students may develop their projects and hourly labor will be hiredto assist in monitoring pest problems, natural enemies and pollinators. 3.- Evaluation of horticultural practices to [improve soil fertility and reduce erosion. We will plant cover crops in the two demonstration sites in small plots; and replicated in two other organic sites. In half of the small plots, cover crops will be maintained during the entire year and in other half only during growing season, whereas in the organic grower\'s fields, we will test different cover crops]{.mark}. In the large plots we will have two objectives: i)[Evaluation of yield and measuring of nitrogen]{.mark}. Soil analysis will be performed prior to the cover crop but after the last crop. Cover crop will be planted and yields and percent nitrogen will be recorded with the crop plowed into the soil for a green manure crop. ii)Measuring pest impacts and abundance of natural enemies: Here we are going to evaluate the impact of a cover crop in organic vs. conventional in pest and natural enemies abundance. All studies will be completed in a three-year period. 4.- Arthropod pest management studies in organic demonstration sites and comparisons of conventional and organic farming in large plot farms In the demonstration sites, population of pests, natural enemies and native pollinator will be tallied with live counts and yellow sticky traps. In farmers sites, two of each organic and conventional fields will be studied and the most important pests and natural enemies will be tallied every two weeks. Comparisons between the two demonstration sites and the organic farmer sites will be analyzed. 5.- To perform a carbon sequestration feasibility study, a stochastic simulation of a model farm will be used to empirically estimate the net income distributions for alternative production systems. Prices and yield will be stochastic variables in the model starting on the second year of the project. A multivariate empirical distribution of prices and yields will be estimated and used to simulate these variables. A research assistant will be hire to work in activities related in this objective. 6.- Results of all objectives will be delivered with diverse media, including media announcements, newsletters, publication in trade magazines and scientific journals, and a well designed web page for Hispanic growers based on research conducted in the RGV. Also we will publish research information, recommendations and educational opportunities in Spanish and English. All people involved in this proposal will participate in state, national and international conferences disseminating the information collected in this study. An organic pest management guide will be published in Spanish and English.

Research will begin in Fall 2010 on University Experiment Station sites in Iowa and Florida, and on grower-cooperator fields in each state. For each on-station trial, the design will be a split-split-split plot in time. [Crop varieties and soil fertility treatments are based on grower recommendations.]{.mark} The main unit treatments will be [two crop sequences in rotation, with tillage and soil amendments as sub-treatments]{.mark}. Crop sequence 1 will consist of spring tomato − fall lettuce; followed by spring yellow squash − fall broccoli; and spring onions - fall beans. Crop sequence 2 will consist of spring onions - fall beans; followed by spring tomato − fall lettuce; and spring yellow squash − fall broccoli. The two, 3-year rotations will include 6 cash crops. The sub-plot treatments will be tillage: (1) [till with plastic mulch (2) till without plastic mulch and (3) organic no-till]{.mark}. Sub-sub plots will be organic fertility treatments: (1) composted animal manure alone (no cover crops) and (2) composted animal manure + cover crops. Hairy vetch and rye will be grown as fall cover crops in Iowa while only rye will be planted in FL. In summary, the treatment structure is a 2 x 3 x 2 where the factors are crop sequence, tillage system, and fertility amendment. Treatments will be replicated four times for a total of 48 plots. Hairy vetch and rye will be planted at a rate of 25 lb hairy vetch + 90 lb rye/acre in Fall 2010. In FL, rye will be planted at a rate of 115 lb/acre. Cover crops will be terminated at the appropriate phonological stage in spring 2011 at all locations with the roller/crimper. Cover crop management in the following years may be modified based on the previous year\'s results. Tomato, broccoli, lettuce, and onions will be planted using transplants, while yellow squash and beans will be direct seeded. The same varieties will be used across locations; organic seeds will be used for all varieties in the organic plots if commercially available. [Composted poultry manure will be applied prior to vegetable planting at rates based on N content and availability from the organic amendments, soil test results, and crop needs. Compost will also be side-dressed at the time of vegetable planting in the cover crops treatments. Application rates will be determined based on the above calculations plus estimates of N availability from cover crop decomposition.]{.mark} Total (aboveground + belowground) vegetable and cover crop plant biomass C inputs, vegetable C, compost C, and annual net CO2 flux will be used to construct annual C budgets. Annual C budgets for each phase of the 3-yr rotation will be used to calculate C budgets for entire rotation. Rotation C budgets developed by estimating plant and compost inputs and CO2 losses will be compared to measured changes in soil profile C content. Carbon budgets, gas flux estimates, and nitrate-N leaching below the rooting zone will be conducted at the ISU on-station site only, due to the Iowa location of equipment needed for this component. Aboveground and belowground vegetable plant biomass C inputs will be measured for each crop every year at harvest.

The following systems will be compared: 1) Winter cover crops (oat/rye mix) followed by conventional tillage prior to planting and as needed on a spring green bean crop followed by soybeans in the summer as a green manure crop followed by a fall broccoli crop; 2) A field that has had bahiagrass for two year will be turned and planted to winter cover crops (oat/rye mix) followed by conventional tillage prior to planting and as needed on a spring green bean crop followed by soybeans in the summer as a green manure crop followed by a fall broccoli crop; 3) Winter cover crops (oat/rye mix) followed by strip tillage into rolled down cover crops in the spring prior to planting green beans which will be harvested. Soybeans will be no tilled drilled into the greenbean stubble as a nitrogen producing crop for the strip tilled fall broccoli crop; 4) A field that has had bahiagrass for two year will be turned and planted to winter cover crops (oat/rye mix) followed by rolling the cover crop and strip tilling green beans into them for harvest. Soybeans will be notilled drilled into the greenbean stubble as a nitrogen producing crop for the strip tilled fall broccoli crop. Systems 1 and 3 and systems 2 and 4 can be compared for tillage effects and systems 1 and 2 and systems 3 and 4 can be compared to the impacts of rotating perennial grass through vegetable land. These plots wil be monitored for ecosystem function and farm economics. All treatments will have green beans (spring) and broccoli (fall) as cash crops. The four rotation treatments will be set up on organically-certified land at the NFREC-Quincy. After initial plot layout, we will collect baseline data on the plots. The weeds species and densities will be assessed. Plant mesurements include stand density, fruit quality, yield, net photosynthesis, stomatal conductance, and leaf nutrient analyses. Pest management will include OMRI-approved organic pesticides such as Matran, BT and Entrust. [The population of athropods,nematodes, soil microbes and plant pathogens will be examined every two weeks.]{.mark} The physical (bulk density, particle size distribution, soil water status, wet aggregate stability), chemical (Kjeldahl N, extractable soil nutients) and biological (organic matter) properties will be examined. Plant and soil data will be used to construct carbon, nitrogen and water budgets for the four rotation treatments. We will perform a complete economic budget using enetrprise budgets. [Community level analyses on arthropods (herbivores and predators), pathogens, nematodes, soil microbes and weed species will consist of diversity indices and principle component analyses to determine significant factors and relationships of plot factors to fauna populations]{.mark}. We will track the individual treatment plot variables over the course of the rotations and expenditures such as fuel, etc. will be recorded by plot. Outreach will comprise extension venues of field days, presentation at grower meetings, county agent in service trainings, web site postings, and presentations at professional and grower meetings.

PROGRESS

2008/09 TO 2013/08 Target Audience: We reached organic and conventional farmers, farm animal veterinarians, industry professionals such as nutritionists and organic certifiers, stakeholders attending professional meetings and extension agents and scientists in universities and agricultural firms. Consumers also were reached through our internet presence. Changes/Problems: This project was largely completed as designed and we had no major changes to the study design nor to the outreach efforts. What opportunities for training and professional development has the project provided? This project provided for the successful graduate training of 1 PhD student and 2 Master\'s students. All of the students completed their degrees successfully. The results have also contributed to professional devellopment of many veterinarians who have attended a number of state and national veterinary meetings where the data has been presented in either lecture or workshop format. How have the results been disseminated to communities of interest? All 300 farms received final reports that detailed the results of the project and they also received copies of the factsheets that have been produced for this project (available at: http://milkquality.wisc.edu/organic-dairies/project-c-o-w/). The factsheet titles are: 1. Assessment of Herd Health and Management on Organic Dairy Farms; 2. Where are the Veterinarians on Organic Farms?; 3. No Veterinarian? Could Mean Higher Somatic Cell Counts for Your Organic Dairy Herd; 4. Occurrence and Treatment of Mastitis on Organic Dairy Farms; 5. The Risks of Disease Perception on Organic and Small Conventional Dairy Farms. Each farmer also received an evaluation form for the overall project and these evaluations have been summarized and being used to improve future projects. The evaluations will also be used in an article in the popular dairy press about how to best reach the organic dairy industry. Results of this study have been presented twice during this reporting peirod to industry professionals during a 3 hour shortcourse offered at the National Mastitis Council annual meeting in 2013 and 2014. The data was presented to organic dairy farmers and industry stakeholders in workshop format at the MOSES Organic Conference in LaCrosse, WI. Numerous presentations of preliminary and final data have been presented at at least 4 state and national veterinary meetings and at a number of producer meetings organized within each participating state. An advisory group of organic dairy industry stakeholders has met to review the data and provide input of how to best impact end users. The scientific audience of veterinarians and dairy professionals has been reached by the publication 6 manuscripts in peer-reviewed scientific journals (including J Dairy Science and Journal of the American Veterinary Medical Association. One additional paper is currently accepted for publication in BMC Veterinary Research and 2 additional papers are pending acceptance in Journal of Dairy Science. Data from each of the accepted papers has been used in the preparation of extension materials (see previous section). Additional outreach has occured through a popular websites (http://milkquality.wisc.edu/organic-dairies/project-c-o-w/) that includes an interactive section for benchmarking performance data of organic herds. We have also reached a number of stakeholders with Youtube videos that have been viewed by \>14,000 viewed. What do you plan to do during the next reporting period to accomplish the goals? Nothing Reported

2011/09/01 TO 2012/08/31 OUTPUTS: A number of outreach activities occurred during the reporting period. All 300 farms received extensive reports that detailed the results of the animal observations, bulk milk testing and results of individual milk samples. The reports included individual results and comparisons to peer groups. Results of this study have also been presented annually in research sessions at the National Mastitis Council, and in workshop format at the MOSES Organic Conference. Numerous presentations of preliminary data have been presented at state and national veterinary meetings and at producer meetings organized within each state. An advisory group has met to review the data and provide input of how to best impact end users. A series of factsheets presenting results of the recently analyzed data are currently being prepared and will be distributed to key stakeholders and extension services. Multiple presentations on research conclusions of this project were presented at conferences of veterinarians, dairy scientists, farmers, and other professional groups. Key presentations were as follows: November 2011 - 4 presentations at the North Carolina Veterinary Conference (Ruegg) January 2012 - 1 presentation to veterinarians in Denmark (Ruegg); 1 presentation at the National Mastitis Council Meeting in Tampa, FL (Richert) February 2012 - 2 presentations at the Ohio Veterinary Conference in Columbus (Ruegg); Presentation of 2 posters and a 2 hour workshop at the MOSES Organic Conference in La crosse, WI (Ruegg, Richert,Bergman & Lennart) April 2012 - presentation to Dairy Science Dept. (Richert) Additional presentations by project collaborators were given in Oregon and New York. Evaluation tools for benchmarking were produced and posted on the UW Milk Quality Website; The questionnaire and preliminary results of some of the analyses are available for review on the project website: http://milkquality.wisc.edu/organic . A YouTube video that describes treatment options for dairy animal care has been created and viewed by \>300 people. The project website also contains an area that allows producers to input current data for benchmarking against self selected peer-groups. http://milkquality.wisc.edu/milking-management/evaluation-tools/. More extension materials will be released as the scientific papers are accepted by peer reviewed publications. PARTICIPANTS: P.L. Ruegg (PI), M. Gamroth (co-PI), Y.H.Schukken (co-PI), K.M. Cicconi (graduate student,) R.M. Richert (graduate student), K.E. Stiglbauer (graduate student), N.Lennart (outreach specialist). TARGET AUDIENCES: Organic dairy farmers and consultants, small scale conventional dairy farmers and consultants, veterinarians, nutrition professionals, extension personnel, researchers, academics. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2010/09/01 TO 2011/08/31 OUTPUTS: Visits to 292 farms were completed and the database was finalized. All laboratory work was completed. Analysis of preliminary data has been completed and presented at the NMC meeting, the Mastitis Research Workers conference and at a state veterinary meeting. A descriptive analysis of the participating herds has been completed. The greatest demographic differences are based on breed characteristics, feeding programs and production. Analysis of differences between organic and conventional herds relative to perception of disease, treatments of ill animals, use of veterinarians, and milk quality characteristics is ongoing and will be completed in 2012. A part-time outreach specialist has been hired and a website has been launched to begin dissemination of outcomes. An internet based video series has been launched with the first video focusing on Animal Health Requirements on Organic Dairy Herds. Stakeholders have been consulted to help with dissemination of results and assessment plans are being developed. PARTICIPANTS: Pamela Ruegg (PI); Roxann Weix Richert, (research assistant); Mike Gamroth (co-PI), Ynte Schukken (co-PI), Kellie Cicconi (research assistant); Katie Stiglbauer (research assistant); Carol Hulland (researcher); Nicole Lennart (outreach specialist); Meghan Brockmeyer (research assistant) TARGET AUDIENCES: Farmers, veterinarians, organic certifying agencies, dairy processors. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2009/09/01 TO 2010/08/31 OUTPUTS: The overall objectives of this project are to assess dairy cattle health and well-being on farms that use organic management systems and develop and disseminate recommendations for cost-effective, preventive health management programs for dairy cattle on organic farms. The project is being be conducted on 300 commercial dairy farms in the following sites: Wisconsin (n = 100 Organic and 50 Conventional farms); New York (n = 75 Organic and 25 conventional farms); and Oregon (n = 25 organic and 25 conventional farms). All collaborating states have successfully executed annual subcontracts and have successfully enrolled the specified graduate students and maintained appropriate support staff. As specified in the original proposal, the project is being supported by 2 PhD students (1 at Cornell and 1 at Wisconsin) and 1 master\'s degree student (Oregon). During the period of data collection trained study personnel in each state are collecting retrospective and demographic data during a single scheduled farm visit. Prospective data is collected and submitted by farmers during the 60 days following the farm visit. Herd visits began in April 2009 and have been scheduled so that approximately equal numbers of herd visits occur within each season of the year for both ORG and CON herds. Each farm visit takes approximately 1 day. During a farm visit, the questionnaire is administered by study personnel to the individual identified as the primary animal health manager on each dairy. The questionnaire includes questions about: case definition of selected diseases; methods and frequency of disease detection, treatments used for defined case scenarios, and methods used to evaluate results of treatments. Retrospective animal health data for the previous 60 days before the farm visit is also collected during the farm visit. After the farm visit is completed, each producer is instructed how to collect an aseptic milk sample from cases of clinical and subclinical mastitis that occur in the 60 days following the visit. Additional disease data is collected for each of the following diseases that occur in adult cows: Respiratory disease, metabolic disease, foot disorders and reproductive disorders. Data (symptoms, clinical diagnosis, usage of veterinarian, methods & cost of treatment, duration of treatment, mortality and culling within 60 days of diagnosis) are collected on selected diseases that occur in calves: pneumonia, diarrhea, other non-specified disorders. As defined by the original proposal, a number of indicators of overall herd health are being collected by retrieval of farm records and selected observations that occur during each farm visit. Bulk milk samples are collected and used to screen herds for Listeria monocytogenes, Salmonella DT104 and Shiga toxin producing E.coli. Herd visits began in April 2009 and we estimate that all visits will be completed by March 1, 2011. More than 100 bulk tank milk samples have been processed by Cornell QMPS. To date, few (\<5%) bulk milk samples have indicated the presence of pathogens with the potential to cause human disease. PARTICIPANTS: Project Director: Pamela Ruegg, DVM, MPVM, Dip. ABVP (Dairy Practice), Dept. of Dairy Science, 1675 Observatory Dr., Madison, WI 53706, plruegg@wisc.edu. CoPDs: Ynte Schukken, DVM, PhD, Quality Milk Production Services, Cornell University, 22 Thornwood Drive, yhs2@cornell.edu ; Mike Gamroth, M.S., Animal Sciences, 112 Withycombe Hall, Corvallis, OR, 97331; Carol Hulland - researcher, University of Wisconsin, Madison, Graduate Students: Roxann Weix (UW, Madison), Kelli Ciconi (Cornell), Katie Sigelbauer (Oregon State) TARGET AUDIENCES: Organic and conventional farmers and their support personnel. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2008/09/01 TO 2009/08/31 OUTPUTS: The overall objective of this 48 month project is to assess dairy cattle health and well-being on farms that use organic management systems and develop and disseminate recommendations for cost-effective, preventive health management programs for dairy cattle on organic farms. Specific aims are: (1) Identify and address unique methods used by organic dairy farmers to define, detect, monitor the severity, treat, and judge the efficacy of disease treatment interventions. (2) Compare disease prevalence, severity, economic consequences, and management-related risk factors among organic dairy farms with the aim of identifying management factors that influence animal well-being and farm profitability. (3) Use indicators of herd health & milk quality identified in participating organic and conventional dairy farms to create benchmarks that can be used to help farmers recognize and diagnose problems and optimize animal well-being and farm profitability. (4) Provide participating farmers with diagnostic animal health and milk quality data on their farms, coupled with comparisons to benchmarking data for other conventional and organic herds participating in the study. (5) Use data and analytical results to develop & disseminate information and extension recommendations for preventive health management of organic dairy cattle, consistent with maximizing milk quality and net farm income. To date, all study personnel at all 3 collaborating universities have been hired, all farm visit tools and assessments have been developed, farm recruitment efforts have been successful and farm visits are underway as scheduled. PARTICIPANTS: Participating individuals include: Pamela Ruegg, University of Wisconsin - Madison (PD); Linda Tikofsky, Cornell University (co-PI); Ynte Schukken, Cornell University (co-PI); Mike Gamroth, Oregon State University (co-PI); Carol Hulland, University of Wisconsin - Madison (research specialist); Roxann Weix, University of Wisconsin-Madison (research assistant); Kellie Cicconi, Cornell University (research assistant); Katie Stiglbauer, Oregon State University (research assistant) TARGET AUDIENCES: Organic and conventional dairy producers and the professionals that work with them. PROJECT MODIFICATIONS: None

2008/06 TO 2013/05 OUTPUTS: This multi-state, long-term organic experiment was established in six states in 2008 as a comprehensive study of organic no-till production\'s effect on crop productivity, yields, soil quality, and economic performance. [Wheat was grown on all plots in 2008, creating a uniform rotation history]{.mark} in Iowa (IA), Minnesota (MN), Michigan (MI), Wisconsin (WI), North Dakota (ND), and Pennsylvania (PA). Cover crops (CC) of hairy vetch (HV), at 25-30 lb per ac, or rye at 200-225 lb per ac, were planted in Fall 2008 and again in 2010. Treatments, in a 2 x 2 factorial randomized complete block design with treatment combinations replicated 4 times, included conventional tillage (CT) (CC disked) and no-till (NT) (CC rolled-crimped: RC) with corn (following HV) and soybean (following rye) planted the following spring. [Oats were planted in all plots in Spring 2010 and 2012 to create a three-crop rotation in each system]{.mark}. Oat yields in previous NT corn and bean plots averaged 26.4 bu per ac compared to 71 bu per ac in previous CT plots. In NT plots where oats did not mature, oatlage yields averaged 6,249 lbs per ac. Lower yields in NT plots were associated with excessive perennial weeds, such as Canada thistle, dandelion, quackgrass and clovers, and resurgence of previously planted (2008, 2010, 2012) HV and rye. An advisory committee decision was reached to till all plots in Fall 2010 before drilling CC. In 2011, HV and rye biomass averaged 3,758 and 5,536 lbs per ac, respectively. After RC-NT or disking CC and planting cash crops in May-June 2011, corn and bean plant populations were similar between treatments; NT and CT corn populations averaged 25,690 and 24,904 plants per ac, respectively. CT and NT soybean stands averaged 136,356 and 132,658 plants per ac. A cold, wet spring in 2011 with slow seed germination led to NT soybean yields ranging from 15 to 30 bu per ac, averaging 25 bu per ac across all sites (CT yielding 36), similar to 2009\'s yields of 26 (NT) and 33 (CT) bu per ac. In IA, NT and CT soybean yields were statistically equivalent at 30 bu per ac. In 2011, NT corn suffered from [winter-kill of HV and insufficient HV biomass]{.mark} in some cases, heavy early rains, [failure of HV termination, mid-season drought (PA), excessive weeds, and lack of N]{.mark}, leading to an average yield of 40 bu per ac in the NT system (108 bu per ac in CT), similar to 2008, where the 5-state average was 33 bu per ac with only one (PA) site yielding 117 bu per ac. These results suggest that [Midwest conditions do not support successful organic NT corn with only HV as the source of external

N.]{.mark} Weeds were more persistent in NT than CT corn and bean plots. Only in 2 sites were annual grasses and broadleaves greater in CT over NT systems. Oats with an underseeding of alfalfa were planted in 2012 to determine if this rotation would assist in perennial weed management. NT oat yields in 2012 averaged 54 bu per ac compared to CT yields of 73 bu per ac, but weeds continued to be significantly greater in NT. Soil analysis revealed equivalent pre-experiment soil quality in Fall 2008 between treatments, but greater soil quality in NT over CT over the course of the experiment. PARTICIPANTS: Kathleen Delate, Iowa State University; Cynthia Cambardella, USDA, ARS, Ames, IA; Dale Mutch, Michigan State University; Jeff Moyer, Rodale Institute; Patt Carr, North Dakota State University; Lee Klossner, University of Minnesota; Erin Silva, University of Wisconsin; Sharon Weyers, USDA-ARS, Morris, MN. TARGET AUDIENCES: Target audiences primarily include organic farmers, but conventional farmers with an interest in transitioning to organic production are also included. Agricultural professionals, including Extension, USDA, NRCS, and Resource, Conservation and Development staff, have participated in trainings and conferences related to the Organic No-Till Project. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2011/06/01 TO 2012/05/31 OUTPUTS: This multi-state, long-term organic experiment was established in six states in 2008 as a comprehensive study of organic no-till production\'s effect on crop productivity, yields, soil quality, and economic performance. Wheat was grown on all plots in 2008, creating a uniform rotation history in Iowa (IA), Minnesota (MN), Michigan (MI), Wisconsin (WI), North Dakota (ND), and Pennsylvania (PA). Cover crops (CC) of hairy vetch (HV), at 25-30 lb per ac, or rye at 200-225 lb per ac, were planted in Fall 2008 and again in 2010. Treatments, in a 2 x 2 factorial randomized complete block design with treatment combinations replicated 4 times, included conventional tillage (CT) (CC disked) and no-till (NT) (CC rolled-crimped: RC) with corn (following HV) and soybean (following rye) planted the following spring. Oats were planted in all plots in Spring 2010 and 2012 to create a three-crop rotation in each system. Oat yields in previous NT corn and bean plots averaged 26.4 bu per ac compared to 71 bu per ac in previous CT plots. In NT plots where oats did not mature, oatlage yields averaged 6,249 lbs per ac. Lower yields in NT plots were associated with excessive perennial weeds, such as Canada thistle, dandelion, quackgrass and clovers, and resurgence of previously planted (2008 and 2010) HV and rye. An advisory committee decision was reached to till all plots in Fall 2010 before drilling CC. In 2011, HV and rye biomass averaged averaged 3,758 and 5,536 lbs per ac, respectively. After RC-NT or disking CC and planting cash crops in May-June 2011, corn and bean plant populations were similar between treatments; NT and CT corn populations averaged 25,690 and 24,904 plants per ac, respectively. CT and NT soybean stands averaged 136,356 and 132,658 plants per ac. A cold, wet spring in 2011 with slow seed germination led to NT soybean yields ranging from 15 to 30 bu per ac, averaging 25 bu per ac across all sites (CT yielding 36), similar to 2009\'s yields of 26 (NT) and 33 (CT) bu per ac. In IA, NT and CT soybean yields were statistically equivalent at 30 bu per ac. In 2011, NT corn suffered from winter-kill of HV and insufficient HV biomass in some cases, heavy early rains, failure of HV termination, mid-season drought (PA), excessive weeds, and lack of N, leading to an average yield of 40 bu per ac in the NT system (108 bu per ac in CT), similar to 2008, where the 5-state average was 33 bu per ac with only one (PA) site yielding 117 bu per ac. These results suggest that Midwest conditions do not support successful organic NT corn with only HV as the source of external N. Weeds were more persistent in NT than CT corn and bean plots. Only in 2 sites were annual grasses and broadleaves greater in CT over NT systems. Oats with an underseeding of alfalfa were planted in 2012 to determine if this rotation would assist in perennial weed management. Soil analysis revealed equivalent pre-experiment soil quality in Fall 2008, but greater soil quality in NT over CT in IA, MI, MN, PA and WI in Fall 2009 and Fall 2011. PARTICIPANTS: Kathleen Delate, Iowa State University; Cynthia Cambardella, USDA, ARS, Ames, IA; Dale Mutch, Michigan State University; Jeff Moyer, Rodale Institute; Patt Carr, North Dakota State University; Lee Klossner, University of Minnesota; Erin Silva, University of Wisconsin; Sharon Weyers, USDA-ARS, Morris, MN. TARGET AUDIENCES: Target audiences primarily include organic farmers, but conventional farmers with an interest in transitioning to organic production are also included. Agricultural professionals, including Extension, USDA, NRCS, and Resource, Conservation and Development staff, have participated in trainings and conferences related to the Organic No-Till Project. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2010/06/01 TO 2011/05/31 OUTPUTS: This multi-state, long-term organic experiment was established in six states in 2008 as a comprehensive study of organic no-till production\'s effect on crop productivity, yields, soil quality, and economic performance. Wheat was grown on all plots in 2008, creating a uniform rotation history in Iowa (IA), Minnesota (MN), Michigan (MI), Wisconsin (WI), North Dakota (ND), and Pennsylvania (PA). Cover crops (CC) of hairy vetch (HV), at 25-30 lb per ac, or rye at 200-225 lb per ac, were planted in Fall 2008 and again in 2010. Treatments, in a 2 x 2 factorial randomized complete block design with treatment combinations replicated 4 times, included conventional tillage (CT) (CC disked) and no-till (NT) (CC rolled-crimped: RC) with corn (following HV) and soybean (following rye) planted the following spring. Oats were planted in all plots in

Spring 2010 to create a three-crop rotation in each system. Oat yields in previous NT corn and bean plots, averaged 26.4 bu per ac, compared to 71 bu per ac in previous CT plots. Lower yields were associated with excessive perennial weeds, including Canada thistle, dandelion, quackgrass and clovers, and resurgence of HV and rye. At one site (PA), CT perennial broadleaf (BL) weeds averaged 11 lb per ac and 52 lb per ac in NT. In 2011, HV and rye biomass averaged 3,758 and 5,536 lbs per ac, respectively. After RC-NT or disking CC and planting cash crops in May-June 2011, corn and bean plant populations were similar between treatments; NT and CT corn populations averaged 25,690 and 24,904 plants per ac, respectively. CT and NT soybean stands averaged 136,356 and 132,658 plants per ac. A cold, wet spring led to slow seed germination, but soybean yields similar to 2009\'s NT and CT yields of 26 and 33 bu per ac, respectively, are expected in 2011. In 2011, NT corn suffered from various causes, leading to low expected yields in the NT system, similar to 2008, where a 5-state average was 33 bu per ac with only one (PA) site yielding 117 bu per ac. In the renewal project, we will add N from compost or manure in NT corn, and consider a rye-vetch mixture to increase biomass. Weeds were more persistent in NT than CT corn and bean plots. The average ratios of NT to CT soybean and corn BL weeds were 85 to 1 and 1.22 to 1, respectively, although larger ratios were reported. The annual and perennial grass weed NT to CT ratio was smaller, suggesting grain crops are competitive with grass weeds in the NT system. Soil analysis revealed equivalent pre-experiment soil quality in Fall 2008, with greater soil microbial biomass carbon (MBC) in NT over CT in IA, MI, MN, PA and WI in Fall 2009. In Fall 2010, NT soil quality enhancement was seen in 5 of 6 sites in moist Midwest and PA ecosystems. In IA, MI and MN, NT residual soil nitrate-N, pH and EC were greater than in CT. Bulk density was similar at 50% of sites and higher in CT (MN, PA), indicating NT had differential soil compaction effects. Total soil N and potentially mineralizable N were higher under NT (WI), demonstrating enhanced N cycling and storage. Soil quality differences were not as apparent at the semi-arid North Dakota site. PARTICIPANTS: Kathleen Delate, Iowa State University; Cynthia Cambardella, USDA, ARS, Ames, IA; Dale Mutch, Michigan State University; Jeff Moyer, Rodale Institute; Pat Carr, North Dakota State University; Lee Klossner, University of Minnesota; Erin Silva, University of Wisconsin; Sharon Weyers, USDA-ARS, Morris, MN. TARGET AUDIENCES: Target audiences primarily include organic farmers, but conventional farmers with an interest in transitioning to organic production are also included. Agricultural professionals, including Extension, USDA, NRCS, and Resource, Conservation and Development staff, have participated in trainings and conferences related to the Organic No Till Project. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2009/06/01 TO 2010/05/31 OUTPUTS: This multi-state, long-term organic experiment was established in six states in 2008 as a comprehensive examination of the effects of organic no-till production on crop productivity, yields, soil quality, and economic performance. In order to create a uniform study background (rotation history) in Iowa, Minnesota, Michigan, Wisconsin, North Dakota, and Pennsylvania, wheat was grown on all IOP (Integrated Organic Program) experimental plots in the spring of 2008. Following wheat harvest, cover crops were seeded at all sites in Fall 2008 (September) to prepare for the initiation of the no-till segment of the study. Hairy vetch (HV) was seeded at 25 to 30 pounds per acre and rye (Aroostock) was seeded at 200 to 225 pounds per acre. Tillage treatments in Spring 2009 included conventional tillage (CT) and no-till (NT), with cover crop planted in the future NT plots as either hairy vetch (HV) or rye. Cash crops to be planted the following spring were corn (following HV) and soybean (following rye). Treatments were arranged in a randomized complete block design as a 2 x 2 factorial with treatment combinations replicated four times. In Spring 2009 (May to June, weather-dependent), cover crops were either disked in the conventional till treatment (CT) or rolled/crimped in a one-pass organic no-till system (NT) with the goal of the crushed cover crops serving as a dried mulch between corn and soybean rows throughout the season. The NT system worked well for soybean in the crushed rye in all states where soybean was grown, when rye was rolled at or post-anthesis. In general, organic soybean yields were acceptable in the NT system, averaging 26 bushels per acre compared to 33 in the CT system. The NT corn system was much more difficult, however. There was only one state (Pennsylvania) where NT organic corn yields were greater than 100 bushels per acre. The average corn yield over the remaining 5 states was only 33 bushels per acre, compared to 73 with CT. The low corn yields overall were associated with poor overwintering of the HV cover crop; a wet, cool season; high weed populations; and a corn crop relying strictly on N from the HV, with no compost, which is atypical for organic corn production. Across 6 states, HV biomass averaged 4,118 pounds per acre, with 2 of the northernmost states (MN and ND) reporting 0 and 1,800 pounds per acre, respectively. Rye biomass averaged 8,952 pounds per acre across 5 sites. In general (5 of 6 states), weeds were greater in the HV-corn NT system than the CT system. Perennial weeds were particularly problematic in the organic NT system after one full season of no tillage. Although weeds appeared to be less of a problem in the early season NT soybean plots, presumably from the rye\'s allelopathy and high density creating a thick, weed-free mulch, the rolling/crimping appeared to stimulate reproductive growth of secondary tillers, and by the end of the season, NT soybean plots had many rye plants in between soybean rows. While not critically impacting soybean yield, the presence of the rye plants at the end of 2009 led to interference with the growth of the oat crop, which followed soybean in the rotation in 2010. PARTICIPANTS: Kathleen Delate, Iowa State University; Cynthia Cambardella, USDA, ARS, Ames, IA; Dale Mutch, Michigan State University; Jeff Moyer, Rodale Institute; Patt Carr, North Dakota State University; Lee Klossner, University of Minnesota; Erin Silva, University of Wisconsin. TARGET AUDIENCES: Target audiences primarily include organic farmers, but conventional farmers with an interest in transitioning to organic production are also included. Agricultural professionals, including Extension, USDA, NRCS, and Resource, Conservation and Development staff, have participated in trainings and conferences related to the Organic No-Till Project. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2008/06/01 TO 2009/05/31 OUTPUTS: Sustainable fruit, vegetable, grain and turfgrass production systems continued to be developed for Iowa conditions from 2006 to 2009. Effective pest management practices and new cultivars will be necessary for the continued viability of sustainable/organic agriculture in Iowa. Research developed through this project included organically-approved spray treatments for codling moth in organic apples, with a multi-pronged approach of mating disruption, a spinosad-based natural insecticide, and codling moth granulosis virus affording the best control. Interest in commercial grape plantings, including organic grapes, continues to increase in Iowa. The identification of grape cultivars adapted for Iowa winters and humid summer conditions will allow growers to avoid significant losses associated with planting non-adapted cultivars. A grape cultivar by management system trial comparing straw mulch to herbicides for weed control was established at two sites representing different climatic and soil conditions in 2002. Lower pruning weights and cordon establishment were associated with the use of the straw mulch at the colder site, but not at the warmer site. At both sites, vines with a straw mulch had lower yields and smaller clusters that vines treated with herbicides. Work continues on the development of the sprayable corn gluten hydrolysate for use as a natural herbicide. Patent #5,290,749 was licensed by the Iowa State Research foundation in 2006 to a company in Ontario Canada on this technology. Production techniques were being refined in 2008 and plans are being expanded for marketing in the United States and Europe. Work continues on the use of dry corn gluten meal as a natural herbicide. That technology has been licensed to more than twenty companies in the US under patent \# 5,030,268. High tunnel production of primocane raspberries and blackberries can be profitable as the result of an expanded harvest season and high yields. However, control measures for Botrytis blossom blight and fruit rot must be taken to maintain productivity. In other grain and vegetable research projects across Iowa, organic crops fertilized with compost produced similar yields to conventional crops, and where organic corn followed alfalfa in a four-year rotation, yields were greater than the three-year rotation. Soil health parameters, including organic carbon pools and microbial biomass, remained high in organic systems, even under multiple tillage operations. Organic tomato and pepper yields were outstanding in 2008, as were organic soybeans, yielding 54 bushels/acre, even under flooded conditions. Corn yields were reduced due to floods and competition with excess weeds. PARTICIPANTS: Nothing significant to report during this reporting period. TARGET AUDIENCES: Nothing significant to report during this reporting period. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2009/09 TO 2013/08 Target Audience: Scientific community, Dairy, beef, and sheep producers, government agencies, agricultural and food processing industry representatives Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided? The summer interns in the ORIP program at OARDC obtained HHEI Qualified Data Collector (QDC) training and took field trips to the NAEW facility in Coshocton to learn the relationships between soils, surface and subsurface water. These interns were assisted by graduate STEM fellows in our NSF GK-12 program who conducted stream HHEI assessments. Project details and partial results were presented to Ohio State graduate students and faculty during Jed Stinner's master's thesis exit presentation for the Environmental Science Graduate Program (November 2012). ORIP students presented project details and partial results during their exit presentations to peers and OARDC/Ohio State faculty (August 2012). Farm results from previous year (2011) were handed back to all farmers (June-August 2012). Partial results were presented at International Forest Insect Research Advisory Workshop in Breckenridge, Colorado (January 2012). How have the results been disseminated to communities of interest? The transitioning to organic research site and discussion of current research was included in a variety of station tours (tours included scientists, students, agricultural groups, etc.). The North Central Ohio Dairy Grazing Conference January 26-27, 2012 planning committee included a breakout session emphasizing ongoing need to implement basic management practices. The speakers' handbook was distributed to 500 farms with a brief summary of the initial findings point out [the need to emphasis basic water quality and quantity management practices for both organic and conventional grazing farms]{.mark}. Fact sheets around water and water practices were updated and distributed at multiple workshops, field days and other events annually. What do you plan to do during the next reporting period to accomplish the goals? Nothing Reported

2011/09/01 TO 2012/08/31 OUTPUTS: During the summer of 2012, 25 sites (13 organic and 12 conventional) were reevaluated using the HHEI, biological indices, nutrient, and water chemistry as indicators. Additionally, streams originating on farms were sampled (25 organic and conventional combined) for the herbicides atrazine and glyphostate during a 2-day sampling period (end of June). HHEI (habitat index) scores indicate a difference between organic and conventional dairy farms. Organic dairy farm streams had higher scores than conventional dairy farms when means were compared, 69.6 versus 61.1 respectively (P-value= 0.056). Out of the 25 streams originating on farms, glyphosate was found in 6 out of the 9 organic dairy farm streams and 4 out of the 16 conventional dairy farm streams. Atrazine was found in 3 out of the 16 conventional farms and was not found in organic stream sites. Data have been collected to determine effects of transitioning intensively and continuously grazed beef cattle to certified organic management on surface and subsurface water quality and quantity. No differences (P \> 0.05) between organic and conventional practices were detected for soil or water samples or indices of cow performance. Results are being modeled using ArcAPEX. The transitioning to organic research site and discussion of current research was included in a variety of station tours (tours included scientists, students, agricultural groups, etc.). The North Central Ohio Dairy Grazing Conference January 26-27, 2012 planning committee includes a breakout session emphasizing ongoing need to implement basic management practices. The speakers handbook was distributed to 500 farms with a brief summary of the initial findings point out the need to emphasis basic water quality and quantity management practices for both organic and conventional grazing farms. Fact sheets around water and water practices are being updated and prepared for distribution for upcoming workshops, field days and other events. PARTICIPANTS: Contract: Leah Miller SFI Collaborators: S. Loerch, J. McCutcheon, R. Taylor, D. Stinner, R. Moore, J. Bonta, L. Owens Support personnel: S. Metzger, J. Saylor, C. Long, W. Dreher, J. Stinner, J. Felix, L. Shoup TARGET AUDIENCES: Scientific community, Dairy, beef, and sheep producers, government agencies, agricultural and food processing industry representatives PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2010/09/01 TO 2011/08/31 OUTPUTS: Year 2 samples and data on the impact of organic and conventional grazing practices on water quality and quantity on headwater tributaries of the Muskingum River in NE Ohio have been collected. Data have been collected to determine effects of transitioning intensively and continuously grazed beef cattle to certified organic management on surface and subsurface water quality and quantity. Results are being modeled using ArcAPEX. Output from the NAEW watershed model are being used to calibrate a second ArcAPEX model of a \"virtual farm\". The virtual farm model is currently being validated to examine the effect of stocking rate on the impacts of organic and conventional grazing on water quality at the farm scale. Samples and data from Year 2 to compare water chemistry and Headwaters Habitat Evaluation Index (HHEI) on paired organic and conventional dairy farms in headwater streams of the Muskingum watershed have been collected. Monthly spring samples were collected and analyzed for nutrients and carbon; runoff samples were collected and analyzed on an event basis. Soil samples were taken at 5 interval depths on all of the watersheds and analyzed for total organic carbon. The transitioning to organic research site and discussion of current research was included in a variety of station tours (tours included scientists, students, agricultural groups, etc.). Project outline and progress was shared with Board of Ohio Forages and Grassland Council. Two dairy grazing pasture groups in Mill Creek Watershed participated in the farmers and extension teams meeting at NAEW in April 2011. Fact sheets around water and water practices are being updated and prepared for distribution for upcoming workshops, field days and other events. Presentation of research findings with organic dairy grazers in Ohio and beyond was made at the OFFER Field Day in September, 2011. PARTICIPANTS: Contract: Leah Miller SFI Collaborators: S. Loerch, J. McCutcheon, R. Taylor, D. Stinner, R. Moore, J. Bonta, L. Owens Support personnel: S. Metzger, P. Tirabasso, J. Saylor, C. Long, W. Dreher, J. Stinner, J. Felix, L. Shoup TARGET AUDIENCES: Scientific community, Dairy, beef, and sheep producers, government agencies, agricultural and food processing industry representatives PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2009/09/01 TO 2010/08/31 OUTPUTS: Year 1 samples and data on the impact of organic and conventional grazing practices on water quality and quantity on headwater tributaries of the Muskingum River in NE Ohio have been collected. The experiment to determine effects of transitioning intensively and continuously grazed beef cattle to certified organic management on surface and subsurface water quality and quantity using replicated gauged watersheds at NAEW was initiated in April, 2010. Samples and data from Year 1 to compare water chemistry and Headwaters Habitat Evaluation Index (HHEI) on paired organic and conventional dairy farms in headwater streams of the Muskingum watershed have been collected. Monthly spring samples were collected and analyzed for nutrients and carbon; runoff samples were collected and analyzed on an event basis. Soil samples were taken at 5 interval depths on all of the watersheds and analyzed for total organic carbon. The transitioning to a organic research site and discussion of current research was included in a variety of station tours (tours included scientists, students, agricultural groups, etc.)Project outline and progress was shared with Board of Ohio Forages and Grassland Council. Identified two dairy grazing pasture groups in Mill Creek Watershed to participate in the farmers and extension teams meeting at NAEW in April 2011. Met with ATI staff on tying in their interest in hosting a grazing school and sharing the water quality components of research findings once the research is finished. Currently pulling together the potential survey questionnaires for pre- and post surveys of the farmers and extension teams meeting and evaluating which questions to use for pre and post knowledge evaluation for student interns and other students. Discussions that outlined research with five different organic dairy grazers in Holmes County area/Sugarcreek Watershed, as well as Organic Valley staff, OSU extension and county and state SWCD personnel during the past year. PARTICIPANTS: PI: S. Loerch Co-PI\'s: J. Bonta, L. Owens, D. Stinner, R. Moore, R. Taylor Sub Contract: L. Miller, small Farm Institute Technicians: P. Tirabasso,J. Felix, J. Saylor, J. Stinner, L. Shoup,W. Dreher TARGET AUDIENCES: Target audiences are organic, transitioning and non-organic livestock producers. The transitioning to organic research site and discussion of current research was included in a variety of station tours (tours included scientists, students, agricultural groups, etc.) Project outline and progress was shared with Board of Ohio Forages and Grassland Council. Identified two dairy grazing pasture groups in Mill Creek Watershed to participate in the farmers and extension teams meeting at NAEW in April 2011. Conferenced with ATI staff on tying in their interest in hosting a grazing school and sharing the water quality components of research findings once the research is finished. Assembled potential survey questionnaires for pre- and post surveys of the farmers and extension teams meeting and evaluating which questions to use for pre and post knowledge evaluation for student interns and other students. Discussions that outlined research with five different organic dairy graziers in Holmes County area/Sugarcreek Watershed as well as Organic Valley staff, OSU extension and county and state SWCD personnel during the past year. PROJECT MODIFICATIONS: Not relevant to this project.

2009/09 TO 2014/08 Target Audience: Target audiences primarily include organic farmers, but conventional farmers with an interest in transitioning to organic production are also included. Agricultural professionals, including Extension, USDA, NRCS, and Resource, Conservation and Development staff, have participated in trainings and conferences related to this project. Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided? There were several training and professional development activities associated with this project, including field days, workshops, conference presentations and presentations at professional society annual meetings. Extension specialists and farmer-educators were recruited for these technology transfer events, and their expertise blended with project results to increase impacts for a wider audience. How have the results been disseminated to communities of interest? Results from this project were disseminated to an audience of 328 participants through a field day, and three conference presentations. What do you plan to do during the next reporting period to accomplish the goals? Nothing Reported

2012/09/01 TO 2013/08/31 Target Audience: Target audiences primarily include organic farmers, but conventional farmers with an interest in transitioning to organic production are also included. Agricultural professionals, including Extension, USDA, NRCS, and Resource, Conservation and Development staff, have participated in trainings and conferences related to this project. Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided? There were several training and professional development activities associated with this project, including field days, workshops, conference presentations and presentations at professional society annual meetings. Extension specialists and farmer-educators were recruited for these technology transfer events, and their expertise blended with project results to increase impacts for a wider audience. How have the results been disseminated to communities of interest? Results from this project were disseminated to an audience of 268 participants through a field day, and four conference presentations in Iowa. What do you plan to do during the next reporting period to accomplish the goals? We intend to conduct a third field season in Iowa to allow for additional water quality and quantity, soil and yield data in order to publish three years of data related to organic compared to conventional production. We hope to build on our strengths and address the weaknesses uncovered through this research, including the need to manage insect pests on a timely basis.

2011/09/01 TO 2012/08/31 OUTPUTS: Non-point source contamination from leaching of nitrates in synthetic fertilizers is a major water quality concern in the upper Midwest, where extensive subsurface tiling drains the highly productive soils. This multi-disciplinary project aims to assist producers in developing systems that use integrated organic crop rotations with legume and grass crops to improve water retention and water quality by enhancing nutrient and water cycling in the soil-plant system. In order to test this hypothesis, we were required to install state-of-the art water quantity and quality monitoring instruments to develop nitrogen budget and water balance estimates. Thirty plots were established in May 2011 within a 25-ha field at the Agronomy and Ag Engineering Farm that was planted to organic oat and alfalfa in 2006 and maintained as organic alfalfa from 2007 to 2011. Tile drains, flow barriers and sump pumps were installed at the site in July 2011. Sump pits were equipped with water meters, sump pumps, sump basins, distribution pipes and water sampling devices in October 2011. In November 2011, conduit and transmission lines for the data loggers were installed and a permanent weather station was also installed at the field site. Tile drain sampling began on December 1, 2011, and continued every week. Drain flow did not cease in 2011 and 2012 due to a warm winter. Crop rotations in the 2012 season included corn and soybean in the conventional treatment, an organic pasture with grass and legumes, and all crops in an organic corn, soybean, oats, and alfalfa rotation. Plots were maintained as organic through the use of compost fertilization, mechanical tillage for weeding, and naturally-based insect management products. The 2012 drought impacted yields across the state. Despite the lack of rain and extreme heat, crops in this experiment fared reasonably well, with organic yields statistically equivalent to conventional corn and soybean yields. Organic corn yields averaged 136 bu/acre compared to 144 bu/acre in the conventional rotation. Results from this project were discussed at two Field Days in 2012 and at four conferences to a total audience of 288 farmers, ag professionals and students. PARTICIPANTS: USDA ARS National Lab for Ag and the Environment; Iowa State University Departments of Agronomy, Horticulture, Plant Pathology, and Food Science; Scott Shriver, organic farmer, Jefferson, Iowa. TARGET AUDIENCES: Target audiences include organic farmers and conventional farmers interested in organic practices or methods to reduce nitrate leaching and runoff in agriculture. Additional target audiences include ag professionals such as USDA NRCS and Extension. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2010/09/01 TO 2011/08/31 OUTPUTS: Non-point source contamination from leaching of nitrates in synthetic fertilizers is a major water quality concern in the upper Midwest, where extensive subsurface tiling drains the highly productive soils. This multi-disciplinary project aims to assist producers in developing systems that use integrated organic crop rotations with legume and grass crops to improve water retention and water quality by enhancing nutrient and water cycling in the soil-plant system. In order to test this hypothesis, we were required to install state-of-the-art water quantity and quality monitoring instruments to develop nitrogen budget and water balance estimates. Project activities in 2010 included set-up planning, administrative re-organization of funding from ARS to ISU to allow installation of instrumentation on ISU land, and seeking bids for installations. This additional work caused a 1.75-year delay in project initiation. Thirty plots were established in May 2011 within a 25-ha field at the Agronomy and Ag Engineering Farm that was planted to organic oat/alfalfa in 2006 and maintained as organic since that time. Tile drains, flow barriers and sump pumps were installed at the site in July 2011. High-voltage electric power was routed to the field site and secondary electric lines and other electrical components were installed in September 2011. The sump pits were equipped with water meters, sump pumps, sump basins, distribution pipes and water sampling devices in October 2011. In November 2011, trenches were dug for the insertion of conduit and transmission lines for the data loggers were installed. A permanent weather station was also installed at the field site in November 2011. Tile drain sampling began on December 1, 2011, and will continue every week until freezing weather stops drain flow. At the on-farm site, organic corn plots were monitored for the effect of a highly mobile source of naturally-mined nitrogen, Chilean nitrate (CN), currently allowable in certified organic production. There was a trend towards greater corn yields in CN plots (156 bushels per acre), but the 145-bushels-per-acre yield in control plots was not significantly lower than the CN yield. Late-spring soil nitrate-N levels reflected similar differences, with 19 ppm in CN plots an 10 ppm in control plots, with no statistical differences. At the end of the season, corn stalk nitrate-N concentrations also showed the effect of the CN, with 2,117 ppm in CN plots and 2,013 ppm in control plots, showing no statistical differences and both levels below luxury N consumption levels. Lower-depth soil analysis is predicted to show higher nitrate-N moving through the soil profile in CN plots, but, based on above-ground and late-spring nitrate-N results, excessive levels and significant differences between CN and control plots are not expected. Results from this project were discussed at two Field Days in 2011 and at three conferences to a total audience of 288 farmers, ag professionals and students. PARTICIPANTS: USDA-ARS National Lab for Ag and the Environment; Iowa State University Departments of Agronomy, Horticulture, Plant Pathology, and Food Science; Scott Shriver, organic farmer, Jefferson, Iowa. TARGET AUDIENCES: Target audiences include organic farmers and conventional farmers interested in organic practices or methods to reduce nitrate leaching and run-off in agriculture. Additional target audiences include ag professionals such as USDA-NRCS and Extension. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2009/09/01 TO 2010/08/31 OUTPUTS: Outputs from the Iowa State University (ISU) research farm component of this project are minimal at this stage, because final approval from NIFA for the use of funds budgeted for water monitoring instrumentation on the Iowa State University research farm did not occur until January 14, 2010, a full five months after the grant was awarded. A fully executed sub-award agreement between USDA-ARS and ISU was not in place until April 19, 2010. An amendment to the existing lease agreement between ISU and ARS was required by ISU for ARS to conduct water quality research on university research farmland. Iowa State University waived the easement requirement associated with the distribution of electric power to the research site on June 10, 2010, agreed to coordinate the distribution of high voltage power through the Rural Electric Cooperative, and required that the secondary distribution lines and equipment be installed by Iowa State University. The amended lease agreement between Iowa State University and the USDA-ARS was approved by the Iowa Board of

Reagents at their August 5, 2010 meeting. The ARS Administrator signed the amended lease agreement on September 28, 2010. A re-budget request was filed through ISU OSPA on October 4, 2010 for the electric power work. ARS has begun the process to initiate the required 45-day open bid period for the subcontract to install water monitoring instrumentation. We anticipate that the installation of water quality instrumentation and electric power distribution will be completed by the spring of 2011. Crop, soil and water data collection on the Iowa State University research farm will begin immediately after establishment of cropping systems in the spring of 2011. Within the on-farm component of this project, an on-farm experiment was established in 2010 to examine the effect of natural nitrate, an allowable organic fertilizer if providing no more than 20% of the N required by the organic crop (i.e., 180 lb N/acre for corn, so the 20% N applied as natural nitrate corresponded to 36 lb N/acre). This fertilizer, containing16% nitrogen, is a natural product obtained from the Caliche ore in the Atacama Desert of Chile by mechanical and hydraulic processes. The more rapid mobility of the N component in this fertilizer, however, has created concern over leaching and runoff, which this research will attempt to investigate. Results in 2010 included a significant increase in organic corn yield when natural nitrate was applied (147 bushels per acre, versus 133 where no natural nitrate was applied). Corn stalk nitrate results at the end of the season did not show any luxury consumption of nitrogen where natural nitrate was applied (all of the N was taken up by the plant). Corn protein levels, averaging 7.4 percent, did not show any differences with the natural nitrate application, suggesting that the natural nitrate affected corn growth and yield without significantly impacting N leaching. Results of this project were disseminated at four professional meetings in 2010. Field Days will be held with target audiences in 2011 when the experiment is established at the ISU research farm. PARTICIPANTS: USDA-ARS National Lab for Ag and the Environment; Iowa State University Depts. of Agronomy, Horticulture, Plant Pathology, and Food Science; Scott Shriver, organic farmer, Jefferson, Iowa. TARGET AUDIENCES: Target audiences include organic farmers, transitioning farmers and conventional farmers interested in organic practices or methods to reduce nitrate leaching and run-off in agriculture. Field Days will be held with target audiences in 2011 when the experiment is established at the ISU research farm. Additional target audiences include ag professionals such as USDA-NRCS and Extension. Results of this project were disseminated at four professional meetings in 2010. PROJECT MODIFICATIONS: Not relevant to this project.

2009/09 TO 2014/08 Target Audience: Our target audience was other scientist (through our journal article and poster), policy makers (through our poster) and the public through our field day. Changes/Problems: Dr. Greg Jennings was officially removed from this project as he left the university toward the beginning of 2013. What opportunities for training and professional development has the project provided? In addition, we provided 6 field day presentations to farmer and extension audiences where attendance was generally greater than 100 persons per field day. Fact sheets were developed for these field days and handed out. Several presentations on the effectiveness of these systems to reduce agricultural nutrients were made to Crop Consultants and other. How have the results been disseminated to communities of interest? 1. Field days 2. Poster presentations 3. Educational presentations What do you plan to do during the next reporting period to accomplish the goals? Nothing Reported

2013/09 TO 2014/08 Target Audience: 1. Farmers 2. Extension agents 3. Research scientistis 4. Policy makers Changes/Problems: Dr. Jennings was removed as a co-PI as he left the university in early 2013. What opportunities for training and professional development has the project provided? We provided two presentations at a field day where over 100 farmers, government agency personnel, and extension agents attended. How have the results been disseminated to communities of interest? Nothing Reported What do you plan to do during the next reporting period to accomplish the goals? We intend to finalize the project, including a draft of our final papers. We will also have to disassemble a significant amount of equipment.

2012/09/01 TO 2013/08/31 Target Audience: We targeted organic producers at a field day and other scientists. Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided? We provided a one-semester reading class to look at the relationship between organic production and nutrient losses. In addition, we provided yearly talks at the Fresh Market Tomato and Vegetable Field Day at the Mountain Horticulture Research Station Field Day for the past four years. The 2013 presentations are listed below: Producer Training. Fresh Market Tomato and Vegetable Field Day: An Update, Mountain Horticulture Research Station Field Day. 2013. Sweet Corn Yields from a Long Term Tillage & Production Management Experiment. Greg Hoyt, Deanna Osmond, Julie Grossman, Josh Edgell, and Collin Suttles, Department of Soil Science, NCSU. \~ 100 growers Producer Training. Fresh Market Tomato and Vegetable Field Day: An Update, Mountain Horticulture Research Station Field Day. 2013. Effects of Organic and Conventional Production Systems under Conservation and Conventional Tillage on Water Quality. Josh Edgell, Deanna Osmond, Dan Line, Greg Hoyt, and Julie Grossman, Department of Soil Science and Bio and Ag Engineering, NCSU. \~ 100 growers How have the results been disseminated to communities of interest? Field days and classrooms What do you plan to do during the next reporting period to accomplish the goals? Nothing Reported

2011/09/01 TO 2012/08/31 OUTPUTS: Twenty plots (five treatments of 4 replications each) were established in a long-term experiment (\> 15 years) where organic vs conventional management and conservation- vs conventional-tillage treatments were maintained. Crimson clover and wheat cover crops were planted in the organic management treatments and wheat cover crop in the conventional management treatments. Sweet corn was planted yearly (May to June timeframe) and harvested in August. Under conventional management, synthetic pesticides and chemical fertilizers were used; weeds were controlled by either herbicides (no-till treatment) or cultivation (plow treatment). Organic insecticides and pelleted poultry litter were used in the organic management plots; weeds were controlled by either a rototiller (plow treatment) or a lawn mower (no-till treatment). Sweet corn yield, cover crop biomass and N, and other agronomic characteristics have been measured for three years (2010 - 2012; only two years of data are presented). Wood boards around the perimeter of the plots eliminate surface water flow from entering the plots as well as retain internal flow to down slope weirs to which Isco samplers were attached. Water volume was measured and water samples were collected on a flow-proportional basis during storm events. Concentrations of nitrate+nitrite nitrogen (NOx-N), ammonium (NH4), total Kjeldahl N (TKN), total dissolved nitrogen (TDN), total phosphorus (TP), orthophosphate (PO4-P), total carbon (C), particulate organic matter (POM) and sediment (TSS) were measured. Using volume of water and constituent concentrations, total yearly loads were calculated. Additionally, microbial biomass, particulate organic matter, and bulk densities measurements were made. Surface soil core samples 7.5cm deep were used to measured bulk density. Particulate organic matter was determined using a density fractionation, while microbial biomass was measured using a chloroform-fumigation extraction protocol.Information from this work has been transmitted as posters to both national and state-wide audiences. A field day was held for farmers in North Carolina. PARTICIPANTS: Nothing significant to report during this reporting period. TARGET AUDIENCES: A reading class was held fall 2011 to provide graduate students the opportunity to find and discuss research on the water quality effects of conventional and organic management. Graduate students found articles are presented them in class. This allowed each graduate student the opportunity to lead 2 classes. End-of-class surveys demonstrated that all students had increased their knowledge and their critical thinking skills. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2010/09/01 TO 2011/08/31 OUTPUTS: The goals of this project are to measure and model nonpoint source water pollution (nitrogen, phosphorus, and sediment) associated with organic and conventional vegetable farming systems under different tillage practices, and to disseminate results to farmers and students. We are evaluating surface water (nutrients and sediment)from organic and conventional systems that have the same crop production systems and equal amounts of applied but from different sources. The specific objectives of the proposal are seven fold. Besides comparing water quality data, we will also evaluate soil organic matter, cover crop biomass and nitrogen, crop yield, nitrogen uptake and calculate nitrogen use efficiency of the different treatments. The Agricultural Policy Environmental Extender (APEX) model will be used to model the two systems to help quantify losses. We had significant problems implementing field plots: snow on the ground, drought, some reworking of the flumes. By the beginning of 2011 the plots were working well and it was raining again. As such we have collected about 10 months of water quality data; we have two seasons of yield data. Based on the limited information, we have provided producer training (see next).1.Producer Training. Fresh Market Tomato and Vegetable Field Day, Mountain Horticulture Research Station Field Day. 2011. Enhancing Soil Organic Matter in Alternative Production Systems. Erika Larsen, Julie Grossman, Deanna Osmond, and Greg Hoyt. Department of Soil Science, NC State University 2.Producer Training. Fresh Market Tomato and Vegetable Field Day, Mountain Horticulture Research Station Field Day. 2011. Effects of Organic and Conventional Production Systems on Water Quality. Deanna Osmond, Joshua Edgell, Dan Line, Greg Jennings, and Greg Hoyt, Departments of Soil Science and Biological and Agricultural Engineering, NC State University. In addition the APEX modeling has been going well as the graduate student has worked closely with the modelers in Texas to implement APEX for this situation. The graduate student has the advantage of 18 years worth of yield and physical property data to do the modeling. She gave the following presentation: Kieu, L.N. and M.R. Reyes. 2011. Evaluation of APEX model for Organic and Conventional Management under Conservation and Conventional Tillage. Annual Meeting of ASABE, Lexington, KY. PARTICIPANTS: Nothing significant to report during this reporting period. TARGET AUDIENCES: Nothing significant to report during this reporting period. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2009/09/01 TO 2010/08/31 OUTPUTS: During this past year we have developed and instrumented the runoff plots. These plots have been tested several time to ensure that there is no runoff in the plots that would cause artifacts in the data. We are now confident that the plots are working correctly and that the data are reliable. We have refined the methodologies for capturing POM. Agronomically,we planted cover crops, harvested them to determine nitrogen contribution, and applied dairy slurry (organic plots) and commercial fertilizer to the sweet corn. Organic no-till plots were mowed between the rows weekly to reduce weeds, while plow-organic plots were roto-tilled to kill weeds. Conventionally treated sweet corn used herbicides. Sweet corn yields were as followed: no-till, conventional production yielded \>\> conventional till, conventional production = no-till organic \> plowed organic. Deep soil samples were collected 3 times this past year and segregated into 6 inch depths to sample soil nitrogen and carbon. Soil carbon in the first inch was the same for all conventionally tilled plots and the control (\~ 0.8%), whereas soil carbon was almost double (\~1.6%) for all no-tilled plots. By six inches, however, there was no difference in soil carbon. PARTICIPANTS: Nothing significant to report during this reporting period. TARGET AUDIENCES: Nothing significant to report during this reporting period. PROJECT MODIFICATIONS: In the proposal we stated that we would evaluate groundwater nitrate concentration. Several project reviewers stated that the groundwater samples would not necessarily reflect the plot treatments. As such we modified the experiment and are collecting deep soil samples (3 feet deep) and analyzing nitrate-N and ammonium-N in six in segments in an attempt to follow N losses through the soil system. This is a surrogate test for groundwater nitrate.

2010/09 TO 2014/08 Target Audience: Winter wheat farmers, local citizens, university scientists, research station techhnical support staff who participated in the Wyoming and Nebraska Agricultural Experiment Station Field Days in Lingle, WY and Sidney, NE; farmers who are on the project steering committee, farmers and researchers from other universities who inquired about research after reading published research articles; freshmen undergraduate students taking Agroecology 1000 class, senior undergraduate students taking the capstone seminar \"Issues in Sustainable Agriculture\" (AECL 4990), graduate srtudents taking PLNT 5790 \"Soil-Plant-Atmosphere Relationships in Managed Ecosystems\", students and scientists attending Plant Sciences Department seminar series; small-scale organic producers who attended Wyoming Organic Conference, Farm and Ranch Days, Westi Ag Days; local highschool and elementary school teachers, extension educators and extension specialists, USDA ARS researchers who work on model simulations, ASA-CSSA-SSSA annual conference atendees. Changes/Problems: Two-year severe drought resulted in need to collect additional year of data that added to budget analytical expenditures. Health related leave of a MS student in Ag Economics slowed the process of additional analyses associated with C footprint and energetics analyses. It is our hope that the data can be used by another student or when the original MS student returns. Project started at the same time new analytical equipment for gas chromatography was installed in the lab. Trouble shooting and student learning impacted QA/QC of a number of sample analyses and resulted in spotty data sets. What opportunities for training and professional development has the project provided? Two graduate students completed a week-long training to learn how to perform model simulations using their own data. They successfully completed their exercises and drafted the results into their thesis/dissertation. A couple of undergraduate work study students collected data for research projects to complete their internship requirements. Project provided data to explore possibilities of additional data analyses of cross-comparison between dryland and irrigated agroecosysems in winter wheat production regions of higher annual precipitation. How have the results been disseminated to communities of interest? Results were disseminated as a series of mini articles published in Agricultural Experiment Station Field Days Bulletins. Results were presented as open cross-campus presentations during graduate student PhD and MS defense seminars. Oral presentation was given at Dryland Agriculture Community (American Society of Agronomy) annual meeting in Sidney, NE. Oral presentation was given during annual ASA-CSSA-SSSA meeting in Long Beach, CA in November. One article was published in ASA monthly Crops and Soils and one article was published in Western Soil Nutrient Management Newsletter. Based on published information, a number of inquiries came from Montana State University, ARS, and from a couple of dryland winter wheat farmers who contacted PD via phone. PIs intend to continue publishing the results and collaborate with ARS to disseminate the information. What do you plan to do during the next reporting period to accomplish the goals? Nothing Reported

2012/09/01 TO 2013/08/31 Target Audience: Farmers who participated in the Research Station Field Days at WY and NE Agricultural Research Stations, farmers who are on the project steering committees, undergraduate students taking the capstone AECL 4990 (Issues in Sustainable Agriculture) class; local highschool and elementary school teachers, extension educators and extension specialists, researchers who work on model simulations, conference attendees. Changes/Problems: 2012 was a drought year that created a need for additional 2013 field sampling and hence, non-funded one year project extension. What opportunities for training and professional development has the project provided? Training and professional development: One PhD student attending a week-long training to learn how to model using DAYCENT; One MS student attended a week long training to learn how to model soil water relationships; Two Agronomy students participated in annual ASA-CSSA-SSSA conference where they presented their results and attended a variety of workshops offerred by the society to graduate students; Agronomy graduate students and post-doc met weekly with project PD and discussed research results and interpretation; PIs and students met twice to discuss progress and results; PD attended a series of on-campus workshops to learn how to handle large datasets using ACCESS; PIs participated in a teacher training workshop aimed at designing a module for local teachers to use as intergrated science based project; How have the results been disseminated to communities of interest? Field Day Presentation to an audience of 30 plus farmers, local community members and educators; Class presentations to senior undergraduate capstone class; Individual conversations with farmers via phone or email; Field trips organized for teachers and graduate students to tour the sites; Visits by international undergraduate and graduate students to learn the methodologies used to collect data. What do you plan to do during the next reporting period to accomplish the goals? Finish data collection; Carry-on modeling exercises; Continue submitting papers for peer-reviewed publications; Write extension bulletins that will include student participation; Graduate two more students; Organize a workshop about the outcomes at the research stations; Organize Teachers workshop. Present outcomes at the PDproject meetingin October, annual ASA-CSSA-SSSA meeting and multi-state project conference.

2011/09/01 TO 2012/08/31 OUTPUTS: Activities: Six separate experiments were well under way in year two. Experiments established in dryland and irrigated production at MAP of 11 inches (Lingle, WY) and MAP of 14 inches (Sidney, NE) included: (1) dryland winter wheat fallow production in second year of transition to organic; (2) impacts of first field preparation of winter wheat fallow while transitioning to organic; (3) irrigated organic cash crop production (a) and livestock integrated crop production (b) in the third year of transition to organic; (4) organic dryland winter wheat/fallow/sunflower (or millet) crop production; (5) no inputs irrigated or dryland alfalfa grass hay production; and (6) impacts if summer rainfall events in dryland and irrigated no-inputs alfalfa grass hay production. Survey and inventory data was also collected for economic analysis and assessment of agroecosystem sustainability by using carbon (C) footprint approach that will lead to future Life Cycle Assessment (LCA). Assessments: PI meetings held in late fall (November); meeting with the steering committee (spring), 5 graduate student committees; weekly meetings with individual graduate students, a post doc and undergraduate interns. Teaching: PD, U. Norton used preliminary results during undergraduate/graduate Soil Ecology Class and mentored 3 US and one international undergraduate internships. Conference presentations: Bista, P, U. Norton and R. Ghimire, and J. Norton. 2011. ASA-CSSA-SSSA annual meetings, San Antonio, TX; Peterson, B., U. Norton, and J. Krall. 2011.ASA-CSSA-SSSA annual meetings, San Antonio, TX; Peterson, B., U. Norton, and J. Krall. 2012. ESA annual meetings, Portland, OR; Ghimire, R., U. Norton, and J. Norton. 2012. Western ASA-CSSA-SSSA annual meetings,Davis, CA; Bista, P, U. Norton and R. Ghimire. 2012. ASA-CSSA-SSSA annual meetings, Cincinnati, OH; Kaur, G., T. Persson, T. Kelleners, U. Norton and A. Garcia y Garcia. 2012. ASA-CSSA-SSSA annual meetings Cincinnati, OH. Field Days presentations: Sustainable Agriculture Research and Education Center (SAREC) Field Days, August 2012, Lingle, WY: Norton, J.B., R. Ghimire, U. Norton, J. Meeks, S. Paisley. Peterson, B., U. Norton, and J. Krall. Kaur, G., and A. Garcia y Garcia. Symposia/public meeting presentations: Norton, U., P. Bista, B. Peterson, R. Ghimire and T. Hurrisso. Public meeting at SAREC, Lingle WY in April 2012. Norton, U., P. Bista, R. Ghimire, B. Peterson, J. Odhiambo, T. Hurrisso and J. Norton. Annual ASA Dryland Agriculture Systems Community meeting, August 2012. Workshops: One day workshop attended by two PIs, three science teaching leaders and three K-12 science teachers from WY on designing outcomes and objectives for the upcoming science teachers (K-12). Dissemination: public meeting in April, 2012 (attended by 20 people), annual ASA Dryland Agriculture Community meeting in SAREC in August 2012 (attended by 50 people) and SAREC Summer Field Days in August 2012 (attended by over 150 people). PARTICIPANTS: PD, Urszula Norton: organized steering committee meetings, participated in biweekly field sampling trips, gave presentations to public during ASA Dryland Community meeting, managed grant budget, recruited one more PhD student in Agronomy, recruited three undergraduate interns and two summer part-time undergraduate field assistants, co-authored one peer-reviewed paper, six conference presentations and two Field Days presentations; helped prepare three PhD students seminar presentations; participated in preparatory workshop to develop K-12 teacher training. PI, Axel Garcia y Garcia: participated in steering committee meeting, purchased and installed sensory equipment for soil water and temperature monitoring, mentored one MS student in Agronomy, co-authored one conference presentation, and one Field Day presentation; helped prepare one MS student seminar presentation. PI, John Ritten: participated in steering committee meeting; mentored one MS student in Agricultural Economics; purchased software for economic modeling. PI, Jay Norton: participated in two steering committee meetings; mentored one post doc scientist in Soil Science, co-authored four conference presentations, and two Field Day presentations, supervised field operation manager located at SAREC in Lingle, WY, participated in preparatory workshop to develop K-12 teacher training. PI, Gary Hergert: participated in two steering committee meetings, participated in two trips to Agriculture Experiment Station (Sidney, NE). PI, Steve DelGrosso: mentored one PhD student in Agronomy, Prakriti Bista: participated in two steering committee meetings, led biweekly field trips to Lingle, WY, co-authored two conference presentations; supervised one part-time undergraduate field technician. PhD student in soil

Science, Rajan Ghimire: participated in two steering committee meetings, led biweekly field data collection to Lingle, WY; authored (main) one peer-reviewed article and one submitted in press, authored (main) one conference oral presentation, co-authored two conference poster presentations. Post-doc Scientist, Tunissa Hurisso: participated in one steering committee meeting, led biweekly field sampling trips to Sidney, NE. Undergraduate field technician, Haley Roberts: participated in field and lab work. Undergraduate field technician, Erin Anders: participated in field and lab work. Field Operations Manager , Jenna Meeks: participated in the steering committee meeting, participated in all biweekly field monitoring; managed experimental plots and authored one lay audience article. Partner Organizations: University of Wyoming; UW Sustainable Agriculture Research and Education Center, Lingle, WY; University of Nebraska; University of Nebraska Agricultural Experiment Station, Sidney, NE; ARS USDA NPA- Ft. Collins, CO. Collaborators and contacts: Neil Hansen-Colorado State University; Anowar Islam, James Krall-University of Wyoming. Training: 3 MS students, 4 PhD students, 1 post doc, 4 undergraduate internships, 3 K-12 science coordinators, 3 K-12 science teachers, 3 undergraduate summer field technicians; 1 MS student spent one week attending a modeling workshop. TARGET AUDIENCES: Dryland winter wheat farmers and ranchers from WY and NE, students from the University of Wyoming who intend to become farmers after graduation, scientists, local politicians and administrators who participate in Field Days presentations, Formal classroom instructions (AECL 4990 Capstone seminar), laboratory instruction (SOIL 4140/5140), national and international internships, K-12 science leaders\' workshop, development of a curriculum module for K-12 science teachers, informal science presentations, student seminars, extension and outreach. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2010/09/01 TO 2011/08/31 OUTPUTS: Activities: In spring 2011 we established plots in dryland winter wheat-fallow at SAREC (Lingle, WY). Treatments included conventional, no-till and organic farming systems. \"Transition to organic\" treatments were superimposed in conventional and no-till systems. Total of 10 trts replicated 5 times were created. These plots were monitored biweekly for greenhouse gas emissions (GHG), soil and plant biomass parameters starting in May 2011. In July 2011 we carried out an intensive GHG and soil sampling following a single tillage event in no-till plots as a part of conversion from no-till to organic. In May 2011 we established biweekly GHG, soil and plant parameters monitoring under irrigated cash crop and livestock integrated production in conventional, reduced inputs and organic farming at SAREC (Lingle, WY). In late summer 2011 we started establishing plots on dryland winter wheat millet (and/or sunflower) fallow rotations on Agriculture Experiment Station in Sidney, NE. Treatments included conventional, minimum-till and organic farming systems. \"Transition to organic\" treatments will be superimposed in spring 2012. Total of 12 trts replicated 5 times are going to be created. In fall 2011 sensors for monitoring soil water and temperature were purchased and are currently installed on all sites. Events: In April 2011 we convened a project meeting between the farmers who are a part of the steering committee, PIs. students and support staff to discuss project objectives and research establishment. In June 2011 preliminary project results were presented during Western Crop Science Society of America-Soil Science Society of America-Agronomy Society of America (CSSA-SSSA-ASA) meetings in Laramie, WY (http://a-c-s.confex.com/crops/ws2011/webprogram/Paper69113.html). In July 2011 research was presented to a large group of farmers during the Field Day organized by Sustainable Agriculture Research and Education Center (SAREC) Lingle, WY. In August 2011 project Director, Urszula Norton gave a synopsis of the research as an oral presentation to a large group of scientists and farmers from CO, NE, KS, WY and MT during \"Tear Down the Walls\" ASA Dryland Cropping section annual meetings in Ft. Collins, CO. Two abstracts are submitted for the presentations during annual ASA-CSSA-SSSA meetings in San Antonio, TX in October, 2011. Products: (1) baseline data of soil, plant and residue parameters collected before treatment establishment; (2) data from biweekly monitoring of GHG, soil, residue and plant parameters starting in May 2011; (3) data from intensive hourly monitoring of GHG, soil and plant parameters following conversion from no-till to organic production; (4) LAI measurements at peak winter what biomass growth; (6) data from the end of season root sampling. Dissemination: In April 2011 we met with farmers who specialize in no-till, organic and conventional winter wheat production to discuss the project objectives and solicit the feedback. In July 2011 research was presented during SAREC Field Day attended by farmers, ranchers, scientists, local citizens and politicians. PARTICIPANTS: PD, Urszula Norton: (1) organized two steering committee meetings in April and June 2011, (2) convened meeting with scientists in ARS Ft. Collins, CO on data collection and development of model simulation, (3) experiment establishment in SAREC (Lingle, WY) and biweekly monitoring trips, (4) trip to Agriculture Experiment Station (Sidney, NE) and experiment establishment, (5) presented during ASA Dryland Cropping section annual meetings in Ft. Collins, CO in August, 2011, (6) managed grant budget, (7) recruited one PhD student in Agronomy (spring 2011), (8) recruited one summer part-time undergraduate field assistant, (9) co-authored two presentations during Western CSSA-SSSA-ASA meetings; PI, Axel Garcia y Garcia: (1) participated in first steering committee meeting in April 2011, (2) purchased sensory equipment for soil water and temperature monitoring soon to be established, (3) recruited one MS student in Agronomy (fall 2011) PI, John Ritten: (1) participated in first steering committee meeting in April 2011; (2) recruited one MS student in

Agricultural Economics (Fall 2011); (3) purchased software for economic modeling PI, Jay Norton: (1) participated in two steering committee meetings; (2) recruited one post doc scientist in Soil Science (summer 2011), (3) co-authored two presentations during Western CSSA-SSSA-ASA meetings, (4) supervised field operation manager located at SAREC in Lingle, WY PI, Gary Hergert: (1) participated in two steering committee meetings,(2) participated in two trips to Agriculture Experiment Station (Sidney, NE) and experiment establishment PI, Steve DelGrosso: (1) participated in a meeting between PIs and scientists in ARS Ft. Collins, CO on data collection and development of model simulation PhD student in Agronomy (spring 2011), Prakriti Bista: (1) participated in two steering committee meetings, (2) participated in the meeting with scientists in ARS Ft. Collins, CO, (3) participated in experiment establishment in SAREC (Lingle, WY) and all biweekly monitoring trips, (4) participated in two trips to Agriculture Experiment Station (Sidney, NE), (5) co-authored two presentations during Western CSSA-SSSA-ASA meetings;(6) supervised one part-time undergraduate field technician PhD student in soil Science (fall 2009), Rajan Ghmire: (1) participated in two steering committee meetings, (2) participated in the meeting with scientists in ARS Ft. Collins, CO, (3) participated in experiment establishment in SAREC (Lingle, WY) and all biweekly monitoring trips, (4) co-authored two presentations during Western CSSA-SSSA-ASA meetings Post Doc Scientist, Tunissa Hurisso: (1) participated in one steering committee meeting, (2) participated in biweekly monitoring trips, (3) participated in experiment establishment and two trips to Agriculture Experiment Station (Sidney, NE) Undergraduate field technician, Sarah Legg: (1) participated in field and lab work Field Operations Manager (spring 2011), Jenna Meeks: (1) participated in the first steering committee meeting in April 2011, (2) participated in experiment establishment in SAREC (Lingle, WY) and all biweekly monitoring trips; (3) managed experimental plots TARGET AUDIENCES: Target audiences: dryland winter wheat farmers and ranchers from WY and NE, students from the University of Wyoming who intend to become farmers after graduation, scientists, local politicians and administrators who participate in Field Days presentations Efforts: formal classroom instructions (Agroecology 4990 Issues in Sustainable Agriculture), capstone class for students graduating in Agroecology, one internship offered to undergraduate student majoring in Agroecology, development of innovative teaching approach of using this project as a case study , extension and outreach through meetings with farmers and field day presentations PROJECT MODIFICATIONS: None

2010/09 TO 2014/08 Target Audience:The target audiences reached for the entire proposal persiod include the dairy farming industry including the Northeast Organic Dairy Association and UNH Cooperative Extension. We also had outreach to the K-16 community. Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided?Extension and/or education activities We have describedin the previous section thespecific opportunities for training and professional development related to K-12 activities. Dr. Varner also used/s this approach as a portion of her undergraduate course \"Techniques in Environmental Science\" to teachundergraduate Environmental Science majors about the measurement of greenhouse gases, data anlalysis and relationships between temperature, moisture and CO2 emissions. She was able to reach a total of 80 undergraduates with this research over the project period.In addition to this, ourresearch has also supported one post-doc (part-time), one master\'s students (full-time), a senior undergraduate thesis, and several class projects as part of a UNH Soil Ecology course and the Techniques in Environmental Science course. How have the results been disseminated to communities of interest?In addition to our publications, presentations and outreach to K-16, the broader impact of this study was to develop a web-based decision support tool for quantitatively evaluating the best management practices that enhance ecosystem services in livestock systems, both at individual farms and across the Northeast. We built the foundation for this outcome with our intensive field data collection, model testing, and GIS database development.We also develped this decision support tool, the Northeast Dairy Emissions Estimator and this is currently online and accessible. http://nedairy.ags.io/ What do you plan to do during the next reporting period to accomplish the goals? Nothing Reported

2010/09 TO 2014/08 Target Audience: Our target audience includes farmers, educators, and the general public. We have reached these groups through presentatons at professional meetings, meetings for growers, field days, and through electronic media, webinars and websites. Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided? We have held interactive sessions at field days and grower conferences, given webinars through eOrganic and the NRCS, and organized a panel discussion at the National Soil and Water Conservation Society\'s annual meeting. The panel discussion \"Beg, Borrow or Steal to Improve Stewardship: Will Segmenting Midwest Row Crop Actors Improve Management?\" considered how technical standards and decision tools might be used to alter lease agreements and federal programs to improve stewardship and be tailored for effective use by different farming segments, consumers, and the public. How have the results been disseminated to communities of interest? Interactive session: Partnerships for Conservation Innovation Field Day, Alison Organic Research and Demonstration Farm, Illinois Organic Growers Association. Roseville IL. August, 2011. Wander, M.M. Benefits of Organic Management. Organic

Environmental Benefits: Climate Change & Water Quality Use Session. Invited speaker. Organic Trade Association, All Things Organic, Expo East. Baltimore, MD. September, 2011. Wander, M.M. Organic Agriculture and Soil Conservation. Invited presentation. Illinois Specialty Growers, Agritourism and Organic Conference. Springfield, IL. January, 2011. Wander, M. and C. Ugarte. Soil Quality and Stewardship. Invited presentation. MOSES and the Illinois Organic Growers Association\'s Organic Grain Production, Soil Carbon Monitoring, and Cover Crops Field Day.Malta IL. September, 2012. Ugarte, C., Zaborski, E. and M. M. Wander. Total and Active Soil Carbon Fractions in Row Crop Systems Under Organic and Conventional Management: Assessment for Adequate Sampling. Volunteered presentation. Soil Science Society of America Annual Meeting. Cincinnati OH. October, 2012. Wander, M., Jackson, L., Snapp, S. and Grossman, J. Highlights from E-organic\'s Soils and Climate Change Communities. Soil Science Society of America Annual Meeting.Cincinnati, OH. October, 2012. Andrews, S.A., Ugarte, C. and M.M. Wander. eOrganic Webinar. NRCS Conservation Practices Organic Management and Soil Health Webinar.http://www.extension.org/pages/67366/. Also on YouTube http://www.youtube.com/watch?v=87poEEwckvM. March, 2013. Wander, M. and C. Ugarte.Methods and Metrics for Soil Conservation and Stewardship; What Works for You? For the Organic Track at the Illinois Specialty Crops, Agritourism and Organic Conference, Springfield, IL. January, 2014. Wander, M. , Ugarte, C. and E. Phillips. Illinois Grain Farmers\' Goals and Soil Stewardship Behaviors. For theNational Soil and Water Conservation Meeting. Chicago, IL. July, 2014. Wander, M., Ugarte, C. and E. Phillips. Beg, Borrow, or Steal to Improve Soil Stewardship: Will Segmenting Midwest Row Crop Actors Improve Management? Panel discussion at the National Soil and Water Conservation Meeting, Chicago, IL. July, 2014. What do you plan to do during the next reporting period to accomplish the goals? Nothing Reported

2012/09 TO 2013/08 Target Audience: Farmers, educators, researchers, and policy makers. Changes/Problems: We received a no cost extension so the date should be rolled back one year to be 2014. What opportunities for training and professional development has the project provided? The second part of our study evaluates tools used to predict changes in carbon sequestration, soil quality and the associated benefits resulting from different farming practices and determines barriers to the use of instruments that rank system performance. We are considering [practice-based instruments (organic certification, NRCS program tools, and process models) that focus on soil stewardship and carbon sequestration]{.mark}. We have used a mixed method approach that includes focus groups, interviews, and a quantitative survey to apply the theory of planned behavior to identify groups of farmers and issues that influence practice choice and willingness to participate in the program to incentivize carbon sequestration and resource conservation. The qualitative research phase has been completed. First year efforts included farmer focus groups, expert interviews and a design workshop that used clickers to document behavior and attitude change. We used a post-then-pre instrument design for the clicker exercise to allow participants to more accurately assess their baseline behaviors. First year efforts were used to inform qualitative farmer interviews conducted in 2012 and 2013 that are being used to develop scales, refine questions about attitudes, norms, and perceived and actual behavioral control factors. The qualitative summary is being used to design a quantitative survey that will be distributed in this winter. Farm interviews have also been used to gather management history needed to run evaluation tools and models to predict outcomes for individual farms. [Preliminary analysis of the CMT shows that the tool ranks the performance of organic farms more highly than conventionally tilled grain farms for all eight macro-concerns. Average CMT scores (conservation points) for organic and conventional farms using conservation tillage both exceed the stewardship thresholds for all eight macro-concerns. Organic systems ranked highest in all cases except for energy. Conventionally-managed farms that use standard tillage practices failed to meet stewardship thresholds for all areas except for plant production. These results will be compared with estimates for carbon sequestration, erosion, and greenhouse gas emissions made using process models that are widely used to rank or inventory stewardship]{.mark}. Where possible, sub-scores for macro-concerns are being compared against measured properties that are dominant contributing factors within the NRCS scoring system. How have the results been disseminated to communities of interest? Extension and/or education activities completed or upcoming: Wander, M.M. Methods and Metrics for Soil Conservation and Stewardship; What Works for You? Interactive session. Partnerships for Conservation Innovation Field Day, Alison Organic Research and Demonstration Farm, Illinois Organic Growers Association. Roseville IL. August 3, 2011. Wander, M.M. Benefits of Organic Management. Organic Environmental Benefits: Climate Change & Water Quality Use Session. Invited speaker. Organic Trade Association, All Things Organic, Expo East. Baltimore, MD. September 2011. Wander, M.M. Organic Agriculture and Soil Conservation. Invited presentation. Illinois Specialty Growers, Agritourism and Organic Conference. Springfield, IL. Jan. 8, 2011. Wander, M. and C. Ugarte. Soil Quality and Stewardship. Invited presentation. MOSES and the Illinois Organic Growers Association's Organic Grain Production, Soil Carbon Monitoring, and Cover Crops Field Day.Malta, IL. September 6, 2012. Ugarte, C., Zaborski, E. and M. M. Wander. Total and Active Soil Carbon Fractions in Row Crop Systems Under Organic and Conventional Management: Assessment for Adequate Sampling. Volunteered presentation. Soil Science Society of America Annual Meeting. Cincinnati, OH. October 22-24th 2012. Wander, M., Jackson, L., Snapp, S. and Grossman, J. Highlights from E-organic\'s Soils and Climate Change

Communities. Soil Science Society of America Annual Meeting.Cincinnati, OH. October 22-24th 2012. Andrews, S.A., Ugarte, C. and M.M. Wander. eOrganic Webinar. NRCS Cconservation Practices Organic Management and Soil Health Webinar. http://www.extension.org/pages/67366/. Also on Youtube http://www.youtube.com/watch?v=87poEEwckvM. March 2013. Websites, patents, inventions, or other community resources created: We are now developing a public page for eOrganic's Climate Change and Organic Farming Systems group that will allow all users of the workspace to aggregate related resources for eOrganic users. The group workspace is at http://eorganic.info/group/5461. Once the public page is launched it will reside on the home page in the list of Projects at eOrganic. What do you plan to do during the next reporting period to accomplish the goals? We will present an update to IOGA at the January conference (Illinois Soil Quality Initiative III: Stewardship on Organic, Conventional and Conservation Till Grain Farms) and plan to conduct a workshop at the National Soil and Water Conservation July 2014 meeting in Chicago as part of a session on 'Informing Conservation through Social Science: Factors Influencing Adoption of Agricultural and Natural Resource Best Management Practices'.

2011/09/01 TO 2012/08/31 OUTPUTS: The 2012 field season began earlier due to the warm dry weather. It was more difficult to identify organic and true no-till farms that had well matched soil types. Due to these challenges we were not able to maintain perfect matching between soybean and corn fields. A total of 21 farm fields were sampled in Spring; 9 of them had produced soybean and 12 had produced corn. We are on track to sample many more fields than initially proposed. On the fields that had produced corn, we established 10ft by 10ft micro-plots with organic soybean provided by Albert Lee. Hand watering was required to rescue crops due to the extreme drought. Poor stand establishment created significant variability and limited our ability to detect differences among systems. Interviews with farmers continued. Instead of meeting through focus groups we visited each farm and conducted one on one interviews after asking them to complete the Conservation Measurement Tool for the fields we are studying. Laboratory analyses continue. Reports summarizing results for 2011 farms and an interpretation guide have been developed and returned. Planning for a future workshop is underway. We had the following presentations: Michelle Wander and Carmen Ugarte presented a project update Soil Quality and Stewardship at the Organic Grain Production, Soil Carbon Monitoring, and Cover Crops Field Day, Organized in partnership with MOSES and IOGA, September, Malta IL. Carmen M. Ugarte, Edmond Zaborski, and Michelle M. Wander. \'Total and Active Soil Carbon Fractions in Row Crop Systems Under Organic and Conventional Management: Assessment for Adequate Sampling\' Soil Science Society of America. October, Cinncincatti, Ohio. Michelle Wander maintains ongoing outreach efforts to organize webinars for eOrganic and series of articles on organic and climate change. For more information consult eorganic.info. PARTICIPANTS: Nothing significant to report during this reporting period. TARGET AUDIENCES: Nothing significant to report during this reporting period. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2010/09/01 TO 2011/08/31 OUTPUTS: Multiple sets of farms (locations) selected for inclusion in the study include fields that have been under (1) Conventional, (2) Non tillage, and (3) Organic management for at least 5 years. (1) and (2) were corn-soybean based rotations and (3) were 3-5 year rotations that include small grains and cover crops or forages. Soil samples were collected using stratified grid sampling from 5-ha fields from the corn and soybean phases of the rotation in the spring. Samples (24 cores per field in 24 fields) were collected in depth increments of 0-15, 15-30 and 30-60 cm. Biochemical and physical measures have been or are being analyzed. We conducted four focus groups and had participating farmers complete detailed management surveys used for field assessment using the NRCS\'s Conservation Measurement Tool (CMT). To Meet Education and Extension Objectives: 1. We partnered with Western Illinois University and the Illinois Organic Growers Association on \"Innovations in Soil Conservation\" Field Day held on Wednesday, August 3, 2011. Our team added a morning session to the traditional lunch and afternoon tour at the Allison Organic Research and Demonstration Farm. This was an interactive discussion on various aspects of soil conservation, including nutrient management, water quality, and carbon sequestration. Participants included organic and conventional farmers, IEPA, NRCS and SWCDs. 2. We facilitated content development of eOrganic\'s Climate Change and Organic Agriculture and Soils groups including a webinar series: 1. http://www.extension.org/pages/30850/impact-of-organic-grain-farming- methods-on-climate-change-webinar; 2. http://www.extension.org/pages/32626/greenhouse-gas-emissions-associa ted-with-dairy-farming-systems-webinar; 3. http://www.extension.org/pages/30835/greenhouse-gases-and-agriculture :-where-does-organic-farming-fit-webinar 3. We provided staff support for eOrganic\'s administrative core by providing copy editing and review support for articles published to eXtension. PARTICIPANTS: Ryan Anderson of the Delta Institute helped to identify potential participants and provided input on educational content to be shared at the field day. Dick Breckinridge, IEPA, and Brett Roberts, NRCS provided educational content and participated in the Field Day. TARGET AUDIENCES: The research component is participatory in nature. This educational exchange is multi-directional (researchers, educators, farmers and agency personnel). The eOrganic community of practice includes farmers, educators and experts in the organic arena. The eXtension website that eOrganic supports serves educators, farmers, and the public including policy makers and industry. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2010/09 TO 2014/12 Target Audience: Target audiences: Growers in the Rio Grande Valley in south Texas, these included small to medium size vegetable producers, large citrus farmers and organic sorghum growers. These include mostly Hispanic educationally disadvantaged population and mid size Caucasian farmers. Four Annual conferences were completed from 2011 to 2014. Students in the Rio Grande Valley, in south Texas had learning opportunities thanks to annual competitive awards where they developed short studies in organic agriculture. Students partnered with a Texas A&M AgriLife Extension Faculty to conduct an study with a farmer. Students were able to be trained on data collection in fields and conduct laboratory studies. These studies were delivered in the four annual organic conferences with a wide assistance of the public of diverse ages. Scientific community: several presentations were deliver on science-based studies to the scientific community in the USA, Mexico, Peru and Spain. Also, people were educated through formal or informal educational programs such as filed days, master gardener classes and invitations to different educational activities. The significance of finding for organic agriculture: The studies completed in this grant is a compendium of preliminary findings on pest and beneficial insects in transitional organic farms in the Rio Grande Valley; we found that some mulch types affected directly insect pest populations and others increased yields, identified the leaf cutter ant as main pest defoliating vineyards, identify main insect pollinators, and compared pests, and natural enemies densities of organic and conventional systems. We also found that a three-acre organic vegetable farm can be profitable averaging \$41,318 in net cash income per year. Farmers are utilizing some of the tools provided such as the use of mulch (due to intense heat some mulch types last only one year), T-tape for water efficiency, organic insecticides for pest management decision for control of pests Some of the farmers are expanding their farms, including a mixture of crops and livestock or starting new farms by young farmers as described below: Farmer Markets: in 2009 there was only three in the valley in McAllen, Brownsville, and South Padre Island to this date there are 9 new farmer markets across the RGV: 2 in McAllen, 1 in each Weslaco, Harlingen, Edinburg, Brownsville, San Juan, Mission and South Padre Island. Yahweh Farm continued with CSA and move into providing land for a CSA\' type community garden, now including animals and projected opening of a farm market. Two former technicians started his new Organic farms, now using tools learned in this program to develop their business. Citrus organic: Thompson Rio Pride in Weslaco -a grower cooperator during the last 3 yrs- had 12 organic transitional acres in 2010, however now in 2014 is transitioning all his acreage into organic farming production (\>200 acres). This company sends grapefruit all over the U.S. and Canada. In 2014, an invasive pest (sugarcane aphid) was eefectively controlled on sorghum using organic insecticides A 1.5 acre is being used and designated as an Organic area in the Texas A&M AgriLife Research and Extension Center in Weslaco Changes/Problems: These studies shown that in the RGV region of Texas organic agriculture can be profitable at all levels: organic established growers can sell their high priced grapefruits at 3 to 4 times higher prices than conventional growers, and help to support underprivileged individuals bringing an income that will benefit the entire family. Students of STC were able to develop knowledge and discipline to carry on systematic data recording. Involving these students in research is a contribution not only in their professional development but also in research conduction where labor and basic knowledge is scarce. Below are some noticeable examples on how this project contributed to the development of these students: Currently, J. Borden, A. Lopez, B. Rich, A. Pecero and C. Ybarra are students of Texas University Pan American. David Garza presented at the national meeting, and finishing his studies at UT San Antonio Antonio Martinez winner of the first organic conference presentation, moved to Texas A&M Kingsville. He had chosen a major in Agriculture Guadalupe Alaniz: accepted to participate as a National Community Aerospace Scholar, once a nursing major, now Biology major since gaining the experience of both Microbiology (in class) Juan Enciso: Co Author of first publication (see above) he concluded his studies in Economy at UT Pan-American in McAllen, and hired to work for Texas A&M AgriLife Extension. Lauren Fann started in this program when she was doing a simultaneous enrollment with STC and was a 12th grade high school student. Now transferred to Texas A&M University and working part time in one of the laboratories of the Department of Entomology, in 2013 won the third place on the Subtropical Plant Soc. Conf. in 2013 (http://subplantsci.org/2013%20Subtropical.html) competing against graduate student. In November 2013 she presented her study in the Annual meeting of the Entomological Society of America. Problem with growing seasons of this region: For this southern region (Rio Grande Valley) of the USA the change in the extension of this grant was necessary, the growing season had already been completed by September and a new season starts in January. This complicates the work of the students because most of the work need to complete while students are attending classes while this not happen in the rest of the nations and even in Texas. Number of student awards: Depending of the load of work these awards need to be reduced from the original eight to a maximum of six. Working with undergraduate students is demanding, and although in this case most of the students completed their presentations and reports there were two that did not complete a report or not conduct a presentation. Carbon sequestration studies were not completed. What opportunities for training and professional development has the project provided? Presentations to community: 37 =2 in 2010, 8 in 2011, 10 in 2012, 9 in 2013, 6 in 2014, 2 in 2015 Presentations were conducted supporting the local extension agents, community and church organizations, local schools, colleges and universities. The audience included growers, kids, educators and students. We used video projectors as well hands-on in orchards, and community gardens Scientific meeting presentations: 21= 1 in 2010, 2 in 2011, 5 in 2012, 9 in 2013 and 4 in 2014 Presentations were conducted in National meetings of the Entomological Society (national and branch meetings), the small farm conference all in the USA, the international congress of acarology in Japan, the sustainable agriculture meeting in Peru, the biological control meeting in Merida, Mexico. Conferences organized: 4 = 2 in 2011 (Science conference at STC and 1st Joint Organic Conference STC-Texas A&M AgriLife Extension in Weslaco), 2nd and 3rd Organic Conferences in 2012 and 2013. 2 in 2011 (Science conference at STC and 1st Joint Organic Conference STC-Texas A&M AgriLife Extension in Weslaco), 2nd and 3rd Organic Conferences in 2012 and 2013. How have the results been disseminated to communities of interest? Presentations Several in situ demonstrations and presentations were conducted byresearchers and students with awardsin collaboration with the extension agents of Willacy, Cameron, Hidalgo, and Starr counties, as well as community organizations and churches as mentioned above Websites, or other community resources created: Economic feasibility of a small acreage organic vegetable farm in South Texas: -http://agecoext.tamu.edu/fileadmin/user upload/Documents/Resources/Publication s/SmallAcreage.pdf -http://southtexas.tamu.edu/programs-and-services/entomology/organic-transition / -http://biologygrants.southtexascollege.edu/org-farm/ What do you plan to do during the next reporting period to accomplish the goals? Nothing Reported

2011/09 TO 2012/08 OUTPUTS: Students awarded with scholarships on the 1st year developed short studies and made presentations on the 1st Joint Organic Conference in Weslaco on 12/10/11. Dr. Villalon encouraged awardees to participate in meetings such as Subtropical Hort. Sci. Conference (2/29/12). Awardees testimonials are in the www of STC. Mrs. Storz expanded the South Texas Educational Garden, in San Juan, TX to serve as an outdoor learning space overseen by Texas A&M AgriLife Extension and the Hidalgo Co. [The site demonstrates best management practices in plant selection, rainwater collection and irrigation techniques, maintenance for the south Texas sub-tropical, semi-arid environment, and teaches classes to everyone to be good stewards of our land and, to re-cycle materials and compost waste]{.mark}. Organic research is conducted in the site in cooperation with local colleges and universities. Dr. Villanueva conducted studies on: a) [Non-woven 100% polypropylene and woven polypropylene mulches used against weed and to observe the effects on arthropod populations]{.mark}. Predatory arthropods in watermelon were similar under the 2 mulches, but pests such as leafminers and whiteflies were greater in the nonwoven than woven mulch. Light reflectance or temperatures might have affected pest abundances. These 2 mulches deteriorated after 1-yr due to the environmental conditions of S. TX; b) Damage of leaf cutter ants (LCA) in Black Spanish grapes was evaluated using organic pesticides in a vineyard. LCA caused great defoliation to the vines in 2011and 2012. Spinosad treated vines had high yield and low damage in 2011 but not in 2012. LCA damage showed that 60% defoliation can cause \>90% reduction on grape yield; c) [we tallied pollinators on yellow traps. Six insect families of pollinators were found. There were 1.9 honeybees/trap across all dates, others pollinators were sphecid, chrysid wasps, sweat bees, cuckoo, red, paper, mud dauber, and threadtail wasps]{.mark}; d) Studies comparing organic and conventional control strategies on mites on grapefruits from 2010 to 2012 resulted on [effective controls of spider mites and rust mites under the two systems]{.mark}. Dr. Ribera studied the [Economic feasibility of small organic vegetable farms. Income relied on 3 streams; a CSA Program, farmers markets, and sales to local restaurant establishments]{.mark}. CSA income was estimated at \$40,500. Sales to farmers markets in Harlingen and McAllen, accounted for sales of \$18,021. Restaurant sales accounted \$5,185/yr. Income was high from Jan-Jun because leafy greens are not produced from Aug-Dec. Actual costs of production were utilized and estimated at \$20,063. Labor cost accounts for about 62.2 % of the total cost of production as 2 part-time workers are needed to help, the owner is assumed to work full time. [The farm experienced positive net cash income in 2011 of \$41,318 (total cash receipts minus total cash expenses). Amount does not reflect profit, as principal payments on loans, and employment and income taxes must be paid from this value. This sensitivity analysis demonstrates the importance of the CSA program to organic farm\'s profitability over sales on farm markets and/or restaurants]{.mark}. PARTICIPANTS: From 1/1/11 to 12/31/11 awarded students included David Garza, Antonio Martinez, Guadalupe Alaniz, Juan Enciso, Araceli Lopez, Josiah Borden, Bobby Castillo, Juan Davila and Ruben Navarro From 1/1/12 to 12/31/12. awarded students included David Garza, Juan Enciso, Araceli Lopez, Brian Rich, Sandra Ureste, Lauren Fann, Jonathan Martinez, and Vanessa Candanoza In addition, Dr. Gabriela Esparza was hired to work as post doc and Mr. Frank Garza was hired to supervise tests from 09/01/11 to 07/31/12. M Raulston from the Agric. Economy department and Juan Anciso and Horticulturist participated in the publication. TARGET AUDIENCES: Three presentations were conducted [targeting underserved socially disadvantaged mostly Hispanic women, two presentations were made to local growers and local students in Weslaco, and four presentations were made in scientific venues at the regional and national level]{.mark}. Presentation at local level targeting locally disadvantaged women: Insects in Organic Gardens:

What we need to know Growing Grower\'s Program Organized by Barbara Storz, 11/30/11, San Juan, TX. Pest Control in Organic Vegetable Gardens. . Growing Grower\'s Program Organized by Barbara Storz, 12/14/11, San Juan, TX. Control of Insects, Mites and Mollusks in Backyard Gardens, Presented to Earth Kind Vegetable Garden, Organized by Barbara Storz, 08/9/12 in San Juan Student and grower talks: Insect problems in the organic production of watermelon, onions, and grapes in the valley. Texas AgriLife, Entomology Science Conference, 11/1/11, College Station, TX. Major Problems in Organic Agriculture in the Rio Grande Valley. 2011. First Joint Organic Meeting STC and Texas AgriLife Extension, 12/10/11, Weslaco, TX. Scientific meeting: Learning organic farming while working with college students and small farmers in South Texas. G. Esparza, L. Ribera, R T. Villanueva. Annual Meeting of the Entomological Society of America Reno, NV, 3/6/12. Insect problems growing organic citrus, onions, watermelon and grapes in the Rio Grande Valley. Villanueva, R. T., G.Esparza-Diaz and L. Ribera. Southeastern/ Southwestern Joint Annual Meeting of the ESA, 3/6/12. Little Rock, AR. Endemic pollinators of a small organic farm in the Rio Grande Valley. Esparza-Diaz , G.; A. Martinez and R. T.Villanueva.. Southeastern/Southwestern Joint Annual Meeting of the ESA, 3/6/12. Little Rock, AR. Can spinosad be used to manage Texas leafcutter ants in organic Black Spanish Grapes 2012. Garza, D., G. Esparza-Diaz, and R. T.Villanueva. Southeastern/Southwestern Joint Annual Meeting of the ESA, 3/6/12. Little Rock, AR. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2010/09/01 TO 2011/08/31 OUTPUTS: The first event conducted under this program was to search for student to be selected as recipients of 8 scholarships (\$3000 each) between Oct. to Nov. 2010. We had near 30 applications, and the selections of students were made by a committee of 4 South Texas College (STC) instructors and 4 Texas Agrilife faculty. Scholarships for the students were divided in three parts (\$1000 each on Feb., May and Aug.). Students were assigned to a faculty to develop a short study. Preliminary results of seven different short studies were presented in Aug. 26, 2011; the final presentation for this first group of STC awardees will be titled \"First joint organic conference in Weslaco: South Texas College-Texas Agrilife Extension\" on Dec. 10, 2011. The titles of the studies and their authors for the Aug. 26 preliminary conference were: [(1) Organic farming evaluating vineyards, D. Garza; (2) Native pollinators of a small organic farm in the Rio Grande Valley, A. Martinez; (3) What\'s BUGGIN\' organic crops, A. Lopez; (4) Differences of microbial communities in organic and conventional soil, G. Alaniz Jr.; (5) Conventional Vs. organic research 2011 presented by J. Borden; (6) Weed control for organic crops, J. Davila; (7) Economic analysis of two small farms in the RGV, J. Enciso and R. Navarro]{.mark}. This event was attended by the faculty and student of STC as well as by farmers and the public in general (approx. 100 people) Full time personnel hired under this program include a Research Associate, Mr. J. Raulston, hired to conduct economic and carbon sequestration analysis for this project; an Extension Assistant, Mr. F. Garza, hired to provide support, make evaluations and to apply pesticide in the organic tests, and a Postdoctoral Extension Associate in Entomology, Dr. G. Esparza-Diaz, hired to design, conduct tests, data analysis, and support students. All working 100 percent of their times in this project. Results from the studies conducted by Drs. R. Villanueva, G. Esparza-Diaz, and L. Ribera had been presented in annual meeting of the Entomological Society of America, and the Southern Agricultural Economics Association Annual Meeting, respectively; as well as at the Departmental Seminar of Entomology of the Texas A&M U. in College Station. Also, in cooperation with Mrs. B. Storz, all PI presented their findings at the Master Gardeners programs in Hidalgo and Cameron Co. meetings, the Growing Grower\'s Program and the Vegetable Gardening Class Organized by Barbara Storz, July 28, 2011 in McAllen, the TOTAP Coop. of Cameron Co., Weslaco elementary schools and in the \"Kids appreciation day\" at the Gladys Porter Zoo of Brownsville. People that attended these events were small local farmers, backyard gardeners and people interested in transitioning organic production and [children interested to learn about pollinators.]{.mark} The dissemination of this information was done through local newspaper notes, in the official web sites of STC and Texas Agrilife and gardening sites (i.e. Grant helps grow a fresh crop of organic vegetable farmers: http://www.texasgardener.com/Newsletters/101117/). PARTICIPANTS: Raul Villanueva (PI) and coordinator of this program participated in two national presentations dealing with studies from this project (Comparison of the foliar acarine in grapefruit under conventional and organic pest management programs in Texas-2010 in San Diego CA; and Learning organic farming while working with college students and small farmers in South Texas-2011 in Reno, NV). Luis Ribera (Co-Pi) working in the economic analysis of small to medium size organic farms as well as carbon footprint analysis. B. Storz (Co-PI) organizer of the Growing Grower\'s and the Organic Vegetable Gardening Class. Debbie Villalon, coordinator of the activities of STC students, organizer of the selection of students awarded with scholarships and prepared the preliminary report conference on short studies conducted by STC awardees. Student awarded with scholarships are David Garza, Anthony Martinez, Araceli Lopez, Guadalupe. Alaniz Jr., Josiah Borden, Juan Davila, Juan. Enciso, and Ruben Navarro. Full time personnel hired to work in this program: J. Raulston, hired to conduct economic and carbon sequestration analysis for this project; Mr. F. Garza, hired to provide support, make evaluations and to apply pesticide in the organic tests, and Dr. G. Esparza-Diaz, a Postdoctoral Extension Associate in Entomology. In addition, Texas Agrilife Research faculty, STC instructors, and ARS-USDA personnel are collaborating providing support to students awarded with scholarships. TARGET AUDIENCES:

During the Aug 26 report the majority of the audience was STC students, and faculty. However, in our meeting on Dec. 10, 2011 the audience will be diverse and include many small to medium size growers. In addition, all growers that were attending presentations by Dr. L. Ribera, R. Villanueva and B. Storz will be recruited due to effect that local studies are scarce and this will be the first event with studies conducted in organic production in the Rio Grande Valley. PROJECT MODIFICATIONS: Recruiting qualified personnel for the full time positions offered was difficult; this event delayed the initiation of parts of the program (i.e. Mr. F. Garza started on Jan. 2011 and Dr. Esparza-Diaz started in June 2011). Also, to accommodate STC students, their projects will run from January to December of each of the three-yr program, hopefully we will have an extension to complete this project until December 2013 A major problem we had was providing the funds to the students; the first year program we gave the funds in advance (January, April and August), the next two years the funds will be awarded by the end April, August and December.

2010/09 TO 2015/08 Target Audience:Target audiences include organic farmers and conventional farmers interested in organic practices or methods to improve organic vegetable production and soil qulaity in organic systems. Additional target audiences include ag professionals such as USDA NRCS and Extension. Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided?There were several training and professional development activities associated with this project, including field days, workshops, conference presentations and presentations at professional society annual meetings. Extension specialists and farmer-educators were recruited for these technology transfer events, and their expertise blended with project results to increase impact for a wider audience. Over the course of the project, numerous educational programs have been offered, including 10 Publications and 10 Presentations at Conferences or Workshops. Research findings also have been integrated into course lectures in Iowa State University\'s Organic Agriculture: Theory and Practice class (AGRON/HORT/SUSTAG 484/584), offered in 2012 and 2014, and in the core courses in the Organic Crop Production specialization within the Horticultural Sciences major at the University of Florida, including HOS3281C - Principles of Organic and Sustainable Crop Production (Fall 2012-2014) and HO4283C - Advanced Organic and Sustainable Crop Production (Spring 2013-2015). All information from this project was uploaded to the ISU Organic Ag website: http://extension.agron.iastate.edu/organicag/. How have the results been disseminated to communities of interest?Results from this project were disseminated to an audience of 1,689 participants through 4 field days, 10 publications and 10 conferences/workshop presentations. All produce produced in the Iowa experiment was used by UI Dining Services for over 1,200 participants at the Iowa Organic Conference each November of the project, where attendees received information on the project. What do you plan to do during the next reporting period to accomplish the goals? Nothing Reported

2013/09 TO 2014/08 Target Audience: Target audiences include organic farmers and conventional farmers interested in organic practices or methods to reduce nitrate leaching and runoff in agriculture. Additional target audiences include ag professionals such as USDA NRCS and Extension. Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided? There were several training and professional development activities associated with this project, including field days, workshops, conference presentations and presentations at professional society annual meetings. Extension specialists and farmer-educators were recruited for these technology transfer events, and their expertise blended with project results to increase impact for a wider audience. How have the results been disseminated to communities of interest? Results from this project were disseminated to an audience of 328 participants through a field day, and three conference presentations. All produce produced in the experiment was used by UI Dining Services for 325 participants at the Iowa Organic Conference at University of Iowa, held on November 16-17, 2014. What do you plan to do during the next reporting period to accomplish the goals? We intend to conduct a fifth field season in Iowa to allow for additional lysimeter, soil quality and yield data in order to publish two years each of data related to organic sweet corn, pepper and tomato production. We hope to build on our strengths and address the weaknesses uncovered through this research, including the need to apply organic-compliant treatments for timely corn earworm management.

2012/09/01 TO 2013/08/31 Target Audience: Target audiences include organic farmers and conventional farmers interested in organic practices or methods to reduce nitrate leaching and runoff in agriculture. Additional target audiences include ag professionals such as USDA NRCS and Extension. Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided? There were several training and professional development activities associated with this project, including field days, workshops, conference presentations and presentations at professional society annual meetings. Extension specialists and farmer-educators were recruited for these technology transfer events, and their expertise blended with project results to increase impact for a wider audience. How have the results been disseminated to communities of interest? Results from this project were disseminated to an audience of 268 participants through a field day and four conference presentations in Iowa. All produce produced in the experiment was used by UI Dining Services for the Iowa Organic Conference at University of Iowa, held on November 17-18, 2013. In Florida, results from the project were delivered in four classroom/conference presentations to an audience of 120 producers, students and ag professionals. What do you plan to do during the next reporting period to accomplish the goals? We intend to conduct a fourth field season in Iowa to allow for additional lysimeter, soil quality and yield data in order to publish two years of data related to organic sweet corn, pepper and tomato production. We hope to build on our strengths and address the weaknesses uncovered through this research, including the need to apply irrigation on a timely basis during drought months.

2011/09/01 TO 2012/08/31 OUTPUTS: This multi-disciplinary, multi-state project addresses critical stakeholder needs for improving organic vegetable farming practices to optimize pest management, crop quality, and profitability, while enhancing soil quality to help mitigate global climate change. In 2012, experiments were continued in two states (Iowa and Florida) across two contrasting soil types (low vs. high fertility) and climatic conditions (sub-tropical vs. temperate) using vegetable rotations appropriate for the region. Two long-term rotation sequences were established at each site. Six cropping system treatments with different management practices were examined at each site: four treatments using cover crops (CC) and two without CC. Of the four CC treatments, two were treated as organic no-till (cover crop rolled) and two were tilled prior to vegetable crop planting/transplanting. Compost and mulch were applied to a sub-set of these treatments to test the effect of these potential soil amendments. In 2012, peppers and sweet corn were grown in Iowa, and squash and zucchini in Florida. Using lysimeter measurements, leached nitrate-N concentrations were determined throughout the growing season in Iowa and compared with vegetable yield and quality. In Iowa, organic no-tillage crops performed better in 2012 than in 2011, with no-tillage peppers averaging 5,532 lb/acre compared to 8,012 lb/acre in tilled yields. Mulch provided an advantage to pepper yields, with mulched pepper plots averaging 9,385 lb/acre, while non-mulched averaged 6,640 lb/acre. No-tillage sweet corn failed to compete with mulched and tilled yields, averaging 2,472 lb/acre. Tilled and mulched yields were excellent, with tilled sweet corn plots producing 4,545 and mulched yielding 4,423 lb/acre. While the tilled crops were more productive, the mulched and no till peppers had higher quality fruit. In Florida, the organic no-till system performed better than in Iowa, but any novel system will be difficult to compete with the performance of crops grown with plastic mulch, due to intense weed pressure under sub-tropical conditions. Plastic mulch treatments resulted in the highest tomato yields in 2011, but in 2012, organic no-till summer squash yields were not significantly different from mulched plots, averaging 5,689 lb/acre over all systems. Zucchini yields were equivalent in no-till (3,161 lb/acre) and mulched plots (5,821 lb/acre). In both years, cover crops did not significantly increase yields, but some weed management was observed. Populations of grass and annual broadleaf weeds did not differ among treatments, but higher populations of perennial broadleaf weeds were observed in treatments without plastic mulch. Use of plastic mulch in tilled plots and the no-till treatment reduced the nutsedge weed population, demonstrating a benefit of organic no-till. Results from this project were disseminated to an audience of 701 participants through two field days, four conference presentations and three classroom presentations in Iowa. In Florida, results from the project were delivered in one workshop and four classroom/conference presentations to an audience of 116 producers, students and ag professionals. PARTICIPANTS: USDA ARS National Lab for Ag and the Environment; Iowa State University Departments of Agronomy, Horticulture, Plant Pathology, and Food Science; organic farmers. TARGET AUDIENCES: Target audiences include organic farmers and conventional farmers interested in organic practices or methods to reduce nitrate leaching and runoff in agriculture. Additional target audiences include ag professionals such as USDA NRCS and Extension. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2010/09/01 TO 2011/08/31 OUTPUTS: This multi-disciplinary, multi-state project addresses critical stakeholder needs for improving organic vegetable farming practices to optimize pest management, crop quality, and profitability, while enhancing soil quality to help mitigate global climate change. The long-term goal is to provide organic producers with decision-making tools to enhance environmental services derived from mulches, compost, cover crops, and reduced tillage in organic vegetable systems. In 2011, experiments were established in two states (Iowa and Florida) across two contrasting soil types (low vs. high fertility) and climatic conditions (sub-tropical vs. temperate) using vegetable rotations appropriate for the region (tomatoes and onions in Iowa; squash and tomatoes in Florida). Using lysimeter measurements, leached NO_3-N concentrations were determined throughout the growing season in Iowa and compared with vegetable yield and quality. In Iowa, organic no-tillage yields (tomatoes: 317 kg/ha; onions: 281 kg/ha) failed to compete with mulched and tilled tomato and onion yields. Tilled and mulched yields were excellent, with tilled onion plots producing 2,215 kg/ha, and mulched onions yielding 2,266 kg/ha. Cover crops and compost offered no advantage in terms of increasing onion production. Tilled tomato plots averaged 16,831 kg/ha, while mulched tomatoes averaged 12,170 kg/ha, compared to 10,905 kg/ha without mulch. While the tilled tomatoes and onions were more productive, the mulched and no-till vegetables had higher quality fruit, due to the straw or mulch barrier affording greater protection from soil particles. Several factors impacted no-tillage production: delay in planting due to wet spring soil conditions and inability to use the mechanical transplanter because of transplants that were too large for the machine. Hand-transplanting suffered from inadequate preparation of planting area. Additionally, re-growth of the hairy vetch/rye cover crop and weeds in no-till plots impacted production. In Florida, plastic mulch treatments resulted in the highest tomato and squash yields, while cover crops did not significantly increase yields. Winter cover crops in Florida did not provide expected biomass and nutrient quantities, possibly due to slow establishment. As a result of colder weather impacting biomass production, cereal rye mulch was added to no-till plots to simulate a mulch cover in lieu of actual cover crops. No-till vegetable squash and tomato yields were similar to tilled plots without mulches, and weed populations were reduced compared to tilled plots. Overall, root-knot nematode galling was lowest in plots without cover crops. On-farm trials were conducted with cooperating farmers to strengthen the on-station research and contribute to more effective outreach. In Iowa, cover crops in on-farm no-till plots suffered from winter-kill and tomato yields were greater in tilled plots. In Florida, the on-farm trial tested the influence of summer cover crops (sorghum-sudangrass and sunnhemp) on yield of fall vegetables. PARTICIPANTS: Iowa State University and University of Florida Departments of Agronomy, Horticulture, Plant Pathology, and Food Science. TARGET AUDIENCES: Target audiences include organic farmers and conventional farmers interested in organic practices or methods to reduce nitrate leaching and run-off in agriculture. Additional target audiences include ag professionals such as USDA-NRCS and Extension. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

2010/09 TO 2014/08 Target Audience: Our target audience primarily includes small scale and commercial growers, Extension agents, and the scientific community. Much of our results concerns the interactions between soil chemistry, soil microbiology, nematodes, weed ecology, insect density and diversity and plant productivity. Lastly, we will subject the agricultural inputs and outputs to a complete economic analysis. We have had several grower meetings and have developed a Organic Vegetable Sod-based Rotation Website (northfloridaorganics.com). We have had many presentations and abstracts at scientific meetings including the American Society for Soil Science, the American Society of Agronomy, the American Society for Horticultural Sciences, and the International Society of Horticultural Sciences. We will continue to disseminate results after the grant termination date as we complete the 5 papers in preparation. Changes/Problems: The one major change of this project was associated with the resignation of my PhD student. This occurred more than two years into the project and it was diificult to hire another student as the project was nearing completion. I did hire a MS student that is handling some elements of this project. A one year no cost extension of this grant was beneficial in this regard. What opportunities for training and professional development has the project provided? In addition to the ten faculty members from Florida and two from Georgia, a full time post-doc was hired for the execution of the project. A PhD student resigned after the second year; however, another graduate student was recruited toward the end of the project. Training also occurred for the part time technical support personnel associated with the project. How have the results been disseminated to communities of interest? Scientific talks and abstracts have been presented at national and international meetings throughout the duration of the project. Five refereed publications are in progress concerning all aspects of this project. Grower presentations on the applied aspects of the project have also taken place. A North Florida Organic Vegetable website was established (northfloridaorganics.com) that is dedicated to the results of this particular grant. In addition, information and data will also be available on the larger and more inclusive UF Small Farms and Alternative Enterprise website. Lastly, the results of this project will be summarized in the form of electronic publications using the University of Florida EDIS website. As mentioned earlier, Extension Outreach will contiue well beyond the official termination date of this grant. What do you plan to do during the next reporting period to accomplish the goals? Nothing Reported

2010/09 TO 2011/08 OUTPUTS: Crop rotation systems designed to improve soil quality have been successfully implemented nation-wide, and have contributed to the 15% annual increase in organic production for the last decade. However, comparatively few systems have been utilized within the Southern Coastal Plain of Florida, Georgia and Alabama which provides the majority of fall/winter vegetables for much of the US. These states have less than 0.3% of the national acreage for organic production. Poor soils, high temperatures and humidity and high pest pressures pose unique regional problems. Over the last decade we have developed and tested rotational and tillage systems that are highly amenable to incorporation into organic production. We have shown that sod rotations including 2-year plantings of bahiagrass increase soil carbon and water retention, reduce fertilizer and irrigation inputs, and produce higher yields for a variety of crops. Strip tillage coupled with cover crops further enhances soil carbon sequestration, organic matter and moisture retention. Our long growing seasons allow year-round conditioning of the soil, and potentially expedite transition from conventional to organic systems. Moreover, the high ability of bahiagrass to sequester both carbon and water are in concert with responsible land stewardship. We are testing the effects of these rotational and tillage systems for organic vegetable production in the Southern Coastal Plain. Crop rotations and tillage are being evaluated on an ecological level (carbon sequestration, plant biomass, and carbon, nitrogen and nutrient partitioning, water usage), plant production level (yield, fruit quality, etc.), weed and nematode populations and densities and on a economic level. Our primary objective is to integrate the advances that we have made on sod-based rotation and strip tillage into organic systems for vegetable production in the Southern Coastal Plain. Adoption of these systems will promote land stewardship practices designed to rejuvenate depauperate soils. We are evaluating sod-based rotation and tillage in terms of productivity (plant biomass, yield, fruit quality, plant physiology), and pest impacts (arthropods, pathogens, nematodes and weeds), soil impacts (bulk density, soil carbon sequestration, soil nutrients, soil organic matter, and soil moisture retention), and water quality. Plant and soil data will be used to construct carbon, nitrogen and water budgets for the four rotation treatments. We will perform a complete economic budget using enterprise budgets. PARTICIPANTS: Nothing significant to report during this reporting period. TARGET AUDIENCES: Nothing significant to report during this reporting period. PROJECT MODIFICATIONS: Nothing significant to report during this reporting period.

IMPACT

2008/09 TO 2013/08 What was accomplished under these goals? We have successfully accomplished all of those goals. This study was designed as a prospective, cross-sectional multistate study that enrolled both [organic (ORG; n = 192) and similarly sized conventional (CON) farms that utilized both grazing (CON-GR; n = 36) and confinement systems (CON-NG; n = 64).]{.mark} Farms were enrolled between April 2009 and April 2011 from dairy herds located in New York, Oregon, and Wisconsin. Each farm was visited once by one of 3 trained study personnel who administered a 45 page animal health questionnaire that included questions about: case definition of selected diseases; methods and frequency of disease detection, treatments used for defined case scenarios, usage of veterinarians, and methods used to evaluate results of treatments. Data on the incidence, severity and economic consequences of selected diseases was collected during a period of 120 days. Bulk milk samples and individual cow milk samples from each farm were submitted for microbiological and molecular analysis. Key results of specific analyses that have been completed are as follows: Differences in Dairy Animal Management among ORG, CON-GR and CON-NG: About 30% of herds in each of the 3 participating states participated, indicating that the sampled herds were representative of targeted herds in the regions. Annual milk production per cow for ORG herds was about 25% and 37% less than production of CON-GR and CON-NG herds, respectively. The distribution of breeds, animal housing and hours spent outside varied based on management type. The average lactation of animals on ORG and CON-GR farms was 2.6 lactations, which was slightly greater than CON-NG farms (2.3 lactations). A greater percentage of first lactation heifers were found on CON-NG and CON-GR farms than ORG farms. Facilities used by adult animals were not different among the management systems. [Cattle on CON farms were fed approximately twice as much grain as cattle on ORG farms, and had greater milk production. Little difference was found for the average reported somatic cell count (SCC) and standard plate count (SPC), suggesting that milk quality did not vary based on management system.]{.mark} While some disease prevention measures were commonly utilized on ORG farms, (such as keeping a closed herd and having a written record of treatments administered to the animals), [the use of outside support and vaccinations were found to be less prevalent on organic farms than CON-GR or CON-NG farms]{.mark}. Use of Veterinarians: Regardless of management type, intensive practices such as use of a nutritionist, use of vaccinations, use of pregnancy checks, having Holstein as the predominant breed, and exclusive use of artificial insemination for breeding cows were closely associated with frequent usage of veterinarians. Intensity of management was more closely associated with frequency of veterinary usage as compared to association with organic status. This outcomes suggests that veterinarians should consider other management practices (rather than organic management) when identifying herds most likely to utilize their services. [Economic factors create a large barrier to utilization of routine veterinary services on small farms. The cost of routinely scheduled per unit of milk produced was much greater on small farms as compared to large farms, which is a likely reason why small farms (regardless of management system) are less likely to have routinely scheduled visits]{.mark}. More dialogue between veterinarians and small dairy farm owners is needed to identify mutually beneficial preventive programs for animal health management. Risk factors for Selected Diseases: Contagious mastitis pathogens were found more frequently in bulk tank milk obtained from ORG dairy farms. Approximately 30% of all farmers (regardless of management system) could not provide a definition of subclinical mastitis. An increased rate of clinical mastitis was associated with use of CON management, more sensitive detection (removal and observation of foremilk during milking), presence of contagious pathogens in the bulk tank culture, proactive detection of mastitis in postpartum cows, and use of stall barn housing. The application of pre-dip teat sanitizers was associated with reduced rate of clinical mastitis. An increased rate of ketosis was associated having a more sensitive definition of ketosis (anorexia), using stall barn housing, and feeding a greater amount of concentrates. An increased rate of pneumonia was associated with herds that did not use grazing, herds that were of small or medium size (rather than large herd), and presence of Jersey cattle as the predominant breed. Overall, disease definitions and perceptions were similar among the management systems and regardless of management system, the disease definitions that farmers used influenced the rate of detection of clinical mastitis, ketosis and pneumonia. Continued educational programming is needed to ensure that farmers of all management systems understand how to detect and prevent the occurrence of mastitis, and other common diseases of dairy cattle. During the farm visit, study personnel observed and scored individual cows for lameness and hock lesions. The prevalence of lameness as scored by study personnel was only weakly correlated with the rate of lameness that the farmers reported. Researchers frequently observed lame cows on farms where the farmers perceived that lameness was not occurring. An increased rate of lameness events (recorded by farmers) was associated with several management factors such as an increased prevalence of hock lesions, use of ORG management, small herd size, and presence of a breed other than Holstein or Jersey. An increased prevalence of cows observed as lame by study personnel was associated with as an increased prevalence of hock lesions, use of CONNG management, and routine utilization of a footbath. Herd Level Risk factors for positive tests of bulk milk for Johne's disease (MAP): Bulk milk samples were taken from each farm for Mycopbacteria avium paratuberuclosis enzyme-linked immunosorbent assay (ELISA) and other testing, (including somatic cell count and E. coli culture). Statistical models were constructed with MAP ELISA score as the outcome variable and the herd characteristics as independent variables. Herds could have high bulk milk ELISA due to either a high prevalence of MAP infected cows or by having a few infected cows that produce large quantities of antibodies. The concentration of antibodies against MAP in bulk milk varied seasonally. Farms which had livestock enter the herd in the 12 months prior to the study, had lower ELISA than closed farms, which had no entering livestock. Conventional herds that contained more thin cows were more likely to have lower MAP ELISA than CON herds that contained fewer thin cows. Body condition score of cattle was not associated with the ELISA values for bulk milk of ORG farms. New York herds had higher ELISA values, compared to Oregon and Wisconsin herds. This likely reflects a difference in MAP prevalence between regions. Overall, bulk milk ELISA values were associated with regions, contact with other farms and season, but were not associated with management system. **PUBLICATIONS (not previously reported):** 2008/09 TO 2013/08 1. Type: Journal Articles Status: Published Year Published: 2013 Citation: Stiglbauer, K.E., K. M. Cicconi, R. Richert, Y.H. Schukken, P.L. Ruegg and M. Gamroth. 2013. Assessment of herd management on organic and conventional dairy farms in the United States. J Dairy Sci 96:1290-1300. 2. Type: Journal Articles Status: Published Year Published: 2013 Citation: Richert, R.M., K. M. Cicconi, M. J. Gamroth, Y.H. Schukken, K. E. Stiglbauer, and P. L. Ruegg. 2013. Management factors associated with veterinary usage by organic and conventional dairy farms. J Am Vet Med Assoc 242:1732-1743. 3. Type: Journal Articles Status: Published Year Published: 2013 Citation: Cicconi-Hogan, K. M., M. Gamroth, R. M. Richert, P.L. Ruegg, K.E. Stiglbauer, and Y.H. Schukken. 2013. Associations of risk factors with somatic cell count in bulk tank milk on organic and conventional dairy farms in the United States. J Dairy Sci 96:3689-3702. 4. Type: Journal Articles Status: Published Year Published: 2013 Citation: Richert, R.M., K. M. Cicconi, M. J. Gamroth, Y.H. Schukken, K. E. Stiglbauer, and P. L. Ruegg. 2013. Risk factors for clinical mastitis, ketosis, and pneumonia on organic and small conventional farms. J Dairy Sci. 96:4269-4285. 5. Type: Journal Articles Status: Published Year Published: 2013 Citation: Richert, R.M., K. M. Cicconi-Hogan, Y.H. Schukken, M. J. Gamroth, K. E. Stiglbauer, and P. L. Ruegg. 2013. Perceptions and risk factors for lameness on organic and small conventional farms. 96:5018-5026. 6. Type: Journal Articles Status: Published Year Published: 2013 Citation: Cicconi-Hogan, K. M., M. Gamroth, R. M. Richert, P.L. Ruegg, K.E. Stiglbauer, and Y.H. Schukken. 2013. Risk factors associated with bulk tank standard plate count, bulk tank coliform count and the presence of Staphylococcus aureus in the bulk tank on dairy farms in the United States. J Dairy Sci 969:7578-7590. 7. Type: Journal Articles Status: Accepted Year Published: 2014 Citation: Cazer, C.L., R.M. Mitchel, K. M. Cicconi-Hogan, M. Gamroth, R.M. Richert, P.L. Ruegg, and Y. H. Schukken. Associations between Mycobacterium avium subsp. paratuberculosis antibodies in bulk tank milk, season of sampling and protocols for managing infected cows. BMC Veterinary Research 8. Type: Journal Articles Status: Under Review Year Published: 2014 Citation: Cicconi-Hogan, K. M., N. Belomestnykh, R.M. Gamroth, P.L. Ruegg, L. Tikofsky, and Y.H. Schukken. Short Communication: Prevalence of methicillin resistance in coagulase-negative Staphylococcus and Staphylococcus aureus isolated from bulk milk from organic and conventional dairy herds in New York, Oregon and Wisconsin. Revision submitted J Dairy Sci November 2013. 9. Type: Journal Articles Status: Under Review Year Published: 2014 Citation: Bergman, M. A., R.M. Richert, K. M. Cicconi, M. J. Gamroth, Y.H. Schukken, K. E. Stiglbauer, and P. L. Ruegg. 2013. Comparison of selected animal observations and management practices used to assess welfare of calves and adult dairy cows on organic and small conventional dairy farms. submitted J Dairy Sci. Nov, 25, 2013 10. Type: Conference Papers and Presentations Status: Published Year Published: 2013 Citation: Treatments Used on Organic Dairy Farms Pamela L. Ruegg, DVM, MPVM, Roxann Richert, DVM, University of WI, Dept. of Dairy Science, Madison WI 53705, Ynte Schukken, DVM, Phd, Kellie Cicconi-Hogan, PhD, Cornell University, Ithaca NY, Mike Gamroth MS,, Katie

Stiglbauer, MS Oregon State University, Corvallis OR, Proc. Central Vet Conf. Kansas City, MO, Aug 2013. 11. Type: Conference Papers and Presentations Status: Published Year Published: 2013 Citation: USE OF VETERINARIANS BY ORGANIC AND SMALL CONVENTIONAL DAIRY FARMERS Pamela L. Ruegg1, DVM, MPVM, and Roxann Weix Richert,1DVM, MS, Ynte Schukken2, DVM, Phd, Mike Gamroth3, MS, Kellie Cicconi2, Katie Stiglbauer3 University of WI, Dept. of Dairy Science1, Cornell University, Ithaca NY,2 Oregon State University, Corvallis ORG, Proc. Central Vet Conf. Kansas City, MO, Aug 2013.

2011/09/01 TO 2012/08/31 Outcomes of this project indicate that dairy animal well-being is not compromised by use of organic management practices. The small to medium sized organic dairy herds enrolled in this study produced less milk, but used similar definitions and disease detection strategies as compared to similarly sized conventional dairy herds. Organic dairy producers identified fewer production related diseases in their cattle as compared to similarly sized conventional herds located in the same regions. In general, although approved treatments are limited for organic dairy producers, mortality rates and culling of cattle on organic dairy herds are similar to similarly sized conventional dairy herds and there is no evidence that milk quality or animal health is adversely impacted by the use of organic management. While the occurrence of many diseases is relatively infrequent, organic dairy producers could use more resources to prevent and effectively deal with several animal diseases that are caused by bacterial infections (such as pneumonia and subclinical mastitis). Within the guidelines of the NOP, management practices used by organic dairy producers range from very extensive to fairly intensive and use of veterinarians by organic dairy producers is associated with adoption of more intensive management strategies. For most diseases risk factors for development of disease were similar for ORG and CON farmers. There is a need to increase communication between dairy veterinarians and the organic dairy farming community.

2010/09/01 TO 2011/08/31 Final analyis of the dataset must be completed before outcomes can be determined.

2009/09/01 TO 2010/08/31 Within 2 weeks of the farm visit to collect data, all herds receive a comprehensive report describing the results of the observations and scoring that has been conducted on their herds. Farmers also receive approximately 3 more reports describing results of tests performed on their bulk milk and results of individual cow milk samples submitted for mastitis analysis. While the primary extension activities are scheduled to occur in the 3rd and 4th year of the project, several extension activities have already occurred. In Wisconsin, the PI (PLR) and PhD student have given 4 presentations about the project to extension audiences within Wisconsin (organic and conventional dairy producers) and described some preliminary observations about the project. Summarized data about project results for organic herds was presented at the MOSES Organic Farming Conference in LaCrosse WI and was well received.

2008/09/01 TO 2009/08/31 The project plan includes farm visits to a total of 200 organic and 100 conventional dairy farms disbursed across the following states: Oregon (n = 25 ORG & 25 CON); New York (n = 75 ORG & 25 CON) and Wisconsin (n = 100 ORG & 50 CON). All states have contacted organic and conventional farms and have initial enrollments that exceed expectations. Farm visits have been completed on \>60 herds and the prospective data collection period has been completed for \>30 herds. Farm visits are on schedule and are on going. Farmers have received visit reports that include a confidential assessment of observations performed on their farms and the results of diagnostic tests performed on biological samples collected during their visits. Monthly conference calls among study personnel are ongoing.

2008/06 TO 2013/05 Significant outreach occurred in 2012 when investigators published 12 reports and presented 61 talks to an audience of 4,667 producers and ag professionals. Methods for enhancing soil quality in organic systems continue as the main outreach focus. [In general, soil quality continues to be greater under organic NT conditions compared to CT]{.mark}. In 2012, soil quality differences were observed for NT treatments compared to CT, but observed differences varied among the research station sites. Soil quality enhancement under reduced tillage was particularly evident in parameters related to C cycling and storage. Particulate organic matter C (POC) was greater under no-till than conventional till in Iowa and Pennsylvania; microbial biomass C (MBC) was higher at the Wisconsin site; and macroaggregates comprised a greater proportion of the total soil mass at the Pennsylvania and Wisconsin NT sites. Macroaggregation is an integral indicator of soil dynamic change, where enhancement is also related to changes in soil structural stability and water infiltration and storage. Previously, soil quality differences were observed for NT over CT in Fall 2011 at five research sites, all of which were located in relatively moist ecosystems located in the upper and central mid-west and eastern Pennsylvania. At the MI and PA sites, residual soil nitrate nitrogen and electrical conductivity were greater under

NT than CT. Extractable soil K was greater under NT in IA, MI (SD) and WI sites (SD). [NT soil had more potentially mineralizable N than CT soil for 5 of the research sites with SDs at the IA, MI, and WI sites. These results demonstrate that after 4 years of organic NT management, the NT soils had greater capacity to supply N for crop growth than CT soils. Microbial biomass under NT management was increased at 7 of 11 sites in 2011 (4 showings SDs).]{.mark} At 2 of 11 sites, microbial biomass was greater under the rotation beginning with corn. Tillage by rotation effects were not significant. Cover crop residues in NT most likely contributed to the increases in microbial biomass, particularly for the rye cover crop, which may have persisted longer as surface cover and organic resource on which the microbiota could thrive compared to HV residues. The microbial community analysis (fatty acid methyl esters: FAME) showed substantial differences in diversity among locations, but not within a location and field site in 2011. Some profiles showed that tillage more than crop rotation had an effect on microbial diversity. Although total FAMEs within the identifiable categories were not statistically significant, slightly higher total FAMEs within gram-bacteria and fungal groups occurred in NT plots. This occurrence suggests that the build-up of surface residue under NT conditions contributed to microbial community change. These results demonstrate that after 4 years of organic NT management at three research sites in the upper Midwest and Pennsylvania, NT soils had greater capacity to retain biologically active forms of soil C and greater structural stability than CT soils. **PUBLICATIONS (not previously reported):** 2008/06 TO 2013/05 1. Carr, P.M., K. Delate, X. Zhao, C. Cambardella, P.L. Carr, and J. Heckman. 2012. Organic farming: Impacts on soil, food, and human health. In: Soils and Human Health, E.C. Brevik and L.C. Burgess (eds.), pp. 241-254, Taylor and Francis, New York. 2. Delate, K., C. Cambardella and X. Zhao. 2012. Effect of cover crops, soil amendments and reduced tillage on carbon sequestration and soil health in a long term organic vegetable system. p. 22-26. In: S. Smith, M. Peet and M. O Reilly (eds.). Proceedings of Organic Programs Project Directors Meeting, October 2012. USDA NIFA, Washington, D.C. 3. Delate, K. 2012. Environmental Benefits of Organic Farming. Getting into Soil and Water Conservation, p. 22-23. Iowa Water Center, Iowa State University, Ames, IA: http://www.water.iastate.edu/sites/www.water.iastate.edu/files/iowawa tercenter/bookDraft 20120222.pdf. 4. Delate, K., and C. Cambardella. 2012. Organic no till production in Iowa: Effects on crop productivity and soil quality. American Society of Agronomy Annual Meetings, October 23, 2012: http://scisoc.confex.com/scisoc/2012am/webprogram/Paper75770.html. 5. Marose, B.H., M. Cavigelli, K. Delate, E. Mallory, C. Shapiro, L. Kolb, C. Reberg-Horton, J. Maul and S. Mirsky. Growing the eOrganic grains Community of Practice. American Society of Agronomy Annual Meetings, October 22, 2012: http://scisoc.confex.com/scisoc/2012am/webprogram/Paper73223.html. 6. Delate, K., C. Cambardella, C. Shennan, C. Cogger, E. Silva, and X. Zhao. 2012. Organic vegetable research: Twenty years of progress across the U.S. American Society for Horticultural Science Annual Conference, Miami, FL, ASHS, Alexandria, VA. 7. Delate, K., D. Cwach, C. Cambardella, M. Fiscus and W. Emley. 2012. Evaluation of an Organic No Till System for Organic Corn and Soybean Production: Agronomy Farm Trial, 2011. Organic Agriculture Webpage, Iowa State University, Ames, IA: http://extension.agron.iastate.edu/organicag/researchreports/nk11noti ll.pdf. 8. Delate, K., D. Cwach, A. McKern, and K. Schwarte. 2012. Evaluation of an Organic No Till System for Organic Corn Production, Neely Kinyon 2011. Organic Agriculture Website. Iowa State University, Ames, IA: http://extension.agron.iastate.edu/organicag/researchreports/nk11noti llcorn.pdf. 9. Mutch, D. (and 20 co authors). 2012. Midwest Cover Crops Field Guide. Midwest Cover Crops Council and Purdue University: https://ag.purdue.edu/agry/dtc/Page/CCFG.aspx. 10. Silva, E.M. 2013. Performance of five fall sown cover crops in an organic no till system. Renewable Agriculture and Food Systems, Accepted 3/2013. 11. Ziegler-Ulsh, C. 2012. Challenging yields, challenging weather, Rodale Institute, Kutztown, PA: http://rodaleinstitute.org/2012/challenging-yields-challenging-weathe r/. 12. Ziegler-Ulsh, C. and R. Seidel. 2012. Applied no till for carbon positive farming, Rodale Institute, Kutztown, PA: http://rodaleinstitute.org/2012/applied-no-till-for-carbon-positive-f arming/.

2011/06/01 TO 2012/05/31 Significant outreach occurred during this reporting period when investigators published 10 reports and presented talks to an audience of 2,839 producers and ag professionals. Methods for enhancing soil quality in organic systems continue as the main outreach focus. In general, soil quality continues to be greater under organic NT conditions compared to CT. Soil quality differences were observed for NT over CT in Fall 2011, but observed differences varied among research station sites. Soil quality enhancement under NT was observed at five research sites, all of which were located in relatively moist ecosystems located in the upper and central mid-west and eastern Pennsylvania. At the MI and PA sites, residual soil nitrate nitrogen and electrical conductivity were greater under NT than CT. Extractable soil K was greater under NT in IA, MI (SD) and WI sites (SD). NT soil had more potentially mineralizable N than CT soil for 5 of the research sites with SDs at the IA, MI, and WI sites. These results demonstrate that after 4 years of organic NT management, the NT soils had greater capacity to supply N for crop growth than CT soils. Microbial biomass under NT management was increased at 7 of 11 sites in 2011 (4 showings SDs). At 2 of 11 sites, microbial biomass was greater under the rotation beginning with corn. Tillage by rotation effects were not significant. Cover crop residues in NT most likely contributed to the increases in microbial biomass, particularly for the rye cover crop, which may have persisted longer as surface cover and organic resource on which the microbiota could thrive compared to HV residues. The microbial community analysis (fatty acid methyl esters: FAME) showed substantial differences in diversity among locations, but not within a location and field site in 2011. Some profiles showed that tillage more than crop rotation had an effect on microbial diversity. Although total FAMEs within the identifiable categories were not statistically significant, slightly higher total FAMEs within gram- bacteria and fungal groups occurred in NT plots. This occurrence suggests that the build-up of surface residue under NT conditions contributed to microbial community change. We plan to continue this long-term experiment to verify long-term changes induced by the different soil management strategies (i.e., NT and CT).

2010/06/01 TO 2011/05/31 Tremendous outreach occurred during the third year of this project when investigators wrote a total of 23 refereed or extension publications and presented 225 talks to an audience of 7,694 producers and ag professionals. Methods for enhancing soil quality in organic systems continue as the main outreach focus. In general, soil quality continues to be greater under organic NT conditions compared to CT. In Fall 2010 soil samples after the oat crop, MBC quantity ranged from statistical greater to numerically larger in organic NT over CT plots at 5 of 7 research station sites. MBC data included: IA: NT-194 mg/g, CT-185; MN: NT-218 (Significantly Different: SD), CT-191; PA: NT-190, CT-170; WI: NT-174, CT-162; MI: NT-173, CT-166; ND1: NT-273, CT-264; and ND2: NT-99; CT-102. Microbial biomass nitrogen (MBN) followed a similar trend, with significantly greater MBN in organic NT over CT at two sites (IA and PA). Rotation effects over all sites were not as consistent as tillage effects. MBN data included: IA: NT-48 mg/g (SD), CT-35; MN: NT-69, CT-65; PA: NT-66 (SD), CT-51; WI: NT-49, CT-47; MI: NT-36, CT-36; ND1: NT-42, CT-38; and ND2: NT-23; CT-23. These findings could be explained by noting that MBC and MBN quickly react to soil management changes as experienced with the NT treatment, as reduced soil disturbance from NT and higher available C and N concentration in the top soil layer has been shown to lead to increased microbial populations. In addition, higher microbial biomass content is generally considered as one of the indicators of soil fertility. On-farm soils did not reflect as clear a trend as on-station, with no significant differences in MBC or MBN between NT and CT plots. Fatty acid methyl esters (FAMEs), an indicator of the community composition of soil microbes, have been extracted and analyzed for all sites through 2009. Over seventy different FAMEs have been identified, with the majority common to all locations, and an average of 35-40 different FAMEs occurring at each location, but few differences were noted between treatments. An example of FAME richness data includes: IA: NT-39, CT-40; PA: NT-39, CT-37; and WI: NT-29, CT-34. Because all plots at each site have been under organic production, differences may not be as extensive as could be expected when comparing organic to conventional systems. The majority of shifts in FAME peaks occurred by year and did not seem to change with different tillage or rotation practices. Although most FAMEs were indicative of bacteria, the fungal peak was higher under NT management at two locations, as fungi are known to be dominant components of the microbial community under NT management. We are expecting greater distinctions between NT and CT over time. We plan to continue this long-term experiment in the renewal phase of this project to verify long-term changes induced by the different soil management strategies (i.e., NT and CT). A complete economic and energy analysis of systems across all 6 states is currently underway, including an examination of organic NT benefits in carbon-offset programs.

2009/06/01 TO 2010/05/31 Prior to cash crop planting in Spring 2009, soil quality analysis revealed no significant differences in any parameters between the NT and the CT treatments in samples taken in Fall 2008 at all sites. After the first corn and soybean season, in Fall 2009, soil microbial biomass carbon (C) values were significantly greater in NT than in CT plots at the Iowa, Michigan, Minnesota, Pennsylvania and Wisconsin research station sites. All other soil quality indicators in the study did not present any significant differences. These findings could be explained by noting that microbial biomass C quickly reacts to soil management changes as experienced with the NT treatment, as reduced soil disturbance from NT and higher available C concentration in the top soil layer has been shown to lead to increased microbial populations. In addition, higher microbial biomass content is generally considered as one of the indicators of soil fertility, despite lower yields in the NT treatment. Further research will be conducted to verify long-term changes induced by the different soil management strategies (i.e., NT and CT). A complete analysis of soil and weather properties will be conducted in 2010 to determine why the HV-corn NT system is more successful in the sandier soils in the more temperate climate of Pennsylvania. All co-PIs presented information on the No-Till project at 50 venues to more than 1,200 participants over the reporting period.

2008/06/01 TO 2009/05/31 Grape cultivars and low-input grape management systems adapted for Iowa winters and humid summer conditions have been reported through horticultural Field Days, publications and the ISU Viticulture webpage. The Turf Field Day also attracts over 1,000 people each year. Three organic Field Days were held in 2008, covering topics ranging from organic crop rotations to no-till vegetable production, reaching over 300 people. A Transitioning to Organic workshop was held in September 2008 for 60 producers from three states. The ISU Organic Ag webpage hosts all research reports and organic information covered in this project. The Iowa Organic Conference had 236 people in attendance from five states in the Midwest. For farmers utilizing organic practices, savings from avoiding petroleum-based fertilizers and pesticides in growing organic crops will result in input cost savings of \$300/acre, in addition to countless environmental benefits, such as reduced nitrate leaching from the use of compost in place of highly mobile synthetic nitrogen. The patent on the corn gluten meal material has brought in more than \$1,200,000 in royalties, which are used to further the educational capacities of ISU.

2009/09 TO 2013/08 What was accomplished under these goals? Objective 1: Data were collected to determine effects of transitioning intensively and continuously grazed beef cattle to certified organic management on surface and subsurface water quality and quantity. [No differences (P \> 0.05) between organic and conventional practices were detected for soil or water samples. These included N, organic N, ammonia, and P in water, as well as PO4-P, NH4+, NO3-, and pH. In soil.]{.mark} Results were modeled using ArcAPEX. No differences (P \> 0.05) between organic and conventional practices or between continuous or managed intensive grazing were detected. During the 3 years of the project, cows averaged 641 kg and had an average daily gain during grazing of 0.17 kg/d. Gain/ha also was not affected (P \> 0.05) by treatments applied and averaged 21 kg. Calf performance revealed no differences (P \> 0.05) due to transition to organic grazing (calves had a gain of 129 kg during grazing which resulted in a daily gain of 1.16 kg/d). Calf gain/ha averaged 242.2 kg and was not affected (P \> 0.05) by grazing management or the transition to organic production practices. Objective 2: HHEI (habitat index) scores indicate a difference between organic and conventional dairy farms. [Organic dairy farm streams had higher scores than conventional dairy farms when means were compared, 69.6 versus 61.1 respectively]{.mark} (P-value= 0.056). Although the data collected in 2012 showed that there was no statistical difference in macroinvertebrate communities between organic dairy farm streams and conventional dairy farms, the mean HMFEI (macroinvertebrate) scores separated the farm streams into different categories. Organic streams were on average Class III (high quality) and conventional streams were on average Class II. This trend (also seen in the 2010-2011 data) was stronger in 2012 than in the previous years. Out of the 25 streams originating on farms, glyphosate was found in 6 out of the 9 organic dairy farm streams and 4 out of the 16 conventional dairy farm streams. Atrazine was found in 3 out of the 16 conventional farms and was not found in organic stream sites. Atrazine was found, however, in an organic dairy farm stream that was downstream of a conventional farm. This site was selected to sample for herbicides to aid in determining potential impacts affecting biological communities of an organic dairy farm stream. Objective 3: The transitioning to organic research site and discussion of current research was included in a variety of station tours (tours included scientists, students, agricultural groups, etc.). The North Central Ohio Dairy Grazing Conference January 26-27, 2012 planning committee included a breakout session emphasizing ongoing need to implement basic management practices. [The speakers' handbook]{.mark} was distributed to 500 farms with a brief summary of the initial findings point out the need to emphasis basic water quality and quantity management practices for both organic and conventional grazing farms. Fact sheets around water and water practices were updated and distributed at multiple workshops, field days and other events annually. Objective 4: The summer interns in the ORIP program at OARDC obtained HHEI Qualified Data Collector (QDC) training and took field trips to the NAEW facility in Coshocton to learn the relationships between soils, surface and subsurface water. These interns were assisted by graduate STEM fellows in our NSF GK-12 program who conducted stream HHEI assessments. **PUBLICATIONS (not previously reported):** 2009/09 TO 2013/08 No publications reported this period.

2011/09/01 TO 2012/08/31 Educational outputs include reports to stakeholders. Research reports have been distributed at the 2012 Family Farm Field Day and the OFFER Field Day. Results suggest an interaction of extreme weather events and conventional and organic management styles in their impact on water quality. HHEI results suggest no advantage to organic production practices on water quality. Resources from the project were used to conduct research on the 2 main objectives and to generate information for dissemination at meetings with stakeholders. The project evaluation revealed that all components/aims of the project are on schedule and no delays have been experienced.

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2009/09/01 TO 2010/08/31 Project outputs to date are limited because by their very nature, changes in water quality occur slowly in response to animal production practices. Educational outputs have occurred regarding presentation of information outlined above (producer groups, politicians, etc.) Extension education planning and generation of producer surveys have occurred. More time is needed before impacts can be fully assessed. The project evaluation revealed that all components/aims of the project are on schedule and no delays have been experienced.

2009/09 TO 2014/08 What was accomplished under these goals? Non-point source contamination from leaching of nitrates in synthetic fertilizers is a major water quality concern in the upper Midwest, where extensive subsurface tiling drains the highly productive soils. The aim of this multi-disciplinary project was to assist producers in developing systems that use integrated organic crop rotations with legume and grass crops to improve water retention and water quality by enhancing nutrient and water cycling in the soil-plant system. In order to test this hypothesis, we were required to install state-of-the art water quantity and quality monitoring instruments to develop nitrogen budget and water balance estimates. Thirty plots were established in May 2011 within a 25-ha field at the Agronomy and Ag Engineering Farm that was [planted to organic oat and alfalfa in 2006 and maintained as organic alfalfa from 2007 to 2011]{.mark}. Tile drains, flow barriers and sump pumps were installed at the site in July 2011. Sump pits were equipped with water meters, sump pumps, sump basins, distribution pipes and water sampling devices in October 2011. In November 2011, conduit and transmission lines for the data loggers were installed and a permanent weather station was also installed at the field site. Tile drain sampling began on December 1, 2011, and continued every week. [Crops in the 2012, 2013 and 2014 seasons included corn and soybean in the conventional treatment, rotated between plots; an organic pasture with mixed species grass and legumes; and all crops in an organic corn, soybean, oats, and alfalfa rotation]{.mark}. Plots were maintained as organic through the use of [compost fertilization, mechanical tillage for weeding, and naturally-based insect management products.]{.mark} The 2012 organic corn yields, at 136 bu/acre, were statistically equivalent to conventional corn (144 bu/acre) and soybean yields, averaging 44 bu/acre, were also equivalent between systems. In 2013, weather conditions were extremely challenging, with excessive rains in April and May, causing a delay in planting and poor germination. Beginning in late June, drought conditions occurred and a hailstorm damaged plants in early July. Organic corn averaged 105 bu/acre while conventional corn averaged 133 bu/acre. Organic soybeans averaged 33 bu/acre and conventional soybeans averaged 32 bu/acre. Organic oats averaged 73 bu/acre. In 2014, weather was again challenging, with a wet spring delaying weed management; a dry July affecting plant growth; and then a wet fall. There were no differences between conventional corn (116 bu/acre) and organic corn (112 bu/acre) but organic soybeans (56 bu/acre) were greater than conventional soybeans (46 bu/acre). Differences between organic and conventional treatments observed with the water quality and quantity monitoring instrumentation in the 2012-growing season included an average of 7.9 kg/ha of nitrate-nitrogen loss under the organic corn-soybean-oat/alfalfa-alfalfa rotation, averaged over all crops in the rotation, which was only 3% of applied N. This compares to 10.1 kg/ha from the conventional corn-soybean rotation, which was 12% of applied N. The lowest amount of nitrate-N leaching of 7 kg/ha occurred under the organic, mixed-species pasture system. Corn systems leach the greatest amount of nitrate-N; thus, extending crop rotations to include more legumes and small grains will assist in lowering nitrates from agricultural systems. During 2013, the concentration of tile drain nitrate-N was again highest for the conventional corn-soybean rotation, up to 35 kg/ha, which was 40% of applied N, and lowest under the organic pasture, with a peak of 10 kg/ha in mid-May. The organic rotation lost 17.7 kg/ha of nitrate-N, which was 8% of applied N. The average amount of nitrate-N lost in he conventional system was 50% of applied N, compared to 11% in the organic rotation. In the third year of production, some trends have emerged from this experiment, including organic rotations with longer periods between corn and soybean crops have the potential to lower nitrates in plant root-zone soil water compared to conventional corn-soybean rotations. Pasture and small grain crops offer the greatest potential for lowering nitrates in agricultural systems compared to high-nitrogen-demanding corn crops. Incorporating forage crops and small grains into a crop rotation scheme can assist in lowering nitrates from agricultural fields that can eventually make their way into groundwater used for drinking water, where the standard for nitrates is 10 ppm. **PUBLICATIONS (not previously reported):** 2009/09 TO 2014/08 1. Type: Conference Papers and Presentations Status: Published Year Published: 2014 Citation: Delate, K. 2014. Innovations in Organic Food Systems: Introduction. American Society of Agronomy International Annual Meetings, Long Beach, CA. ASA, Madison, WI. https://scisoc.confex.com/scisoc/2014am/webprogram/Session14001.html. Abstract. 2. Type: Conference Papers and Presentations Status: Published Year Published: 2014 Citation: Cambardella, C. and K. Delate. 2014. Water Quality in Organic Systems. American Society of Agronomy International Annual Meetings, Long Beach, CA. ASA, Madison, WI. https://scisoc.confex.com/scisoc/2014am/webprogram/Paper85843.html. Abstract. 3. Type: Conference Papers and Presentations Status: Published Year Published: 2014 Citation: Reeve, J.R., A. Atucha, C.A. Cambardella, P.M. Carr, D. Davis, K. Delate, L.A. Hoagland, J.M. Grossman, K. Jacobsen and J. Villalba.

2014. Organic farming, soil health, and food crop quality: Considering possible linkages. American Society of Agronomy International Annual Meetings, Long Beach, CA. ASA, Madison, WI. https://scisoc.confex.com/scisoc/2014am/webprogram/Paper86213.html. Abstract. 4. Type: Conference Papers and Presentations Status: Published Year Published: 2014 Citation: Delate, K., and C. Cambardella. 2014. Long Term Organic Comparisons in the US. American Society of Agronomy International Annual Meetings, Long Beach, CA. ASA, Madison, WI. https://scisoc.confex.com/scisoc/2014am/webprogram/Paper85841.html. Abstract.

2012/09/01 TO 2013/08/31 What was accomplished under these goals? Non-point source contamination from leaching of nitrates in synthetic fertilizers is a major water quality concern in the upper Midwest where extensive subsurface tiling drains the highly productive soils. This multi-disciplinary project aims to assist producers in developing systems that use integrated organic crop rotations with legume and grass crops to improve water retention and water quality by enhancing nutrient and water cycling in the soil-plant system. In order to test this hypothesis, we were required to install state-of-the art water quantity and quality monitoring instruments to develop nitrogen budget and water balance estimates. Thirty plots were established in May 2011 within a 25-ha field at the Agronomy and Ag Engineering Farm that was planted to organic oat and alfalfa in 2006 and maintained as organic alfalfa from 2007 to 2011. Tile drains, flow barriers and sump pumps were installed at the site in July 2011. Sump pits were equipped with water meters, sump pumps, sump basins, distribution pipes and water sampling devices in October 2011. In November 2011, conduit and transmission lines for the data loggers were installed and a permanent weather station was also installed at the field site. Tile drain sampling began on December 1, 2011, and continued every week. Crops in the 2012 and 2013 seasons included corn and soybean in the conventional treatment, rotated between plots; an organic pasture with mixed species grass and legumes; and all crops in an organic corn, soybean, oats, and alfalfa rotation. Plots were maintained as organic through the use of compost fertilization, mechanical tillage for weeding, and naturally-based insect management products. The 2012 organic corn yields, at 136 bu/acre, were statistically equivalent to conventional corn (144 bu/acre) and soybean yields, averaging 44 bu/acre, were also equivalent between systems. In 2013, weather conditions were extremely challenging, with excessive rains in April and May, causing a delay in planting and poor germination. Beginning in late June, drought conditions occurred and a hailstorm damaged plants in early July. Insect pests, including Japanese beetles, caused severe defoliation in both organic and conventional soybeans. Organic corn averaged 105 bu/acre while conventional corn averaged 133 bu/acre. Organic soybeans averaged 33 bu/acre and conventional soybeans averaged 32 bu/acre. Organic oats averaged 73 bu/acre. Differences between organic and conventional treatments observed with the water quality and quantity monitoring instrumentation in the 2012-growing season included an average of 7.9 kg/ha of nitrate-nitrogen collected from tiles under the organic corn-soybean-oat/alfalfa-alfalfa rotation, averaged over all crops in the rotation. This compares to 10.1 kg/ha from the conventional corn-soybean rotation. The lowest amount of nitrate-N leaching of 7 kg/ha occurred under the organic, mixed-species pasture system. Corn systems leach the greatest amount of nitrate-N; thus, extending crop rotations to include more legumes and small grains will assist in lowering nitrates from agricultural systems. During 2013, the concentration of tile drain nitrate-N was again highest for the conventional corn-soybean rotation, up to 35 kg/ha, and lowest under the organic pasture and organic corn plots, with a peak of 10 kg/ha in mid-May. While only in the second year of production, some trends have emerged from this experiment, including organic rotations with longer periods between corn crops have the potential to lower nitrates in plant-root-zone soil water compared to conventional corn-soybean rotations. Pasture and small grain crops offer the greatest potential for lowering nitrates in agricultural systems compared to high-nitrogen-demanding corn crops. Incorporating forage crops and small grains into a crop rotation scheme can assist in lowering nitrates from agricultural fields that can eventually make their way into groundwater used for drinking water, where the standard for nitrates is 10 ppm. Regarding insect infestations, additional monitoring must be incorporated into cropping system plans provided to farm managers so they can alert researchers at the first incidence of insect problems and begin to manage as soon as possible to prevent economic damage to the crop.

2011/09/01 TO 2012/08/31 Differences between organic and conventional treatments observed with the water quality and quantity monitoring instrumentation in the 2012-growing season included the observation of high variability in the water flow between plots which required blocking of plots to address this variation. Water flow between February and August 2012 varied between 10,000 to 15,000 gallons per three-month period from conventional plots to 30,000 to 37,000 gallons per three-month period from the organic crop plots. These results will be compared to nitrate leaching from each treatment to determine if organic plots are allowing more infiltration of rain compared to conventional plots and if nitrate leaching is less under organic conditions.

2010/09/01 TO 2011/08/31 With the installation of water quality and quantity monitoring instrumentation complete at the on-station site, differences between organic and conventional treatments will begin to unfold with the 2012-

growing season. The use of Chilean nitrate in the on-farm component proved beneficial in terms of enhancing plant growth and yield. An increase in yield of 11 bushels per acre with the use of the Chilean nitrate was associated with a \$121 per acre increase in gross income. Because Chilean nitrate can only be applied in late spring when the corn plant is rapidly growing, and at rates equal or less than 20% of the corn crop\'s need (i.e., 36 lb N/acre), deleterious leaching or luxury consumption of N in the corn plant was avoided. Although this organic fertilizer product has proven useful, particularly in times of heavy spring rains when N in pre-plant manure applications may suffer from excess N mineralization, its use may be curtailed in future certified organic operations based on the long-term sustainability of transporting a product from Chile. Long-term effects on soil quality will be determined in the third year of this project.

2009/09/01 TO 2010/08/31 The use of natural nitrate in the on-farm component of this project proved extremely beneficial, in terms of enhancing plant growth, N content in leaves, and yield, without any apparent detriment to water quality as determined by corn stalk nitrate at the end of the season. This fertilizer can be applied at different times during the early growing season, or at least until the last cultivation. Because of these two characteristics, natural nitrate can be used to more effectively synchronize available soil N with crop demand during the important early growth stages. This product is particularly important in times of excessive spring rains as seen in 2010, which may reduce available soil nitrogen by limiting N mineralization rate and by increasing nitrate leaching, respectively. There was an average 13-bushel per acre increase in plots fertilized with the natural nitrate fertilizer in 2010. This amounted to a \$91 per acre increase in gross income. Natural nitrate can be particularly important after heavy rains, as were experienced in 2010, when pre-plant manure applications may have suffered from leaching and/or run-off. We will repeat the experiment in 2011 and conduct extensive soil sampling to monitor N pools throughout the season. For the ISU research station site, we are hopeful that the establishment of tiles and water monitoring equipment will proceed in 2011 in order to begin the cropping systems experiment.

2009/09 TO 2014/08 What was accomplished under these goals? Accomplishments under these goals were as follows: 1) Evaluate nutrient and sediment concentrations and loads in surface runoff, and groundwater nutrient concentrations from long-term conventional and organic systems. We were able to monitor surface water quality and soil nitrate levels from long-term conventional and organic systems for 3-years and thus obtained the concentration and load information and provide statistical analysis of the data. In general, conventional systems lost less soluble P but more nitrate. Conversely, organic systems lost more soluble P but fewer nitrates. Other constituents, such as total phosphorus, total nitrogen, total Kjeldahl nitrogen, and total sediment were a function of tillage type, rather than cropping system. 2) Evaluate nutrient and sediment concentrations and loads from surface runoff and groundwater nutrient concentrations from long-term tillage (conservation and conventional) under conventional and organic systems. We were able to monitor surface water quality and soil nitrate levels from fields under long-term conservation and conventional tillage for 3-years and thus obtained the concentration and load information and provide statistical analysis of the data. In general, tilled plots lost total phosphorus, total nitrogen, total Kjeldahl nitrogen, and total sediment. Some years tillage was the predominant factor but in other years there was a tillage by cropping systems interaction to these nutrient load losses. 3) Evaluate soil organic matter (total and particulate), cover crop biomass and N in order to relate changes in soil properties to nutrient and sediment runoff. We found that the organic system with reduced tillage enhanced labile, total and microbial fractions of organic matter and that generally these indicators were the same for chemical no-till and organic conventional. Despite the increases in organic carbon pools, organic treatments had greatly decreased yields. The conservation tillage systems loss less soil carbon via surface runoff as compared to plowed systems, regardless of cropping system. We found that as total soil carbon increased in agricultural fields, suspended solids lost through surface runoff also decreased. In particular, organic systems with conservation tillage accumulated more soil carbon and may subsequently have lower total suspended solids rates than conventionally tilled fields, regardless of the cropping system. 4) Evaluate crop yield, nitrogen uptake and calculate nitrogen use efficiency of the different treatments. Crop yields were significantly generally greater for conventional-tilled systems than conservation tilled systems and thus nitrogen uptake was also greater. Sweet corn yields were especially low in the conservation tilled organic system where weed competition was extreme after 20+ years of organic production using no-till. 5) Evaluate the predictive performance of the Agricultural Policy Environmental Extender (APEX) model. There were significant issues trying to get APEX to work on the horticultural crops for which we had data. It took considerable changes to APEX in order for it to simulate crop yield well in the rotated chemical management subplots and poor in the rotated organic management subplots and all the continuous subplots. Once the yield could be modeled appropriately, the statistically analysis of APEX demonstrated that runoff simulations relative to surface runoff data collected from 10/1/2010 to 12/31/2011 produced good results. The major drawback using APEX was the great amount of work it took just to obtain appropriate yields and runoff results. 6) Transmit study results to organic and conventional producers, state agency personnel, regional and national audiences (extension). We provided 15 presentations (either posters or presentations) to all of the audiences listed above. In addition, we provided 6 field day presentations to farmer and extension audiences where attendance was generally greater than 100 persons per field day. Fact sheets were developed for these field days and handed out. Several presentations on the effectiveness of these systems to reduce agricultural nutrients were made to Crop Consultants and other. 7) Transmit study results to undergraduate students and interns (students), and the agricultural community as a whole (education). A 1-credit course on water quality to graduate students who are working in the realm of organic farming systems or agroecology to enhance their understanding of the relationship between agricultural production and nonpoint source pollution. In addition a one hour lecture will be delivered, Soil Agroecology (SSC 495). Students in the water quliaty class rated the following items (Quality of the class, utility of the class, how informative the class was and usefullness of discussions) with five\'s\...the highest rating. The students had many positive things to say about the class and learned that nutrient losses may occur under organic systems just as readily as conventional systems. **PUBLICATIONS (not previously reported):** 2009/09 TO 2014/08 1. Type: Journal Articles Status: Published Year Published: 2014 Citation: Larsen, E.M., J. Grossman, J. Edgell, G. Hoyt, D. Osmond, and S. Hu. 2014. Evaluating Soil Carbon Pools and Losses in Long-term Organic and Conventional Farming Systems. Soil Tillage Res. 139:37-45. 2. Type: Theses/Dissertations Status: Accepted Year Published: 2013 Citation: EDGELL, JOSHUA LEE. Comparison of Organic and Conventional Agriculture Production in Till and No-till Systems: Effects on Water Quality and Yield. NC State University, Raleigh, NC. 3. Type: Journal Articles Status: Under Review Year Published: 2014 Citation: Edgell, J., D.L. Osmond, D. Line, G. Hoyt, J. Grossman, and E. Larsen. Comparison of Organic and Conventional Agriculture Production in Till and No-till Systems: Water Quality and Cropping System Efficiency.

2013/09 TO 2014/08 What was accomplished under these goals? Objective 1 and 2: Water quality monitoring continued to collect flow and concentration data from the different treatments (conservation tillage vs conventional tillage and conventional cropping systems vs organic cropping systems). Analysis of these data continued and were used to complete a thesis and start a journal article. Objective 3 was finalized. We found that the organic system with reduced tillage enhanced labile, total and microbial fractions of organic matter and that generally these indicators were the same for chemical no-till and organic conventional. Despite the increases in organic carbon pools, organic treatments had greatly decreased yields. The conservation tillage systems loss less soil carbon via surface runoff as compared to plowed systems, regardless of cropping system. We found that as total soil carbon increased in agricultural fields, suspended solids lost through surface runoff also decreased. In particular, organic systems with conservation tillage accumulated more soil carbon and may subsequently have lower total suspended solids rates than conventionally tilled fields, regardless of the cropping system. Objective 4. We continued to monitor yield and N uptak. Objective 5. The modeling work was completed and a journal draft was started. Objective 6. We continued to provide information at the Mountain Research Horticultural station as well as scientific and farmer conferences both in North Carolina as well as other states. **PUBLICATIONS (not previously reported):** 2013/09 TO 2014/08 1. Type: Theses/Dissertations Status: Published Year Published: 2013 Citation: EDGELL, JOSHUA LEE. Comparison of Organic and Conventional Agriculture Production in Till and No-till Systems: Effects on Water Quality and Yield. NC State University, Raleigh, NC 2. Type: Journal Articles Status: Submitted Year Published: 2013 Citation: Larsen, E.M., J. Grossman, J. Edgell, G. Hoyt, D. Osmond, and S. Hu. 2014. Evaluating Soil Carbon Pools and Losses in Long-term Organic and Conventional Farming Systems. Soil Tillage Res. 139:37-45.

2012/09/01 TO 2013/08/31 What was accomplished under these goals? Accomplishements relative to the goals were as follows. We determined concentrations of pollutantsfrom long-term tillage (conservation and conventional) under conventional and organic systems. In general tillage was more important in determining pollutant losses than system. We evaluated soil organic matter (total and particulate), cover crop biomass and N in order to relate changes in soil properties to nutrient and sediment runoff and found that soil properties were not directly related to nutrient losses. We evaluated crop yield, nitrogen uptake and calculated the yield per amount of pollutant lost. Overall, the conservation tillage, conventional system has the greatest yield with the least pollutant loss. The predictive performance of the Agricultural Policy Environmental Extender (APEX) mode was evaluated and it did not perform very well due to the history of these plots. We transmiedt study results to organic and conventional producers, state agency personnel, regional and national audiences (extension) through field days and conference presentations.

2011/09/01 TO 2012/08/31 [Sweet corn yields were approximately 3-times greater for the conventional management system relative to organic management due in part to weed pressures (no-till organic).]{.mark}Although weed pressure clearly reduced yields in the 2011 plow organic treatment, reduced N rates probably affected yield in 2012 because \< 80% of the applied 180 lb N ac-1 pelleted chicken litter N was available and conventional systems do not account for the N added from cereal cover crops. [Sediment and most nutrient losses were greater for plowed treatments than the no-till treatments, which were very low and resembled each other irrespective of management system.]{.mark}Two nutrients were the exception to the above pattern. [Significantly greater losses of dissolved P were measured in the organic systems (7- to 3-fold greater than the conventional systems) and more NOx-N was found in the soil (2-fold greater) in the conventional management system. T]{.mark}hese results were not surprising in that organic fertilizer materials (organic treatments) increase soluble P losses and the [pelleted poultry litter added P that was not applied to the conventionally managed treatments.]{.mark}Likewise, as there was 40% more available N in the conventional system, it was reasonable that there were higher soil NOx-N concentrations. [Microbial biomass measurements were greatest in the organic management/conservation tillage system; the other systems were similar to each other, except the chemical plow, which produced the lowest microbial biomass numbers]{.mark}. Although there were differences in soil bulk density among treatments, there was no relationship between yield and greater bulk densities. Plowed systems, particularly chemical plow treatments, lost the highest quantities of total carbon through surface runoff as compared to no-till treatments. Although sediment from no-till organic and no-till chemical treatments contained extremely high percentages of carbon across all sampling dates, these systems lost very little sediment overall, suggesting [tillage to be a dominant factor in reducing sediment loss]{.mark}. Typical farmer systems are usually conservation tillage conventional management (no-till conventional) or conventional tillage with organic management (plow organic).When yields, nutrient losses, and other characteristics were compared between these two management systems, microbial biomass, total C, and POM were similar, although bulk density was lower in the conventional tillage organic management (1.51 g cm-1) than the conservation tillage conventional management (1.65 g cm-1).Sweet corn yields, however, were 66% lower (average 2011 and 2012) and nutrient loads were greater from the plow organic than the no-till conventional treatments. Since there were significantly greater nutrient and sediment losses and lower yields in conventional tillage (plow) organic systems than conservation tillage (no-till) conventional management system, the [most environmentally protective and best yielding system, therefore, was conventional management with conservation tillage]{.mark}.

2010/09/01 TO 2011/08/31 Information derived from this work is still in its infancy; it would be premature to have any outcomes.

2009/09/01 TO 2010/08/31 We presented our early-stage research at the following venue: 1. Producer Training. Fresh Market Tomato and Vegetable Field Day, Mountain Horticulture Research Station Field Day. 2010. Effects of Organic and Conventional Production on Water Quality. \~100 producers, ag agents, and others. 2. Producer Training. Fresh Market Tomato and Vegetable Field Day, Mountain Horticulture Research Station Field Day. 2010. Alternative Vegetable Production Systems; Maintaining Yields and Improving Soil Productivity. \~ 100 producers, ag agents, and others.

2010/09 TO 2014/08 What was accomplished under these goals? Activities: Our main transition experiments: [dryland winter wheat-fallow production, irrigated cash crop production, irrigated livestock integrated crop production]{.mark}, all at the James C. Hageman Sustainable Agriculture Research and Extension Center (Lingle, WY) were sampled for GHG emissions, soil and plant parameters and soil water once a month through the winter months and biweekly during the third year until June 2013. [Dryland winter wheat-sunflower-fallow]{.mark} production at the Agricultural Experiment Station in Sidney, NE were sampled for GHG emissions, soil and plant parameters and soil water once a month through the winter months and biweekly during the third year until January 2014. All datasets were completed by May 2014, data analyzed, first drafts completed and submitted to peer review journals. Three graduate students defended their PhD dissertations based on research generated in this project. Specific objectives met: 1. Soil C processes, including sequestration and GHG emissions to quantify performance of organic production relative to conventional and reduced tillage systems: field sampling completed; GHG data sets are completed and available, soil datasets completed. First modeling exercises completed. All data written into dissertation chapters and first manuscripts. 2. Water use efficiency to determine short- to long-term feasibility of both irrigated and non-irrigated production in this moisture-deficient environment: 1-year dataset completed and available. First modeling exercises completed. The second year of data completely processed. MS thesis defended, Manuscript for submission in the final stage of reviews. 3. Field- and farm scale economics to determine the need, timeframe, and level of possible incentives for transition to sequester C in organic production: data collection complete and analyses done. MS thesis not defended yet due to graduate student health-related temporary leave. 4. Energy input:output and C footprint impacts to determine true environmental impacts or services resulting from the practices. Not completed yet. Significant results achieved, including major findings, developments, or conclusions (both positive and negative): • Yields vary by annual precipitation. Transition from no-till to organic has highest yields after drought. • 10-years of no-till improves soil TN by 40% and TOC by 23% compared with frequently tilled soils. This SOM accrual may be lost while tilling during transition to organic but it may take 10 years for SOM to decline. • Reducing tillage intensity while transitioning to irrigated organic production or transitioning to dryland winter wheat farming from no-till production will result in reduced GHG emissions, mainly N2O and production. No-till transition to organic does not impact CO2 and has 26% lower N2O emissions than organic suggesting more efficient way of N retention in soil. • Transitioning to irrigated organic farming requires soil fertility management through periodic manure application. It increases CO2 production at the initial phase of the transition. Research past the transition period is needed to fully embrace accrual of benefits. • Transitioning to dryland organic farming in very low precipitation region requires a period of no-till to accrue SOM benefits instead of manure. Additional challenges include additional efforts associated with combating weeds as more intensive tilling associated with the system enhances weed germination. Alternative tillage practices focusing on evading weed pressures may be required which will accelerate SOM loss.. • Economics: due to poor yields, long-term no-till is the least favorable. This may change if yields increase over time due to improved soil health of no-till but organic is far more profitable, once certification is obtained. Without organic premiums, conventional systems are slightly more profitable in most years. New OREI grant was successfully funded based on hypotheses created from the results of this project. Modelling efforts continue as more data gets published in peer-reviewed literature. **PUBLICATIONS (not previously reported):** 2010/09 TO 2014/08 1. Type: Journal Articles Status: Published Year Published: 2014 Citation: Norton, U., P. Bista, R. Ghimire and J.B. Norton. 2014. One-time summer tillage does not negate long-term benefits of no-till. Crop and Soils, May-June 2014. 2. Type: Journal Articles Status: Published Year Published: 2014 Citation: Norton, U., P. Bista, R. Ghimire and J.B. Norton. 2014. One-time summer tillage of chemical fallow in a dryland winter wheat rotation does not negate long-term benefits accrued under no-till management. Nutrient digest, Nutrient management newsletter for the western US, Spring 2014. 3. Type: Other Status: Published Year Published: 2013 Citation: Bista, P., U. Norton, R. Ghimire, J.B. Norton, J. Meeks. 2013. Effect of Summer Tillage on Greenhouse Gas Emissions from Organic, Conventional, and No-Till Fallows in Dryland Winter Wheat Production. 2013 Field Days Bulletin, pp 89-90. Wyoming Agricultural Experiment Station, University of Wyoming, Laramie, Wyoming. http://www.uwyo.edu/uwexpstn/ files/docs/2013-field-days-bulletin.pdf 4. Type: Other Status: Published Year Published: 2013 Citation: Ghimire, R., U. Norton, J.B. Norton and P. Bista. 2013. Greenhouse gas emissions from alternative management approaches of irrigated crop and forage production system. 2013 Field Days Bulletin, pp 87-88. Wyoming Agricultural Experiment Station, University of Wyoming, Laramie, Wyoming, USA. 5. Type: Conference Papers and Presentations Status: Published Year Published: 2014 Citation: Bista, P, U. Norton, R. Ghimire, J. Norton. Greenhouse gas emissions and soil nitrate in dryland winter wheat/fallow cropping systems under contrasting precipitation years. Oral presentation Nov 2-5, 2014, Long Beach, California, USA. 6. Type: Journal Articles Status: Submitted Year Published: 2015 Citation: Ghimire R., U. Norton, P. Bista, A.K. Obour, and J.B. Norton. Greenhouse gas emissions and nitrogen mineralization during transitioning to irrigated crop rotation. Manuscript under review, Soil Science Society of America Journal (submitted Sept. 25, 2014). 7. Type: Theses/Dissertations Status: Published Year Published: 2014 Citation: Bista, P., Effects of management practices on greenhouse gas fluxes, soil organic matter dynamics and crop performance in dryland wheat production in Wyoming. University of Wyoming, 2014. 8. Type: Theses/Dissertations Status: Published Year Published: 2013 Citation: Ghimire, R., Effects of management practices on soil C and N dynamics in organic, reduced-input and conventional cash crop and livestock integrated irrigated production. University of Wyoming, 2013. 9. Type: Conference Papers and Presentations Status: Other Year Published: 2014 Citation: Norton, U., B. Bista, J. Norton. GHG emissions and soil C and N dynamics from dryland organic, no-till and conventional winter wheat production in eastern Wyoming. 10. Type: Journal Articles Status: Under Review Year Published: 2015 Citation: Tunsisa T. Hurisso, Urszula Norton, Jay B. Norton, Judith Odhiambo, Stephen J. Del Grosso, Gary W. Hergert, Drew J. Lyon. Seasonal Greenhouse Gas Fluxes and Plant Growth Parameters in Dryland Winter Wheat/Summer Crop/Fallow Rotations in western Nebraska. For submission to Soil Science Society of America Journal. 11. Type: Journal Articles Status: Under Review Year Published: 2015 Citation: Bista, P., U. Norton, R. Ghimire, J. Norton. Greenhouse gas fluxes and soil carbon and nitrogen following single summer tillage. For submission to Journal of Environmental Quality. 12. Type: Conference Papers and Presentations Status: Other Year Published: 2013 Citation: Kaur, G., A. Garcia y Garcia, U. Norton, T. Kelleners, and T. Persson. 2013. Sustainability of cropping systems for dryland winter wheat production: A simulation approach. In: Abstracts of the ASA-CSSA-SSSA International Annual Meetings. Tampa, FL. 13. Type: Conference Papers and Presentations Status: Other Year Published: 2013 Citation: Kaur, G., U. Norton, and A. Garcia y Garcia. 2013. Effects of Cropping System on Water Use and Water Productivity of Dryland Winter Wheat. In: 2013 Field Days Bulletin, Wyoming Agricultural Experiment Station, College of Agriculture and Natural Resources, University of Wyoming. \[Xtension\]

2012/09/01 TO 2013/08/31 What was accomplished under these goals? Activities: Our main transition experiments: dryland winter wheat-fallow production, irrigated cash crop production, irrigated livestock integrated crop production, all at James C. Hageman Sustainable Agriculture Research and Extension Center (Lingle, WY) and dryland winter wheat-sunflower-fallow production at the Agricultural Experiment Station in Sidney, NE were sampled for GHG emissions, soil and plant parameters and soil water once a month through the winter months and biweekly during the growing season for the second year in the row. Economic data collection was initiated in late fall 2012. However, the 2012 growing season appeared to be the driest season on record, starting as early as January 2012, and WY and NE dryland experiments experienced a couple of crop planting failures and significant winter wheat yield loss. All researchers agreed to continue sampling for the third consecutive year until September 2013. Specific Objectives met: 1. Soil C processes, including sequestration and GHG emissions to quantify performance of organic production relative to conventional and reduced tillage systems: field sampling completed; GHG data sets are completed and available, soil datasets are still not fully completed. First modeling exercises are underway. 2. Water use efficiency to determine short- to long-term feasibility of both irrigated and non-irrigated production in this moisture-deficient environment: 1-year dataset completed and available. First modeling exercises are underway. The second year of data is not completely processed yet. 3. Field- and farm scale economics to determine the need, timeframe, and level of possible incentives for transition to sequester C in organic production: data collection is almost complete. 4. Energy input:output and C footprint impacts to determine true environmental impacts or services resulting from the practices. Not completed yet. Significant results achieved, including major findings, developments, or conclusions (both positive and negative). Preliminary results from GHG analyses: reducing tillage intensity while tranistioning to irrigated organic production or tranistioning to dryland winter wheat farming from no-till production will result in reduced GHG emissions, mainly N2O and CO2 production. Transitioning to irrigated organic farming results in active soilf fertility management and manure application which also increases CO2 production at the intitial phase of the transition. Research past the transition period is needed to fully embrace accrual of benefits. Transitioning to dryland organic farming has an additional challenge of combating weed invasion as more intensive tilling associated with the system enhances weed germination. Alternative tillage practices focusing on evading the weed pressure problems could help make the dryland winter wheat organic system more successful. Organic dryland practices that involve additional tillage result in greater C and N losses to CO2 and N2O. Designing dryland organic practices that involve reduced tillage operation will help improve soil C and N retention. Field observations suggest that experimenting with alternative crop to sunflower or millet in dryland plots in NE, such as specialty crops that would not deplete deep water from the soil profile would increase winter wheat yields and increase economic benefits.

2011/09/01 TO 2012/08/31 Large datasets are being prepared for validation of the biogeochemical, hydrological, crop performance, economic sand energetics model simulations. Preliminary field data generated numerous additional research questions and experiments. Second year of biweekly results is almost complete. Manuscripts are being prepared for complete sets of data associated with short experiments that will aim at helping interpret large scale field data sets. Second year of data generated that shows notable differences while converting from no-till to organic winter wheat fallow system in terms of the magnitude of the greenhouse gas (GHG) emissions. Plant community dynamics and plant growth parameters show benefits of conversion from no-till to organic. The practice of reintroduction of tillage during this process results in rapid decline in soil organic matter and increase in GHG emissions reducing carbon sequestration and increasing the environmental impact. More data needs to be generated to create simulation models to show long-term impacts. Additional experiment is proposed to evaluate the feasibility of using no-till as an alternative for organic production. The dissemination of the results at public meetings and presentation made public aware of the relationships between land uses and GHG emissions. Farmers\' future decisions on land use changes are better supported and validated by two years of data.

2010/09/01 TO 2011/08/31 Our preliminary results suggest that converting from no-till to organic winter wheat fallow system typically used in the area requires reintroduction of tillage. This practice will result in rapid decline in soil organic matter and increase in GHG emissions reducing carbon sequestration and increasing the environmental impact. More data needs to be generated to create simulation models to show long-term impacts. Additional experiment is proposed to evaluate the feasibility of using no-till as an alternative for organic production.

2010/09 TO 2014/08 What was accomplished under these goals? To date, project outputs have addressed allsix objectives of our study: 1) to collect farm-level observational data for testing and improving the process-based biogeochemical model, Manure-DNDC; 2) to quantify the impact of baseline and alternative management practices on ecosystem services with Manure-DNDC; 3) to develop a Northeastern GIS database to support Manure-DNDC applications at a regional scale, 4) Develop a decision support tool by developing a user-friendly interface to link Manure-DNDC to regional database; 5) Evaluate the decision support tool and 6) Integrate the research objectives with an educational initiative that partners a graduate student with science teachers and their students. To meet out first objective, we initiated a systematic sampling and chemical analysis of pools and fluxes of carbon and nitrogen at two University of New Hampshire farms. We used these farms as model systems to calibrate Manure-DNDC and include the UNH Burley-DeMerrit (organic) and Fairchild (conventional) dairies. In the spring and summer of 2011, plots were established in the cropping areas of each of the farms for measuring carbon and nitrogen pools in crop biomass and soils. We also used the plots for measuring soil greenhouse gas emissions of carbon (methane, carbon dioxide) and nitrogen (nitrous oxide). A spatially intensive soil sampling was completed at both farms during the 2011 and2012 growing seasons, and soil profiles have been characterized for DNDC model inputs such as texture, pH, bulk density, carbon, and nitrogen. Soil greenhouse gas emissions began in July 2011 and consisted of bi-monthly measurements of methane, carbon dioxide, and nitrous oxide. An automated system that continuously collects data on carbon dioxide emissions was deployed to the organic dairy in July 2011. This automated system allowed us to observe fine scale responses to changes in temperature, moisture, and management that our bi-monthly observations may have missed. We also identified and measured \"hotspots\" and \"hot moments\" of greenhouse gas emissions on each of the farms. A \"hotspot\" is a relatively small area where large amounts of greenhouse gases are released, such as in manure and silage stockpiles. A \"hot moment\" is a short period of time where a pulse of greenhouse gases may be released to the atmosphere, such as when manure is applied to a field. We also quantified greenhouse gas fluxes from manure, silage, bedding, and from the cows themselves (enteric emissions), and experimentally manipulated the effects of manure and urine inputs, mowing, grazing, and precipitation on soil greenhouse gas fluxes.The enteric emissions methodology has been published (Dorich et al. 2015) and Mr. Dorich completed his masters degree and has gone on to a position at Colorado State University. To address our second objective, we compiled management data on all aspects of farm operations for both the organic and conventional dairies. We conducted initial DNDC model runs examining the effects of grazing and manure applications on soil carbon sequestration and greenhouse gas emissions. These findings were presented at the 2012 meeting of the Ecological Society of America in Portland, OR. A more complete suite of Manure-DNDC runs for model calibration, validation, and simulation of management scenarios were completed and were used for the development of the decision support tool outlined below. we have three separate manuscripts in preparation addressing 1) hotspots of greenhouse gas emission, 2) experimentally manipulated the effects of manure and urine inputs, mowing, grazing, and precipitation on soil greenhouse gas fluxes and 3) DNDC modeling of these farm ecosystems. For our third objective, we have compiled a GIS database that will enable regional modeling of dairy management throughout the Northeast. The database includes characteristics of soils (clay fraction, organic matter fraction, pH, and bulk density) managed for pasture in the Northeastern US. It contains spatially explicit estimates of dairy farm distribution, daily weather data, and nitrogen deposition. This GIS database was combined with Manure-DNDC to produce the web-based decision support tool outlined in the project proposal. Objective four, to develop a decision support tool using a user friendly interface to link DNDC to a regional database has also been completed. Through our collaboration with AGS, we have developed the Northeast Dairy Emissions Estimator (<http://nedairy.ags.io/>). This web application is a simple yet powerful way for farmers or other interested parties to learn about the general implications of changes to dairy farm management. Its intuitive design allows a user to quickly and easily create an account, locate a farm, and define farm management. Emissions and reactive N losses can be viewed for a single management scenario or compared across management alternatives. We designed, built, and deployedthis web-based application that produces DNDC-based greenhouse gas emissions estimates for New England dairy agriculture systems in response to user specified conditions. These scenarios are described using a key subset of DNDC input parameters. This simplified model, referred to as the DNDC meta-model, utilizes a data mining approach to mimic the functioning of the full complex model and compare results graphically. The purpose of implementing this simplified tool is to allow easy access over the web to DNDC emissions estimates. This addresses a set of issues related to the complexity of DNDC and effort required to set up and execute DNDC simulations. Our fifth objective was to evalaute the decision support tool. On 5/21/14 we held an all day workshop at the Instiutue for the Study of Earth, Oceans and Space at the University of New Hampshire withinvited guestsfrom industry and UNH Cooperative Extension who specifically work with farmers on management practices. This workshop was meant to introduce the concept of theNortheast Dairy Emissions Estimator and gather feedback on the usability of the interface and content. It was organized by the PI Ruth Varner and included presentations by Dr. Varner, Dr. Alexandra Contosta, Mr. Christopher Dorich (all at UNH) and Dr. Pete Ingraham (AGS). Our invited guests included: Nancy Hershberg (formerly of Stoneyfield) Michal Lunak (UNH Extension) John Porter (UNH Extension, emeritus) Dorn Cox (NH Association of Conservation Districts). Obejective 6,to integrate the research objectives with an educational initiative that partners a graduate student with science teachers and their students included graduate student Mr. Christopher Dorich developinga full day workshop to work with12 middle and high school teachers. The workshop consisted of an initial session on carbon cycles and greenhouse gas emissions, a field trip to the organic dairy where Mr. Dorich and Dr. Varner allowed the teachers to investigate a research question of thier own (How does CO_2 emission vary across a farm ecosystem?) using a portable CO_2 flux unit developed by Dr. Varner as part of her leadership of the Joan and James Letizel Center for STEM education. The teachers collected flux data from 3 differnt sites on the famr and then returned to the university to anlayze their results. They discussed implementation of this kind of research, both the content and the scientific appraoch to thier classrooms. Three of the teachers worked with Mr. Dorich in their classes by borrowing the instrument and having him come in to support the measurements and interpretation in their classroom reaching approximately 60 middle and high school students. **PUBLICATIONS (not previously reported):** 2010/09 TO 2014/08 1. Type: Theses/Dissertations Status: Accepted Year Published: 2014 Citation: Dorich, Christopher(2013)Comparison of greenhouse gas emissions on an organic and conventional dairy farm in New Hampshire, Masters Thesis, University of New Hampshire: Durham, New Hampshire. 2. Type: Journal Articles Status: Published Year Published: 2015 Citation: Dorich, C., R.K. Varner, A. Pereira, R. Martineau, K. Soder, A. Brito, (2015) Comparing the sulfur hexafluoride tracer technique and a portable automated open-circuit head chamber system for measurements of enteric methane emissions in mid lactation Holstein cows, J. Dairy Sci., doi:10.3168/jds.2014-8348. **ACCESSION NO:** 0223651 **SUBFILE:** CRIS **PROJ NO:** ILLU-875-634 **AGENCY:** NIFA ILLU **PROJ TYPE:** OTHER GRANTS **PROJ STATUS:** EXTENDED **CONTRACT/GRANT/AGREEMENT NO:** 2010-51106-21824 **PROPOSAL NO:** 2010-03954 **START:** 01 SEP 2010 **TERM:** 31 AUG 2014 **GRANT AMT:** \$0 **GRANT YR:** 2013 **AWARD TOTAL:** \$649,883 **INVESTIGATOR:** Wander, M. M.; Ugarte, C.; Zaborski, E.; Phillips, E. **PERFORMING INSTITUTION:** Natural Resources & Environmental Sciences UNIVERSITY OF ILLINOIS 2001 S. Lincoln Ave. URBANA, ILLINOIS 61801 ***ORGANIC SYSTEMS AND CLIMATE CHANGE***

2010/09 TO 2014/08 What was accomplished under these goals? Sampling and preliminary analyses of data gathered from 72 farm fields and participating farmers have been completed. The field sampling effort assesses how different soil management practices influence soil function including soil productivity and soil carbon storage by comparing soils from organically managed farms with soils from conventionally managed sites that have used standard and reduced tillage practices for at least five years. We sampled fields that had been in corn or soybeans the previous year with a truck-mounted soil probe, taking 5.08 cm soil cores to a depth of 60 cm from a 10-acre area within each field. Soil analyses include: standard soil test measures (pH, plant available P and K, base saturation), texture and bulk density, soil organic carbon (SOC), particulate organic matter (POM), soil biological activity using fluorescein diacetate hydrolysis (FDA) and nitrogen mineralization potential (PMN). All analyses are completed and we are finalizing individualized reports for the farmers who participated in the project. The report format modifies the standard soil test to emphasize the functional role of indicators and permit individuals to determine where their values fall in terms of optimums and study norms. We used year one data for power analysis to determine that sampling efforts can be optimized to detect 7% SOC (1.26 Mg SOC ha-1) change with a 90% degree of precision by collecting 16 samples per 10 acre field in a grid sampling design. Power analysis also indicated we needed to sample a greater number of locations than originally proposed to draw robust conclusions about the relative ability of different practices to build SOC and that study power is greater for important dynamic properties (eg: POM, FDA and PMN) that might be used to index stewardship more readily than total SOC. Management histories were used to run evaluation tools and models to predict outcomes for individual farms. The CMT scores ranked Org\>Conv-reduced till\>Conv-full till, with scores for Org systems being twice those computed for the Conv-full till systems. Measured data suggests organic and conservation management are similar in their ability to increase SOC and active organic matter stocks; the CMT tool over estimates benefits of organic management; and the Century Model accurately ranks sequestration potential if it is initialized and run with detailed field management and yield histories. A mixed method approach was used to apply the theory of planned behavior to and explore the attitudes, norms and perceptions of participants in order to identify groups of farmers and issues that influence practice choice and farmers\' willingness to participate in programs to incentivize carbon sequestration and resource conservation. We found business orientation, land access and social connectedness most influence farmers practice choice and propensity to participate in voluntary stewardship efforts. This information can be used to segment producers into groups with distinct information/programmatic needs. Farmer input suggests refining management within segments is unlikely to improve stewardship unless information can somehow reverse trends of farm-size expansion and increasingreliance on crop insurance that promotes resource degradation and discourages conservation. Our results will improve instruments used to assess C sequestration rates and ecosystem services on organic farms and help to identify practices that perform well enough to allow organic farmers to compete for carbon trading and conservation programs. In addition, we are developing indicators that will be useful to individuals, planners, andbusiness entities. **PUBLICATIONS (not previously reported):** 2010/09 TO 2014/08 Type: Journal Articles Status: Published Year Published: 2014 Citation: Ugarte, M.C., Kwon, H.-Y., Andrews, S.A. and M.M. Wander. A meta-analysis of soil organic matter response to soil management practices in the continental United States. Journal of Soil and Water Conservation. 69:422-430

2012/09 TO 2013/08 What was accomplished under these goals? We have finished sampling and interviewing participating farmers.The field sampling effort was designed to allow us to measure how different soil management practices influence important soil quality characteristics, including soil productivity and soil carbon storage. This work compares soils in organically-managed farms with soils from conventionally-managed sites that have used standard and reduced tillage practices. We used the USDA list of certified organic farms to identify prospective sites followed by phone interviews to identify farms that had applied organic practices in a consistent manner for over five years. We then used soil maps, plat books and word of mouth to identify nearby conventionally-managed fields with similar soil types.[We only sampled fields that had been in corn or soybeans the previous year.]{.mark} A truck-mounted soil probe was used to collect 24 (in 2011) or 16 (in 2012 and 2013) 5.08cm soil cores to a depth of 60 cm from a 10-acre area within the field. [Soil analyses include: standard soil test measures (pH, plant available P and K, base saturation), texture and bulk density, soil organic carbon (SOC), particulate organic matter (POM), soil biological activity using fluorescein diacetate hydrolysis (FDA) and nitrogen mineralization potential (PMN).]{.mark}We have been preparing individualized reports for the farmers participating in the project as results come in to allow them to use the data for individual decision making. These reports [pilot a more holistic approach to soil testing]{.mark}. We have modified the standard soil test representation to allow them to understand the functional role of indicators and where their values fall in terms of optimums and study norms. We conducted power analysis of inorganic nutrients and organic matter measurements from 2011 samples to determine whether sampling intensity was sufficient to meet our objectives and inform the development of protocols for monitoring sequestration in agricultural soils. Power analysis is the probability that the null hypothesis will be rejected when it is false. Power A depends on the aplha value, the replication and the statistical effect size. This evaluates the probability of finding a difference that does exist. Both ad hoc and post hoc power analysis can be very helpful at different stages of hypothesis testing. Using these methods we determined how many fields we need to sample to detect differences of expected magnitudes and how many soil cores would be required to document changes in soil organic carbon (SOC) that might be expected to occur within an individual field during a five year period. After the first year of sampling, the power of our statistical analysis for SOC was around 16% which was inadequate to find SOC differences among systems of 1.8 g C kg-1 soil. This was not sufficient to detect significant differences among crop phases (corn and soybean) or cropping systems that are of the magnitude of interest to carbon trading schemes or aggregators who might need to verify changes in C stocks. We did find a significant depth interaction with higher stocks found in the organic systems. [Power analysis of 2011 results suggests that study power is greater for important dynamic properties (eg: POM, FDA and PMN) that might be used to index stewardship more readily. Based on these results, we decided to reduce sampling intensity within individual fields from 24 to 16 0-60cm cores. Conclusions about the C sequestration potential of practices could not be drawn from the small number of fields used in our 2011 analysis.]{.mark} Power analysis indicated we needed to sample a greater number of locations than originally proposed to draw robust conclusions about the relative ability of different practices to build SOC in Illinois. Some of the pairs sampled in 2012 and 2013 only consider the tilled organic and conventional treatments because we were unable to find well-matched no-tillage or even reduced-tillage practices consistently. **PUBLICATIONS (not previously reported):** 2012/09 TO 2013/08 Type: Journal Articles Status: Awaiting Publication Year Published: 2014 Citation: Ugarte, M.C., Kwon, H.-Y., Andrews, S.A. and M.M. Wander. A meta-analysis of soil organic matter response to soil management practices in the continental United States. Journal of Soil and Water Conservation. (In Press).

2011/09/01 TO 2012/08/31 We conducted power analysis of inorganic nutrients and organic matter measurements from 2011 samples to determine whether sampling intensity was sufficient to meet our objectives. Power analysis is the probability that the null hypothesis will be rejected when it is false. Power A depends on the aplha value, the replication and the desired statistical effect size. This evaluates the probability of finding a difference that truly exists. Both Ad hoc and post hoc power analysis can be very helpful at different stages of hypothesis testing. Using these methods we determined how many fields we need to sample to detect differences of expected magnitudes and how many soil cores would be required to document changes in soil organic carbon (SOC) of specified magnitudes within an individual field. The power of the study during the first year of the project was unable to find SOC differences among systems of a 1.8 g C kg-1 soil magnitude. The power was not sufficient to detect significant differences among crops (corn and soybean) or among cropping systems. We did find a significant depth interaction. Differences were evident in the particulate organic matter (POM) fraction from surface soils, with concentrations higher in organic and conservation than in conventional cropping systems. Using this method we were able to determine that C sequestration monitoring programs could evaluate changes within individual fields using approximately 14 soil samples in a 10-acre based field under similar soil characteristics. Based on these results, we decided to reduce sampling intensity within individual fields from 24 to 16 0-60cm cores. Direct measurement and tool-based evaluations rank cropping systems\' performance differently with direct measures being less conclusive when applied at the farm scale. Summary of first year CMT surveys was completed and compared against field results and results from meta-analysis on the relative performance of organic, no-tillage and conventional systems estimated from the peer reviewed literature. Conclusions about the efficacy of practices could not be drawn from the small number of fields used in our preliminary analysis; the power of our statistical analysis was around 26%. Analysis suggests we will need to sample a greater number of locations (\>15 sets of fields) to draw conclusions about the relative ability of different practices to build soil organic matter in Illinois. Moreover, a much greater number of farms must be sampled to evaluate the use of CMT as a tool to verify C contracts or estimate provision of other ecosystem services of interest.

2010/09/01 TO 2011/08/31 A poster on the project was presented by C. Ugarte, E. Zaborski, and M. Wander entitled \"The Potential for Carbon Sequestration: The Case of Organic Grain Farming Systems in the Midwestern United States\" at the ASA/SSSA/CSA held in October in San Antonio, Texas.

2010/09 TO 2014/12 What was accomplished under these goals? Brief overview In 2010 south Texas growersdid not have any information on organic production. Several studies were developed in manycrops with funds provided by this grant.These studies described below can be the foundation for the future growth of this sector to provide additional resources to low income families and development of the organic production systems from medium to large growers. Fourteen (93.3%) of the fifteen students selected for this program were able to finish their program at South Texas College or switched to a four year university programs. Students were able to complete a small project, some of them lead to a more in depth studies (PDF). Currently there are 9 Famer markets in the Rio Grande Valley since the original three in 2010. Three small acreage growers that worked in this project are showcased as exemplary cases of success (Yahweh\'s All Natural Farm Garden in Harlingen, Terra Preta in Edinburg, and Monte Alto Vineyard near Edcouch). Completed from 2010 to 2014: Combined effects of different pest programs and mulch types in organic tomato, watermelon and bell peppers: These crops were subjected to organic pesticide programs and grown using from 3 to 6 types of mulch from 2011 to 2013: nonwoven polypropylenes (silver reflective, white, and black color), black woven, and cover crop (beans) and hay (Bermuda grass).During 2011 and 2012 a severe drought was observed and populations of whiteflies, aphis or caterpillars did not reach high levels. In most cases the treatments with pyrethrin and azadirachtin controlled whiteflies or aphids in this study. However, the low numbers of caterpillars did not provide an opportunity to evaluate the efficiency of Bt, Beauveria bassiana or spinosad. Mulches can provide a microclimate for some pest species that alter pest populations. Whiteflies in watermelon were more abundant in black non-woven mulch compared with woven mulch in 2011 and 2012. In watermelon grown in hay and pyrethrin plus B. Bassiana rotated with spinosad had the lowest whitefly population and highest marketable fruit. In tomato, silver reflective mulch had less whitefly and aphid population however; black plastic mulch had the highest yield. Field and laboratory assays on Phthia picta and Murgantia histrionica using organic insecticides: P. picta was evaluated on tomato in the field, and tomato fruit in the laboratory; while M. histrionica was tested on kale in the field, and cabbage leaves in the laboratory. Mortalities for both pests were estimated in laboratory experiments every 12 h for 72 h. Azadirachtin, B. thuringiensis, Beauveria bassiana, spinosad, and pyrethrin were the insecticides utilized in these studies. Laboratory results for P. picta shown that azadirachtin produced mean mortalities of 100% with 4 g a.i./L at 24 h and 6 g a.i./L at 12 h. Similarly, mortalities of 100% were obtained with spinosad at 6 g a.i./L. Field studies shown that spinosad (6 g a.i./L) caused significantly highest mortalities of P. picta (60%) after 48 h, and azadirachtin (4 g a.i./L) mortality reached only 10%. In laboratory tests, M. histrionica caused 100% mortalities at 24 h with 6 g a.i./L of spinosad and 5 g a.i./L of pyrethrin. In the field, spinosad and azadirachtin had the lowest population increases of M. histrionica compared with pyrethrin and the untreated control. The latter results were affected by initial non- uniform population on each treatment and were inconsistent with the laboratory test. Importance of planting time on the incidence of yellow leaf curl virus in organic tomatoes: In this study we found that virosis incidence was decreased delaying the transplanting time on tomatoes from 17 September to 5 October. As a consequence those tomatoes planted early (17 and 26 September) were the most infected, these plants had very low yields and some produced no fruit at all. Those planted on 5 October had 50% more yield than those planted early and the rate of infection was low. Economic feasibility of small organic vegetable farms: The study examines the 2011 revenue stream on this three-acre produce operation that relies on three income streams: a Community Supported Agriculture (CSA) program, farmers markets, and sales to local restaurant establishments. We found that when both CSA members and farmers markets/restaurant sales present no reduction, the net cash income is \$41,318. However, if there are no CSA members, meaning the only source of revenue is the farmers markets and restaurant sales, the net cash income is only \$820. Conversely, if the only source of revenue were the CSA, then the net cash income would be \$18,113, thus demonstrating the importance of the CSA to the farm\'s profitability. For more detailed information check the following URL: http://agecoext.tamu.edu/fileadmin/user upload/Documents/Resources/Publications /SmallAcreage.pdf Control of the potato psyllid, incidence of Zebra Chip Disease (ZCD) and effect of silver mulch in organic potatoes:ZCD is caused by Candidatus Liberibacter solanacearum (CaLsol) and transmitted by the potato psyllid Bactericera cockerelli. This is a yearly problem in the Rio Grande Valley, S.Texas. In this study none of the organic insecticides (azadirachtin, pyrethrin or spinosad) controlled B. cockerelli or reduced percentages of ZCD symptoms in tubers in 2013 and 2014. However, pyrethrin and azadirachtin controlled effectively B. tabaci in 2013. Populations of both pests in 2014 were very low to make a conclusive evaluation of the insecticides. In all the studies the percentages of tuber showing ZCD symptoms were \>70%. Yields on silver plastic mulch were significantly different than bare ground planted potatoes; however percentages of ZCD ranged from 80% to 89% in silver plastic mulch and \>99% in bare ground planting. Control of the sugarcane aphid(SCA)in sorghum using organic insecticides: SCA (Melanaphis sacchari) a \'new\' invasive pest has been affecting sorghum fields in the U.S since mid-2013. Nowadays, the SCA is considered the most devastating pest of sorghum; it was invaded 11 states in the USA and 8 in Mexico. In this study we worked with HillTop Farm to control SCA using and evaluated the costs expended to control this pest. Applications of a blend of 4 oz/A of each Karanja oil and Neem oil (Ahimsa Organics®) and 8oz/A BioRepel Garlic (JH Biotech. Inc.) were conducted on three occasions and wew effective controlingSCA however, the costs incurred to control SCA were \$44.55 compared to \$22.38, and \$16.25, for conventional irrigated, anddryland, repectively. Phytoseiids as potential natural enemies of the potato psyllid in organic potato production in south Texas: To evaluate the organic control of the potato psyllid B. cockerelli and the silverleaf whitefly B. tabaci, a 2-y study was conducted in south Texas in 2013 and 2014. We found that azadirachtin, pyrethrin, or spinosad did not provide an adequate control of B. cockerelli in 2013. However, azadirachtin and pyrethrin reduced significantly B. tabaci nymphs and phytoseiids compared with the untreated control and spinosad treatment. The highest numbers of phytoseiids and lowest numbers of potato psyllids in the control plots in 2013 demonstrated a potential predatory-prey relationship of these organisms. The phytoseiids Amblyseius largoensis, Typhlodromips near tennesseensis, and Typhlodromus near peregrinus were identified in this study. Here, we reported for first time the phytoseiid Amblyseius largoensis as predator of B. cockerelli eggs and nymphs. Yields were not different among treatments in 2013 and 2014. However, the high numbers of B. cockerelli in 2013 affected yields that year. Tuber sizes were small, consequently yields were reduced between 1/5 to 1/3 in 2013 compared with yields in 2014. The impact of the predacious phytoseiids needs further evaluations, as well as their potential for mass rearing and release to be used in organic production systems. **PUBLICATIONS (not previously reported):** 2010/09 TO 2014/12 1. Type: Conference Papers and Presentations Status: Published Year Published: 2014 Citation: DEPREDACI?N DEL PS?LIDO DE LA PAPA POR FITOSEIDOS EN PAPA ORG?NICA EN LA REGI?N SUBTROPICAL DE TEXAS 2. Type: Other Status: Under Review Year Published: 2015 Citation: Short Organic Agriculture Reports: Integrating community college students and organic farmers throughout feasibility studies in pest management and horticulture production in South Texas 3. Type: Journal Articles Status: Awaiting Publication Year Published: 2015 Citation: Phytoseiids as potential natural enemies of the potato psyllid in organic potato production in south Texas

2011/09 TO 2012/08 Transition organic farmers are starting to utilize preliminary results provided in this study such as the use of mulch, drip and t-tape for water efficacy use, organic pesticides for control of pests, expanding their farms, and the establishment of new farms by young farmers. In addition, farmer markets had increased from only one in 2009 in the valley in Brownsville, to about 8 farmer markets across the RGV: McAllen (2), Weslaco, Harlingen, Edinburg, Brownsville, San Juan, and Mission (one on each city). These number will increase soon as organic farms in Rio Grande City (upper Rio Grande Valley) starting to plant organically. The Yahweh\'s Farm and Garden -closely related with these studies- had switched its attention toward CSA members instead of farmer markets due to our study on the economic feasibility of organic farmers in the RGV described above. Also the far has been expanded move into providing land for a CSA\'type community garden, now including goats and chicken; and project to open of a community farm market in 2013. The Thompson citrus orchard (a \>50 year old conventional farm) that initiated with 12-acres of organic production has moved toward expanding its orchard into organic farming production triplicating the initial acreage. Two former field assistants (\<30 yr-old) that worked under Dr. Villanueva\'s supervision started to farm organically and use tools developed in program such as t-tape for irrigation, mulch and a pest management program. Regarding the results, these studies represent a compendium of preliminary findings on pest management in transitional organic farms in the Rio Grande Valley. Local growers are adopting mulch and irrigation techniques that affect IPM and best management practices. [We showed that a three-acre organic vegetable farm can be profitable averaging \$41,318 in net cash income per year]{.mark}. Students of STC granted scholarships were able to develop knowledge and discipline to carry on systematic data recording. Involving these students in research is a contribution not only in their professional development but also in research conduction where labor and basic knowledge is scarce. Some noticeable examples on how this project contributed to the development of these students are: (1) David Garza presented his research titled \"Can spinosad be used to manage Texas leafcutter ants in organic Black Spanish Grapes at Joint Meeting of the Southeastern and Southwestern Branches of the Entomological Society of America in 2012. Now he is studying Geology at UT San Antonio. (2) Antonio Martinez winner of the 1st organic conference presentation, moved to Texas A&M Kingsville. After this scholarship he decided for a major in Agriculture. (3) Guadalupe Alaniz: recently accepted to participate as a National Community Aerospace Scholar, once a nursing major, now Biology major since gaining the experience of both Microbiology (in class) (4) Juan Enciso: Co Author of first publication an currently studying Economy and (5) Araceli Lopez Biology- Premed at UT and (6) Josiah Borden Biology, the 3 latter students at UT-Pan-American in McAllen. **PUBLICATIONS (not previously reported):** 2011/09 TO 2012/08 Ribera, L.A., M. Raulston, R. T. Villanueva, J. Enciso-Siller, B. Storz, and J. Anciso Economic feasibility of a small acreage organic vegetable farm in south Texas. Agricultural and Food Policy Center. Texas A&M University. April 2012. Texas AgriLife Research Texas AgriLife Extension Service.

2010/09/01 TO 2011/08/31 The participating college students were able to develop knowledge and discipline to carry on systematic data recording. Involving college students in this program throughout this organic transition project was and is an ongoing contribution not only in their professional development but also in research conduction where labor and basic knowledge is scarce. Students are 85 to 100% satisfied in their programs and what they are learning. The South Texas College faculty that attended the student\'s preliminary report was 85 to 95% percent satisfied on the presentations conducted by the eight students. Participating growers in this program starting to learn about the most damaging pests; for example some of the grower cooperators did not know that thrips and broad mites were the arthropods causing damages to their onions and pepper plants, respectively. Between 72 to 87% of the participants on the organic programs conducted by Dr. Villanueva requested additional presentations; and an average of 78% will recommend to partners and friends to attend his program if they are interested in organic agriculture. Close to 90% of growers require more local research for organic pest management.

2010/09 TO 2015/08 What was accomplished under these goals? This multi-disciplinary, multi-state project demonstrated that [organic vegetable farming practices could be improved through the use of cover crops, compost and mulch to optimize pest management, crop quality, and profitability, while enhancing soil quality. Organic no-till production is still in its infancy, so additional research is needed to provide recommendations for the exact timing for cover crop planting, termination and vegetable crop planting.]{.mark} In Florida\'s sandy soils, organic no-till holds the most promise because of the potential for early cover crop planting, continuous cover crop growth over the year, and earlier termination dates. Broadleaf vegetable crops, such as zucchini, squash, and pac choi also performed better under no-till production in Florida than finer-leafed crops, such as tomato and pepper, in Iowa. Mulch did not improve organic sweet corn production, while mulched zucchini, squash, tomato and pepper yields and overall appearance were greater in mulched vs. non-mulched plots. The response from cover crops was mixed: overall yield benefits were not as apparent as soil quality improvements at both sites. Overall, soil quality data showed enhanced storage of soil organic C, total N, and biologically active soil C and N when cover crops were planted; improved soil structure under reduced tillage; and more soil organic C, total N, biologically active soil N, and higher plant nutrient concentrations with composted animal manure. Lysimeter data showed that the concentration of leached N was consistently lower under vegetables grown with a cover crop and in no-till. Economic analysis showed increased costs with cover crop seed and planting, but, with green payments, these costs could be compensated by increased carbon storage in these fields. Thus, organic farmers are encouraged to use a combination of cover crops and compost to enhance production and environmental quality. Over 1,689 farmers and ag professionals received this information through workshops, Field Days and conferences. Because cover crops in rotation have always been a part of certified organic regulations, in surveys from these events, 100% of farmers stated they are interested in soil conservation and plant cover crops, with 10% having tried organic no-till on their farms. The treatments we studied included three tillage comparisons: (1) tilled followed by straw mulch (2) tilled without straw mulch and (3) organic no-till; and two organic fertility treatments (1) composted animal manure alone and (2) composted animal manure + cover crops. From 2011 to 2014, experiments were conducted in Iowa and Florida across two contrasting soil types and climatic conditions using vegetable rotations appropriate for the region. Iowa had an additional season in 2015. Two long-term rotation sequences were established at each site. Compost and mulch were applied to a sub-set of these treatments. The cover crop in Iowa was hairy vetch/rye, while in Florida sunnhemp was used. Florida also substituted plastic mulch for straw mulch, as is the convention on organic farms in Florida. A fifth season was established in Iowa, by planting a cover crop of hairy vetch and rye (hairy vetch at 25 lb/acre and rye at 1.5 bu/acre) in 15 x 20 ft. plots on October 19, 2014, at the ISU Neely-Kinyon Farm, Greenfield, Iowa. Cover crop emergence and establishment in Spring 2015 were good, but there were many gaps in the cover crop stand, possibly due to winter-kill or poor growth in that particular area. On June 2, 2015, cover crops were either: 1) tilled under with a rotary tiller, or 2) crushed using a no-till roller/crimper when the rye was at anthesis, based on previous research. Tomatoes (an organic cultivar, Defiant, from Johnny\'s Seed, Albion, ME) were seeded on April 24. Sweet corn (organic \'Luscious\', Johnny\'s Seed, Albion, ME) and tomatoes were seeded and transplanted, respectively, into the tilled and no-till plots on June 25 (corn) and June 22 (tomatoes). Manure-based compost (made from local sources) was applied at a rate of 100 lb/acre of nitrogen (N) in vegetable plots before planting on May 12. An additional 50 lb N/acre (Midwest Bio-Ag organic 2-5-4 (N-P-K) fertilizer, Blue Mounds, WI) was side-dressed on July 28. Tilled plots were maintained using typical organic weed management techniques. Crops were harvested at maturity using timely hand harvesting to ensure quality vegetable crops. There were three sweet corn and tomato harvests from September 1 to 30. In 2015, sweet corn silks were attacked by corn rootworm beetles leaving neighboring GMO corn fields, which led to reduced pollination and yields. While there were no significant differences among treatments at Harvest 1, there was trend towards greater sweet corn performance in the tilled plots, averaging 523 lb/acre, compared to 87 lb/acre in the no-till plots. The addition of compost increased no-till production by 134 lb/acre. Plots with mulch averaged 552 lb/acre, while yields from no mulch plots were similar, at 494 lb/acre. An increase in 440 lb/acre was demonstrated with cover crops compared to no cover crops. Because of the high variability in yields among plots and between harvests, there was no statistical difference over the entire season, although yields ranged from 1,201 lb/acre in no-till plots to 4,909 lb/acre in the CC-CAM-T-NM plots. Because of the late planting, earworm pressure was high, and ears from all treatments exhibited earworm damage, with similar earworm presence between treatments. Tomato yields followed the same pattern as sweet corn, with lowest yields in no-till plots, and the addition of compost aiding no-till production. While tilled, mulched plots produced numerically greater yields and cleaner fruit, there were no significant yield differences when compared with tilled, no mulch treatments. These results demonstrate the need for supportive weather conditions for no-till to succeed, allowing cover crop rolling/crimping at an earlier date and earlier application of side-dressed organic fertilizer. The combined effect of planting cover crops and amending the soil with composted animal manure is particularly beneficial for enhancing surface soil quality, regardless of tillage management. We observed significant increases in soil organic C, total N, particulate organic matter C, N mineralization potential, and aggregate stability at the end of the second growing season in the tilled and reduced-till soils that remained stable through the fall of 2014. The observed positive changes in soil quality from planting cover crops were mirrored in enhanced ecosystems services. Nitrate-N leaching below the rooting zone was consistently lower with cover crops under all vegetable crops for all years. Soil respiration, quantified as CO2 flux (gmCO2/m2/h), was consistently higher under reduced tillage. This result demonstrates that rolling cover crops prior to vegetable planting enhances microbial activity compared to tilling cover crops. Changes in soil profile C and N were observed in the top two depth increments only with no change measured below 30 cm. After 4 years of vegetable cropping, the soils with cover crops and composted animal manure, regardless of tillage, had up to 16% higher SOC concentrations and an average of 8% higher TN concentrations in the top 15 cm of soil compared to baseline values. Increased TN concentrations in the top 15 cm were accompanied by an average of 8% decrease in TN concentration in the 15-30 depth increment. The results of this experiment demonstrate that vegetable cropping systems that utilize fall-planted cover crops and composted animal manure will increase overall soil quality, enhance microbial activity, increase C sequestration, and reduce N leaching loss from the rooting zone. Most of these benefits will be derived regardless of whether the cover crop is tilled or roller/crimped prior to vegetable transplanting. **PUBLICATIONS (not previously reported):** 2010/09 TO 2015/08 Type: Journal Articles Status: Published Year Published: 2015 Citation: Delate, K., C. Cambardella, C. Chase, and Robert Turnbull. 2015. A review of long-term organic comparison trials in the U.S. Sustainable Agriculture Research 4(3): http://www.ccsenet.org/journal/index.php/sar/article/view/50095

2013/09 TO 2014/08 What was accomplished under these goals? This multi-disciplinary, multi-state project addresses critical stakeholder needs for improving organic vegetable farming practices to optimize pest management, crop quality, and profitability, while enhancing soil quality to help mitigate global climate change. The treatments we are studying include three tillage comparisons: (1) tilled followed by straw mulch (2) tilled without straw mulch and (3) organic no-till; and two organic fertility treatments (1) composted animal manure alone (no cover crops) and (2) composted animal manure + cover crops. In 2014, experiments were continued in two states (Iowa and Florida) across two contrasting soil types (low vs. high fertility) and climatic conditions (sub-tropical vs. temperate) using vegetable rotations appropriate for the region. Two long-term rotation sequences were established at each site. Six cropping system treatments with different management practices were examined at each site: four treatments using cover crops (CC) and two without CC. Of the four CC treatments, two were treated as organic no-till (cover crop rolled) and two were tilled prior to vegetable crop planting/transplanting. Compost and mulch were applied to a sub-set of these treatments to test the effect of these potential soil amendments. The cover crop in Iowa was hairy vetch/rye while in Florida, sunnhemp was used. Florida also substitutes plastic mulch for straw mulch, as is the convention on organic farms in Florida. Fall cover crops were planted in Iowa on October 11, 2013, at a rate of 25 lb hairy vetch + 90 lb rye/acre. Treatments were replicated four times for a total of 48 plots. Because of the cool, wet spring, cover crops did not mature until late May. Cover crops were mowed at anthesis, and disked on June 3 or terminated with the Rodale Institute roller/crimper on June 6. The late planting date was on June 18 -- two weeks behind schedule. Compost was applied at a rate of 100 lb N/acre on April 14, and organic fertilizer (2-5-4; MBA, Blue Mounds, WI) was side-dressed at 50 lb N/acre on July 28. [Tilled plots were tilled for weed management on July 3, 17 and 31. Sweet corn ears were harvested on August 28 and September 4, 2014. Treatments were as follows: 1) no cover crop, composted animal manure, tilled, mulched; 2) no cover crop, composted animal manure, tilled, no mulch; 3) cover crop, composted animal manure, no-tilled; 4) cover crop, composted animal manure, tilled, mulched; 5) cover crop, composted animal manure, tilled, no mulch; and 6) cover crop, no-tilled]{.mark}. In the first harvest, highest yields were obtained in Treatment 2 (animal manure, tilled) and in Treatment 1 (animal manure, tilled, mulched), Treatment 4 (cover crops, animal manure, tilled, mulched), and Treatment 5 (cover crops, animal manure, tilled). [The two lowest yielding Treatments (3 and 6) were the organic no-till plots]{.mark}. In the second harvest, yields were not statistically different, but yields from the no-till plot (Treatment 6) tended to be more similar to Treatment 4 (cover crops, animal manure, tilled, mulched), which could indicate a later harvest in the no-till plots. Overall total harvest comparisons showed the same pattern as the first harvest, with highest yields in Treatment 2 (animal manure, tilled), followed by the second highest yields in Treatment 1 (animal manure, tilled, mulched), 4 (cover crop, animal manure, tilled, mulched), and 5 (cover crop, animal manure, tilled). The lowest yielding treatments (3 and 6) were no-till, demonstrating the need for supportive weather conditions, allowing cover crop rolling/crimping at an earlier date and earlier application of side-dressed organic fertilizer. Earworm damage was extensive in 2014 because of the late planting and excessive rains during silking, which prohibited the application of Dipel™, an organic-compliant Bacillus thuringiensis formulation. In Florida's sandy soils at the UF-Citra Research Station in 2013, no-till summer squash yields of 443 to 641 grams per plant were equal or greater than tilled yields, with no significant difference between no-till and plastic mulch. Side-dressed organic fertilizer added a numeric boost to no-till yields, but yields were not significantly different from no-till without fertilizer. In the yellow zucchini crop, there were no significant differences between treatments, with no-till equaling tilled treatments, and yields ranging from 376 grams per plant in tilled cover crop plots to 487 grams per plant in the tilled cover crop plots with plastic mulch. Marketable fruit yields followed a similar pattern as the fruit yields, with no differences between treatments for zucchini, and organic no-till squash with extra fertilizer having the highest fruit numbers. Although the no-till plots did not have favorable yields in 2014 in Iowa, soil quality parameters have been higher in no-till plots. Soils results from the 2013 [organic sweet corn plots showed that Treatment 3 (organic no-till) contained the highest amount of soil organic carbon (SOC) at 30.3 g/kg. The two tilled treatments without a cover crop (1 and 2) had the lowest microbial biomass carbon (MBC). Treatments 4 and 5 had the highest MBC, demonstrating the value of composted manure in adding beneficial soil microbes. Treatment 3 had the highest total nitrogen content, followed by the other treatments with cover crops (5 and 4). The lowest total nitrogen content was in treatments without cover crops (1 and 2), with exception of treatment 6 (which had no animal manure application]{.mark}). Overall, soil quality data showed enhanced storage of soil organic C, total N, and biologically active soil C and N when cover crops were planted in the fall before vegetable cropping; improved soil structure under reduced tillage; and more soil organic C, total N, biologically active soil N, and higher plant nutrient concentrations when composted animal manure was applied in the spring. Lysimeter data has been showing that the concentration of leached N has been consistently lower under vegetables grown with a cover crop and in no-till. In Florida, no-till plots showed higher total soil N, particulate organic matter C, extractable K and Mg, electrical conductivity; high biologically active organic matter: POM-C (particulate organic matter carbon): 43% of total soil organic C compared to 22% in Iowa soils under no-till with compost. Mulching with cover crops showed more extractable P and Mg and higher electrical conductivity. Overall, there has been enhanced storage of soil N and biologically active soil C, and higher concentrations of plant nutrients in the no-till treatments. **PUBLICATIONS (not previously reported):** 2013/09 TO 2014/08 Type: Conference Papers and Presentations Status: Published Year Published: 2014 Citation: Delate, K., C. Cambardella, and X. Zhao. 2014. Cover Crop, Mulch, Compost, and No-Till Effects in Organic Vegetable Production Systems. American Society for Horticultural Science Annual Conference, Orlando, FL, ASHS, Alexandria, VA. Abstract.

2012/09/01 TO 2013/08/31 What was accomplished under these goals? This multi-disciplinary, multi-state project addresses critical stakeholder needs for improving organic vegetable farming practices to optimize pest management, crop quality, and profitability, while enhancing soil quality to help mitigate global climate change. The treatments we are studying include three tillage comparisons: (1) tilled followed by straw mulch (2) tilled without straw mulch and (3) organic no-till; and two organic fertility treatments (1) composted animal manure alone (no cover crops) and (2) composted animal manure + cover crops. In 2013, experiments were continued in two states (Iowa and Florida) across two contrasting soil types (low vs. high fertility) and climatic conditions (sub-tropical vs. temperate) using vegetable rotations appropriate for the region. Two long-term rotation sequences were established at each site. Six cropping system treatments with different management practices were examined at each site: four treatments using cover crops (CC) and two without CC. Of the four CC treatments, two were treated as organic no-till (cover crop rolled) and two were tilled prior to vegetable crop planting/transplanting. Compost and mulch were applied to a sub-set of these treatments to test the effect of these potential soil amendments. The cover crop in Iowa was hairy vetch/rye while in Florida, sunnhemp was used. Fall cover crops were planted in Iowa on October 11, 2012, at a rate of 25 lb hairy vetch + 90 lb rye/acre. Treatments were replicated four times for a total of 48 plots. Cover crops were disked under or terminated with the Rodale Institute roller/crimper. Because of extensive spring rains in 2013, cover crops were not disked until June 8 and not rolled until June 20, leading to a planting date of June 24 \-- three weeks behind schedule. Also because extensive spring rains caused a delay in planting, transplants were too large for the mechanical transplanter. Compost is applied at a rate of 100 lb N/acre each spring and organic fertilizer side-dressed after vegetable crop establishment at 50 lb N/acre. Using lysimeter readings from each plot, leached nitrate-N concentrations are determined throughout the growing season in Iowa. In 2013, tomatoes and sweet corn were grown in Iowa, and squash and zucchini in Florida. In Iowa, organic no-tillage crops performed similarly to 2012 results, with tilled CC and compost plots providing higher yields than organic no-tillage plots. Mulch provided an advantage to tomato yields. No-tillage sweet corn failed to compete with mulched and tilled yields. While the tilled crops were more productive, the mulched and no-till tomatoes had higher quality fruit. Lysimeter data has been showing that the concentration of leached N has been consistently lower under vegetables grown with a cover crop and in no-till. Soil quality comparisons show greater soil carbon sequestration with cover crops and compost. An on-farm trial was conducted in summer 2013 in Florida to compare the effects of different mulching methods on plant growth, yield, and pest control in organic yellow zucchini production. Mulches such as paper, rye straw, black plastic, and rye straw + paper greatly reduced weeds as compared with the bare soil control and were not significantly different in their weed suppression effect. Black plastic mulch, however, resulted in significantly higher early and total yields as compared to all other treatments and the bare soil control. The highest yields were also accompanied by the highest detected soil temperatures. Greater densities of squash bugs and stink bugs were also found in the black plastic mulch treatment, suggesting a preventative benefit in terms of pest protection. Soil quality differences were observed within the two organic vegetable rotation sequences at the Florida site in January 2013. Total soil N, particulate organic matter C, extractable K and Mg, and electrical conductivity were significantly lower in the tilled soils. Bulk density and extractable P were significantly greater with a cover crop. Mulching in the presence of a cover crop resulted in more extractable P and Mg and higher electrical conductivity. Mulching in the absence of a cover crop also increase electrical conductivity and resulted in higher bulk density in the top 15 cm of soil. Overall, soil quality data in 2013 for these relatively un-structured Florida soils shows enhanced storage of soil N and biologically active soil C, and higher concentrations of plant nutrients in the no-till organic vegetable rotations compared to the tilled rotations.

2011/09/01 TO 2012/08/31 Results from this project to date have shown excellent organic vegetable yields with improvements in soil and water quality with the use of cover crops. Results from the second season (2012) suggest that, with adequate cover crop biomass and weather conditions permitting vegetable planting on normal dates, organic no-till systems can provide excellent weed management and yields equivalent to tilled systems. The greatest benefits from cover crops in these vegetable systems appear to be related to improvements in soil and water quality. After the first season, in Fall 2011, soil nitrate was lower in tomato plots under cover crop treatments than in plots without a cover crop in Iowa. Without a cover crop, the non-mulched tomato treatment had more nitrate than the mulched plots. In the onion plots, the non-mulched plots had more nitrate for both cover crop and no cover crop treatments. In both the tomato and onion plots, there was more phosphorus in tilled vs. no-till treatments, probably due to tillage stimulating the mineralization of organic phosphorus from added compost. Both phosphorus and electrical conductivity were lower in the no compost treatments. In Florida, soil quality differences were observed in Rotation 2 in 2011 and 2012, where mulching in the absence of a cover crop resulted in higher microbial biomass carbon compared to the no mulch treatment. This suggests that the mulch may be stabilizing soil microclimate (i.e., cooler and wetter) in these relatively un-structured soils to favor the accumulation of microbial biomass carbon, an easily decomposable form of biologically active organic matter. The importance of biologically active organic matter in these very sandy soils is demonstrated by the observation that particulate organic matter carbon represents on average 43.6% total soil organic carbon compared to Iowa soils, where particulate organic matter accounted for 15.4% of total soil organic carbon averaged across treatments. There was a trend toward increasing soil quality from 2011 to 2012 in Florida, where total nitrogen increased in this time frame and soil C:N ratio decreased because of the change in nitrogen content. Extractable phosphorus and calcium also increased from 2011 and 2012. The Florida soils have relatively low amounts of potentially mineralizable nitrogen, but it increased from 2011 to 2012 in the Florida soils, suggesting that the organic management practices encourage accumulation of labile organic nitrogen even in these very sandy Florida soils. Overall, soil quality temporal patterns observed from 2011 to 2012 for Florida soils suggest enhanced cycling and storage of soil nitrogen and soil nutrients in the organically managed vegetable rotation sequences. The benefits of cover crops in this project were primarily from enhancing soil quality and from reducing nitrate-N in lysimeters, which could be extended to enhancement of water quality and groundwater protection. Comparisons with conventional systems may provide larger differences than observed between organic systems and are under evaluation at other sites.

2010/09/01 TO 2011/08/31 In relation to impacts of organic vegetable production treatments on nitrate-N leaching, a primary goal of this project, preliminary lysimeter data showed that the seasonal average root zone nitrate N concentrations under organic tomato and onion were similar and did not exceed the drinking water standard of 10 ppm. In tomato plots, cover crops were associated with decreased nitrate-N in lysimeters compared to plots with no cover crops, particularly in August 2011, when nitrate-N levels in cover cropped plots averaged 5 ppm compared to 15 ppm in plots without cover crops. The concentration of leached N was also consistently lower under onion with a cover crop. No-tillage did not decrease nitrate-N in lysimeters under onions, possibly due to the shallow rooting pattern of the onions. Mulch responses were highly variable under onions and tomatoes, with no obvious benefit in terms of reducing nitrate-N in lysimeters from applying straw mulch. The benefits of cover crops in the first season of this project were primarily from reducing nitrate-N in lysimeters, which could be extended to groundwater protection. Results from this project were disseminated to a broad audience through two field days, two conference presentations and several classroom presentations in Iowa. In Florida, a presentation on the project was delivered in an organic systems workshop organized by Florida Certified Organic Growers and Consumers.

2010/09 TO 2014/08 What was accomplished under these goals? All experiments involving sod based rotation and strip versus conventional tillage have been completed, and all data have been collected and statistically analyzed, with the exception of a complicated weed diversity database. Five manuscripts are being prepared dealing with the interactions of plant productivity, carbon and nitrogen budgets, soil chemistry (inorganic nutrients, mineralizable nutrients, labile carbon, carbon sequestration, soil organic matter, soil moisture), soil microbiology, nematology, weed ecology, and entomology. Lastly, the economics of organic vegetable culture associated with sod-based rotation and tillage are being established. A summary of some of our results will follow: We have shown that two or more years in bahiagrass and strip tillage increases soil organic matter and reduces fertilizer and water inputs (http://nfrec.ifas.ufl.edu/sodrotation.htm) . In our organic vegetable production systems, yields of green beans and broccoli (cash crops)were usually comparable to that published for conventional production. In the initial year of the study, yields were higher for conventional compared to strip tillage treatments. In subsequent years, the effect of tillage was reduced and yields were better correlated with years in bahiagrass. Experiments conducted in a field that had been in bahiagrass for 20 years indicated that high vegetable yields continued until three years of continued vegetable production indicating that the benefits from bahiagrass may diminish in the third year of vegetable production. Available soil N and P decreased with years in bahiagrass, especially in year three. Carbon mineralization was not affected by treatments, possibly due to vegetation inputs from cover crops and weed biomass. The activities of nutrient cycling enzymes (phosphatases, beta glucosidase, beta glucosaminidase, arylsulfatase) and microbial community shifts were sometimes affected by tillage, but not by years in bahiagrass. Increasing years in bahiagrass often reduced populations of Meloidgyne root knot and Rotylenchus reniform nematodes. Weed communities were altered by years in bahiagrass, and grasses and sedges were much more problematic in strip-tilled treatments. Sixty seven species of organisms were collected in pitfall traps. Arthropod abundance and biodiversity were calculated using Shannon-Weiner\'s, Simpson\'s and Horn\'s indices. In general, strip-tilled plots produced a greater number of trap captures, increased species richness and supported greater epigeal diversity than conventionally-tilled plots. Arthropod diversity was lowest in uncultivated plots of bahiagrass. A Risk Rated Enterprise Budget and an Analysis of Variance-Covariance Matrix economic analysis were performed utilizing sod-based rotation (years in bahiagrass) and tillage (strip tillage versus conventional tillage). Three years of bahiagrass in rotation with green bean and broccoli (with rye/oats winter and soybean summer cover crop) in combination with conventional tillage had the highest profitability and was the least risky. Six scientific presentations and several grower talks have taken place during the conduct of this grant. An organic vegetable website has been created (northfloridaorganics.com) that incorporates much of our sod-based rotation data. In addition, we will present our results concerning the organic production of vegetables with sod-based rotation andstrip/conventional in the Southern Coastal Plain on the University of Florida electronic database (EDIS) website. Our results will also be posted on the UF Small Farms and Alternative website receives millions of hits per year. Our major task during this year is to complete the refereed publications associated with this grant. This information has relevance far beyond north Florida, and the dissemination of this research must be national and international. Although the grant has terminated, we will also continue our outreach to vegetable growers and landowners. **PUBLICATIONS (not previously reported):** 2010/09 TO 2014/08 Type: Conference Papers and Presentations Status: Published Year Published: 2012 Citation: 1. Bliss, C.M., P.C. Andersen, C. Mackowiak, S.M. Olson, D.L. Wright, R.F. Mizell, J.J. Marois, A. Blount and D.D. Treadwell. 2012. Tillage impact on carbon and nutrient dynamics within a transitioning organic sod-based rotation. Amer. Soc. Agron. Ann. Meeting Cincinnati, OH 21 - 24 Oct. 2012. Conf. title: Visions for a Sustainable Planet Session No. 142. Agricultural Management Practices on Soil Carbon and Nitrogen Pools and Soil Quality Dynamics: II. Abstr. No. 142-18 2. Bliss, C.M., P.C. Andersen, C. Mackowiak, S. Olson, D.L. Wright, A. Blount and J.J. Marois and R.F. Mizell III. 2013. Tillage impact on soil quality within an organic, sod-based vegetable rotation. 2013 Intern. Meeting Amer. Soc. Agron., Crop Sci. Soc. Amer., Soil Sci. Soc. Amer. Conf. title: Water, Food, Energy and Innovation for a Sustainable World. Session No. 317, General Organic Management Systems: II. 6 Nov. Tampa FL. Abstr. No. 13

2010/09 TO 2011/08 This project is intended to have the following anticipated outcomes: 1) Conventional and limited resource farmers will gain knowledge and skills to incorporate organic production and marketing as viable alternatives to farm operations; 2) Development of an effective outreach and education model for introducing organic production and marketing to limited-resource audiences; 3) Use of Farmers\' markets by all targeted sectors will increase; 4) Acreages of organic production will increase; 5) Local availability of organic produce will increase; 6) New markets for limited resource farmers will be developed; 7) New organizations of organic growers of all types will be implemented, and; 8) Publicity of the accomplishments and the application of the results will be presented, and extramural funding leveraged by the strategic rotations will increase dramatically. We are currently in the data collection phase. Statistical analyses have been initiated. Publications will be forthcoming in years two, three and four of this project. Once sufficient data are collected, outreach will comprise extension venues of field days, presentation at grower meetings, county agent in service trainings, web site postings, and presentations at professional and grower meetings. **PUBLICATIONS (not previously reported):** 2010/09 TO 2011/08 No publications reported this period

PUBLICATIONS

2011/09/01 TO 2012/08/31 1. Richert, R.M., K. M. Cicconi, M. J. Gamroth, Y.H. Schukken, K. E. Stiglbauer, and P. L. Ruegg. The Role of the Veterinarian on Organic and Conventional Dairy Farms. accepted J Am Vet Med Assoc. 24 May 2012. 2. Stiglbauer, K.E., K. M. Cicconi, R. Richert, Y.H. Schukken, P.L. Ruegg and M. Gamroth. Assessment of herd management on organic and conventional dairy farms in the United States. accepted J Dairy Science 8 Oct 2012.

2010/09/01 TO 2011/08/31 1. Ruegg, P.L., R. Richert, Y. Schukken, M. Gamroth, K. Cicconi, and K. Stiglbauer. 2011. Perceptions of Disease by Organic dairy producers preliminary results of a multistate study. Proc. 16th Annual NC Veterinary Conference. Raleigh Nov 4-6, NC. 2. Ruegg, P.L., R. Richert, Y. Schukken, M. Gamroth, K. Cicconi, and K. Stiglbauer. 2011. Treatment of Disease by Organic dairy producers preliminary results of a multistate study. Proc. 16th Annual NC Veterinary Conference. Raleigh Nov 4-6, NC. 3. Ruegg, P.L., R. Richert, Y. Schukken, M. Gamroth, K. Cicconi, and K. Stiglbauer. 2011. Use of Veterinarians on Organic Dairy Farms preliminary results of a multistate study. Proc. 16th Annual NC Veterinary Conference. Raleigh Nov 4-6, NC. 4. Weix, R. M., P.L. Ruegg, M. J. Gamroth, Y. H. Schukken, K.M\> Cicconi, and K. E. Stiglbauer. 2011. Preliminary analysis of bulk tank milk collected on organic and conventional dairy herds in Wisconsin. Pp 17-18 in Proc. 3rd Intl. Symp. Mast. And Milk Quality. Sept., 22-24, 2011. St. Louis, MO

2009/09/01 TO 2010/08/31 No publications reported this period

2008/09/01 TO 2009/08/31 No publications reported this period **ACCESSION NO:** 0213847 **SUBFILE:** CRIS **PROJ NO:** IOW05168 **AGENCY:** NIFA IOW **PROJ TYPE:** OTHER GRANTS **PROJ STATUS:** TERMINATED **CONTRACT/GRANT/AGREEMENT NO:** 2008-51106-19021 **PROPOSAL NO:** 2008-01284 **START:** 01 JUN 2008 **TERM:** 31 MAY 2013 **FY:** 2009 **GRANT AMT:** \$0 **GRANT YR:** 2014 Total grant award \$855,629. **INVESTIGATOR:** Delate, K. **PERFORMING INSTITUTION:** AGRONOMY IOWA STATE UNIVERSITY 2229 Lincoln Way AMES, IOWA 50011 ***DEVELOPING CARBON-POSITIVE ORGANIC SYSTEMS THROUGH REDUCED TILLAGE AND COVER CROP-INTENSIVE CROP ROTATION SCHEMES***

2011/06/01 TO 2012/05/31 1. Carr, P.M., Mader, P., N.G. Creamer and J.S. Beeby. 2012. Editorial: Overview and comparison of conservation tillage practices and organic farming in Europe and North America. Renewable Agriculture and Food Systems: 27(1): 2-6. 2. Carr, P.M., C. Cambardella, C. Cogger, K. Delate, W.B. Evans, J. Reeve, X. Zhao. 2011. A new multi state research coordinating committee for linking food quality to soil health benefits following adoption of organic management systems, American Society for Horticultural Science Annual Meeting, Sept. 25-28, 2011, Waikoloa, HI, On-line at http://ashs.confex.com/ashs/2011/webprogram/Paper5755.html, ASHS, Alexandria, VA. 3. Delate, K., and D. Cwach. 2011. Evaluation of an organic no till rotation: Oat crop Agronomy Farm Trial, 2010. http://extension.agron.iastate.edu/organicag/researchreports/nk10noti ll.pdf Iowa State University, Ames, IA. 4. Delate, K., and D. Cwach. 2012. Evaluation of an organic no till rotation for corn and soybean Agronomy Farm Trial, 2011. On-line at: http://extension.agron.iastate.edu/organicag/researchreports/nk11noti ll.pdf, Iowa State University Organic Agriculture Webpage, ISU, Ames, IA. 5. Delate, K., C. Cambardella and J. Moyer. 2012. Organic No Till Grain Production in the Midwest. On-line at http://eorganic.info/node/7681, e Organic Website, Corvallis, OR. 6. Weyers, S.L. and C. Cambardella. 2011. Soil quality changes with organic no till production. American Society of Agronomy Annual Meetings, San Antonio, TX, ASA Abstracts: http://a-c s.confex.com/crops/2011am/webprogram/Paper66298.html. 7. Mutch, D. 2011. Cover crops are everywhere in Michigan. On line at http://news.msue.msu.edu/news/article/cover crops are everywhere in m ichigan. Michigan State University, East Lansing, MI. 8. Mutch, D. 2011. Plan for your cover crops after wheat now. On line at http://news.msue.msu.edu Michigan State University, East Lansing, MI. 9. Delate K., D. Cwach and C. Chase. 2012. Organic no tillage system effects on soybean, corn and irrigated tomato production and economic performance in Iowa, USA. Renewable Agriculture and Food Systems: 27(1): Renewable Agriculture and Food Systems: 27(1): 49-59. 10. Carr, P. M., R. L. Anderson, Y.E. Lawley, P. R. Miller and S. F. Zwinger. 2012. Organic zero till in the northern US Great Plains Region: Opportunities and obstacles. Renewable Agriculture and Food Systems: 27(1): 12-20.

2010/06/01 TO 2011/05/31 1. Moyer, J. 2011. Organic No Till Farming. Acres USA, Austin TX. ISBN 978-1-60173-017-6. 204 pp. Mutch, D. 2011. Plan for your cover crops after wheat now On line at Michigan State University, East Lansing, MI. 2. Mutch, D. 2011. Planting into cereal rye. On line at Michigan State University, East Lansing, MI. 3. Delate, K., and D. Cwach. 2010. Organic no till in Iowa: many challenges to overcome. American Society of Agronomy (ASA) Annual Meeting, Long Beach, CA, Oct. 31-Nov. 4, 2010, Annual Meetings Abstracts, ASA, CSSA, and SSSA, Madison, WI. 4. Delate, K., D. Cwach, and C. Chase. 2011. Organic no till system effects on organic soybean, corn and tomato production and economic performance in Iowa. Renewable Agriculture and Food Systems, Cambridge, UK. 5. Delate, K., and C. Chase. 2011. Horticultural and economic performance of an organic no till tomato system. American Society of Agronomy (ASA) Annual Meeting, San Antonio, TX, Oct. 16-19, 2011, Annual Meetings Abstracts, ASHS, Alexandria, VA. 6. Gratham, A. and R. Seidel. 2010. Tillage and Toxins. On-line at Rodale Institute, Kutztown, PA. 7. Kimble Evans, A. 2010. In the Field Learning. On-line at Rodale Institute, Kutztown, PA. 8. Kimble Evans, A. 2010. Jeff Moyer: Championing Organic No Till. On line at Rodale Institute, Kutztown, PA. 9. Mutch, D. 2011. Using red clover as a cover crop in wheat. On-line at Michigan State University, East Lansing, MI. 10. Mutch, D. 2011. Plan early to purchase seed for your cover crops. On line at Michigan State University, East Lansing, MI. 11. Singerman, A., K. Delate, C. Chase, C. Greene, M. Livingston, S. Lence and C. Hart. 2011. Profitability of organic and conventional soybean production under green payments in carbon offset programs. Renewable Agriculture and Food Systems: Accepted: August 18, 2011. 12. Ziegler, C. and R. Seidel. 2010. Applied No Till for Carbon Positive Farming. On line at Rodale Institute, Kutztown, PA. 13. Carr, P.M. R. Anderson, Y. Lawley, P. Miller, and S.F. Zwinger. 2010. Organic Zero-till in the Dryland U.S. Plains Region: Opportunities and Obstacles. 2010 Annual Meetings Abstracts, CD-ROM computer disk. ASA, CSSA, and SSSA, Madison, WI. 14. Carr, P.M, Y. Lawley, R.S. Little, D. Lyon, P. Miller. and S.F. Zwinger. 2010. Organic Grain Production in the U.S. Great Plains: Challenges and Opportunities. 2010 Annual Meetings Abstracts, CD ROM computer disk. ASA, CSSA, and SSSA, Madison, WI. 15. Carr, P.M., T. Winch, and G.B. Martin. 2011. Suppressing Weeds with Rolled Crimped Cover Crops in the Northern Great Plains. American Society of Agronomy (ASA) Annual Meeting, San Antonio, TX, Oct. 16-19, 2011, Annual Meetings Abstracts, ASA, CSSA, and SSSA, Madison, WI. 16. Carr, P.M., R.L. Anderson, Y.F. Lawley, P.R. Miller, and S.F. Zwinger. 2011. Organic zero till in the northern U.S. Great Plains region: Opportunities and obstacles. Renewable Agriculture and Food Systems, Cambridge, UK. 17. Carr, P.M., P. Mader, and N.G. Creamer. 2011. Editorial: Commonalities and differences in conservation tillage practices in organic farming between Europe and North America. Renewable Agriculture and Food Systems, Cambridge, UK. 18. Carr, P.M., K. Delate, X. Zhao, C.A. Cambardella, J.R. Heckman, and P.L. Carr. 2011. Organic farming: Impacts on soil, food, and human health. In: E. Brevik and L. Burgess (ed.). Soils in Human Health, Taylor and Francis, Inc., Florence, KY. 19. Carr, P.M., C. Cambardella, C. Cogger, K. Delate, W.B. Evans, J. Reeve, X. Zhao. 2011. A new multi state research coordinating committee for linking food quality to soil health benefits following adoption of organic management systems. American Society for Horticultural Science Annual Meeting, Sept. 25 28, 2011, Waikoloa, HI, Annual Meetings Abstracts, ASHS, Alexandria, VA. 20. Cwach, D., K. Delate, C. Cambardella and M. Duffy. 2011. Effects of cover cropping in organic systems including organic no till. American Society of Agronomy (ASA) Annual Meeting, San Antonio, TX, Oct. 16 19, 2011, Annual Meetings Abstracts, ASA, CSSA,and SSSA, Madison, WI. 21. Delate, K. 2010. Organic grain production in the Midwest. American Society of Agronomy (ASA) Annual Meeting, Long Beach, CA, Oct. 31 Nov. 4, 2010, Annual Meetings Abstracts, ASA, CSSA, and SSSA, Madison, WI. 22. Delate, K., and D. Cwach. 2010. Evaluation of an organic no till rotation: Oat crop: Agronomy Farm Trial, 2010. Iowa State University Organic Agriculture Webpage, ISU, Ames, IA.

2009/06/01 TO 2010/05/31 1. Delate, K., and D. Cwach. 2010. Conventional Till and No-Till Organic Corn and Soybean Production, Agronomy Farm, 2009. Iowa State University Organic Agriculture Webpage, ISU, Ames, IA. 2. Delate, K. An Organic No-Till System for Tomatoes in Iowa. 2009. Iowa Fruit and Vegetable Growers Association Newsletter, Ames, Iowa, Summer 2009. 3. Delate, K. and C. Cambardella. 2009. No-Till Organic Production. No-Till Organic Wiki. E-Organics/e-Xtension Website, Oregon State University, Corvallis, OR.

2008/06/01 TO 2009/05/31 1. Blume, C.J., Fie, S., Christians, N.E., and Stier, J.C. 2008. Field evaluation of reduced-growth, Roundup ready Kentucky bluegrass in competitive stands of turf. Proc. Of the Sec. Inter. Conf. on Turfgrass Sci. and mgt. for Sports Fields. Acta Horticulturae 783:357-370. 2. Chase, C., Delate, K., Liebman, M., and Leibold, K. 2008. Economic analysis of three Iowa rotations. PMR 1001. Iowa State Univ., Ames, IA. 3. Christians, N.E., Liu, D., and Unruh, J.B. 2008. A review of plant protein hydrolysates for weed control. Proceedings of the 1st European Turfgrass Soc. Conf. Pisa Italy p. 69-70. 4. Delate, K., McKern, A., Burcham, B., and Kennicker, J. 2008. Evaluation of varieties, fertility treatments and red clover underseeding in certified organic flax production-Neely-Kinyon Farm-2007, Organic Agriculture Website. Iowa State Univ., Ames, IA. http://extension.agron.iastate.edu/organicag/researchreports/nk07flax .pdf. 5. Delate, K., McKern, A., Rosmann, D., and Burcham, B. 2008. Evaluation of an organic no-till system for organic corn, soybean and tomato production-Neely-Kinyon Farm-2007. Organic Agriculture Website. Iowa State Univ., Ames, IA. http://extension.agron.iastate.edu/organicag/researchreports/nk07noti ll.pdf. 6. Delate, K., McKern, A., Rosmann, D., and VanDee, K. 2008. Evaluation of organic soybean varieties-Southeast Research Farm, 2007. Southeast Research Farm Annual Report, ISU, Ames, IA. http://extension.agron.iastate.edu/organicag/researchreports/crawf07 soybvariety.pdf. 7. Delate, K., Burcham, B., and McKern, A. 2008. Evaluation of soybean rust treatments for organic soybeans-Neely-Kinyon trial, 2007. Iowa State Univ., Ames, IA. http://extension.agron.iastate.edu/organicag/researchreports/nk07soyb rust.pdf. 8. Delate, K., Chase, C., and Kenniker, J. 2008. Organic flax production. PM 2058. Extension Communications, Iowa State Univ., Ames, IA. 9. Delate, K., Cambardella, C., Burcham, B., and McKern, A. 2008. Comparison of organic and conventional crops at the Neely-Kinyon long-term agroecological research site, 2007. Annual Research Reports-2007 Armstrong Research and Demonstration Farm, Iowa State Univ., Ames, IA. http://extension.agron.iastate.edu/organicag/researchreports/nk07ltar .pdf. 10. Domoto, P., Nonnecke, G., Portz, D., Havlovic, B. and Howell, N. 2008. Grape cultivar by management system trial performance in 2007. Ann. Prog. Rept.-2007 for Hort. Res. Sta., ISRF07-36:35-38; and Armstrong R&D Farm, ISRF07-12 http://viticulture.hort.iastate.edu/research/pdf/leopoldgrapecultivar 07.pdf. 11. Havlovic, B., Breach, D., Domoto, P., Nonnecke, G. and Naeve, L. 2008. High tunnel bramble production in 2007. Ann. Prog. Rept.-2007 for Armstrong and Neely-Kinyon R&D Farms, ISRF07-12 http://www.ag.iastate.edu/farms/07reports/Armstrong/HighTunnelBramble .pdf. 12. Hammer, K.D.P., Hillwig, M.L., Solco, A.K.S., Dixon, P.M., Delate, K., Murphy, P.A., Wurtele, E.S., and Birt, D.F. 2007. Inhibition of prostagalndin E2 production by anti-inflammatory Hypericum perforatum extracts and constituents in RAW264.7 mouse macrophage cells. J. Agric. Food Chem. 55(18):7323-7331. 13. Howieson, M.J. and Christians, N.E. 2008. Carbohydrate metabolism and efficiency of PSII in mown creeping bentgrass. HortSci. 43(2):525-528. 14. Jones, M.A., Christians, N.E., Weisenberger, D., and Reicher, Z.J. 2008. Selective removal of creeping bentgrass from Kentucky bluegrass with sulfosulfuron. HortSci. 43:589-968. 15. Joo, Y.K., Jung, Y.S., and Christians, N.E. 2008. Turfgrass revegetation on amended sea sand dredged from the yellow sea. Comm. In Soil Sci. and Plant Anal. 39:11, 1571-1582. 16. Li, D., Minner, D.D., and Christians, N.E. 2008. Managing isolated dry spot by topdressing inorganic amendments on sloped golf green. Proc. Of the Sec. Inter. Conf. on Turfgrass Sci. and mgt. for Sports Fields. Acta Horticulturae 783:341-348. **ACCESSION NO:** 0220197 **SUBFILE:** CRIS **PROJ NO:** OHO01057-SS **AGENCY:** NIFA OHO **PROJ TYPE:** OTHER GRANTS **PROJ STATUS:** TERMINATED **CONTRACT/GRANT/AGREEMENT NO:** 2009-51106-06051 **PROPOSAL NO:** 2009-05497 **START:** 01 SEP 2009 **TERM:** 31 AUG 2013 **GRANT AMT:** \$659,527 **GRANT YR:** 2009 **AWARD TOTAL:** \$659,527 **INVESTIGATOR:** Loerch, S. C.; Moore, R.; Taylor, R.; Stinner, D.; McCutcheon, J.; Bonta, J.; Owens, L. **PERFORMING INSTITUTION:** Animal Sciences OHIO STATE UNIVERSITY 1680 MADISON AVENUE WOOSTER, OHIO 44691 ***IMPACTS OF ORGANIC ANIMAL PRODUCTION SYSTEMS ON WATER QUALITY AND QUANTITY IN OHIO - AN INTEGRATED RESEARCH, EXTENSION AND EDUCATION PROGRAM***

2011/09/01 TO 2012/08/31 No publications reported this period

2010/09/01 TO 2011/08/31 No publications reported this period

2009/09/01 TO 2010/08/31 No publications reported this period **ACCESSION NO:** 0220275 **SUBFILE:** CRIS **PROJ NO:** IOW05242 **AGENCY:** NIFA IOW **PROJ TYPE:** OTHER GRANTS **PROJ STATUS:** TERMINATED **CONTRACT/GRANT/AGREEMENT NO:** 2009-51106-06072 **PROPOSAL NO:** 2009-05499 **START:** 01 SEP 2009 **TERM:** 31 AUG 2014 **GRANT AMT:** \$0 **GRANT YR:** 2013 **AWARD TOTAL:** \$599,027 **INVESTIGATOR:** Delate, K.; Cambardella, C.; Jaynes, D.; Sauer, T.; Malone, R.; Chase, C. **PERFORMING INSTITUTION:** Horticulture IOWA STATE UNIVERSITY 2229 Lincoln Way AMES, IOWA 50011 ***ENHANCING FARMLAND WATER QUALITY AND AVAILABILITY THROUGH SOIL-BUILDING CROP ROTATIONS AND ORGANIC PRACTICES***

2012/09/01 TO 2013/08/31 1. Type: Conference Papers and Presentations Status: Published Year Published: 2013 Citation: Cambardella, C., K. Delate, and C. Chase. 2013. The Long-Term Agroecological Research (LTAR) Experiment in Iowa: Organic Resilience in Soil Quality and Profitability. American Society of Agronomy International Annual Meetings, ASA, Madison, WI. scisoc.confex.com/scisoc/2013am/webprogram/Paper77668.html 2. Type: Journal Articles Status: Published Year Published: 2013 Citation: Delate, K., C. Cambardella, C. Chase, A. Johanns, and R. Turnbull. 2013. The Long-Term Agroecological Research (LTAR) experiment supports organic yields, soil quality, and economic performance in Iowa. Crop Management doi: 10.1094/CM-2013-0429-02-RS.

2011/09/01 TO 2012/08/31 1. Delate, K., and C. Cambardella. 2012. Organic no till production in Iowa: Effects on crop productivity and soil quality. American Society of Agronomy Annual Meetings, October 23, 2012: http://scisoc.confex.com/scisoc/2012am/webprogram/Paper75770.html. 2. Delate, K., C. Cambardella and X. Zhao. 2012. Effect of cover crops, soil amendments and reduced tillage on carbon sequestration and soil health in a long term organic vegetable system, p. 22-26. In S. Smith, M. Peet and M. O Reilly (eds.). Proceedings of Organic Programs Project Directors Meeting, October 2012. USDA NIFA, Washington, D.C. 3. Marose, B.H., M. Cavigelli, K. Delate, E. Mallory, C. Shapiro, L. Kolb, C. Reberg-Horton, J. Maul and S. Mirsky. Growing the e-Organic grains Community of Practice. American Society of Agronomy Annual Meetings, October 22, 2012: http://scisoc.confex.com/scisoc/2012am/webprogram/Paper73223.html.

2010/09/01 TO 2011/08/31 Delate, K. 2011. The use of natural nitrate in organic corn production, 2010. Organic Agriculture Webpage. Iowa State University, Ames, IA. http://extension.agron.iastate.edu/organicag/researchreports/naturaln itrate.pdf

2009/09/01 TO 2010/08/31 Delate, K. 2010. The use of natural nitrate in organic corn production. Organic Agriculture Webpage, Iowa State University, Ames, IA. http://extension.agron.iastate.edu/organicag/researchreports/naturaln itrate.pdf **ACCESSION NO:** 0220146 **SUBFILE:** CRIS **PROJ NO:** NC09794 **AGENCY:** NIFA NC. **PROJ TYPE:** OTHER GRANTS **PROJ STATUS:** EXTENDED **CONTRACT/GRANT/AGREEMENT NO:** 2009-51106-20269 **PROPOSAL NO:** 2009-05488 **START:** 01 SEP 2009 **TERM:** 31 AUG 2014 **GRANT AMT:** \$0 **GRANT YR:** 2014 **AWARD TOTAL:** \$658,769 **INVESTIGATOR:** Osmond, D. L.; Grossman, J. M.; Jennings, G.; Hoyt, G. D.; Reyes, M.; Line, D. **PERFORMING INSTITUTION:** Soil Science NORTH CAROLINA STATE UNIV RALEIGH, NORTH CAROLINA 27695 ***WATER QUALITY EVALUATION OF LONG-TERM ORGANIC AND CONVENTIONAL VEGETABLE PRODUCTION UNDER CONSERVATION AND CONVENTIONAL TILLAGE***

2012/09/01 TO 2013/08/31 1. Type: Journal Articles Status: Under Review Year Published: 2013 Citation: Edgell, J., D.L. Osmond, D. Line, G. Hoyt, and J. Grossman. Comparison of Organic and Conventional Agriculture Production in Till and No-till Systems: Water Quality and Cropping System Efficiency. J. Environ. Qual. 2. Type: Journal Articles Status: Under Review Year Published: 2014 Citation: Edgell, J., D.L. Osmond, D. Line, G. Hoyt, and J. Grossman. Surface Runoff and Nutrient Concentrations from Organic and Conventional Cropping Systems under Conventional and Conservation No-Till Management. J. Environ. Qual 3. Type: Theses/Dissertations Status: Published Year Published: 2013 Citation: Edgell, Joshua. Comparison of Organic and Conventional Agriculture in Till and No-till Systems: Effects on Water Quality and Yield (Master?s Thesis). 4. Type: Journal Articles Status: Accepted Year Published: 2014 Citation: Larsen, E.M., J. Grossman, G. Hoyt, D. Osmond, J. Edgell, and S. Hu. 2014. Evaluating Soil Carbon Pools and Losses in Long-term Organic and Conventional Farming Systems. Soil Tillage Res. 5. Type: Conference Papers and Presentations Status: Other Year Published: 2013 Citation: Quoc Dat, T, L.A Kurkalova, M.R. Reyes, D. Line, G. Hoyt, D. Osmond, Ngoc Kieu, L., and J. Edgell. 2013. Cost-Effectiveness Analysis of Agricultural Pollution Reduction at the Farm Scale Using APEX. ASABE Annual Meeting. 6. Type: Conference Papers and Presentations Status: Other Year Published: 2013 Citation: Edgell, J., D. Osmond, D. Line, G. Jennings, J. Grossman, and E. Larsen. 2013. Comparison of Organic and Conventional Agricultural Production in till and No-till Systems: Effects On Water Quality and Yield. NC Commodity Annual Meeting, Research Triangle Park, NC. 7. Type: Conference Papers and Presentations Status: Awaiting Publication Year Published: 2013 Citation: Edgell, J., D. Osmond, D. Line, G. Jennings, J. Grossman, and E. Larsen. 2013. Comparison of Organic and Conventional Agricultural Production in till and No-till Systems: Effects On Water Quality and Yield. NC Soil Science Annual Meeting. Raleigh, NC. 8. Type: Conference Papers and Presentations Status: Published Year Published: 2013 Citation: Osmond, D., J. Edgell, D. Line, G. Hoyt, E. Larsen, and J. Grossman. 2013. Conventional vs Organic Agriculture with Conventional and Conservation Tillage: Water Quality. Annual Soil and Water Conservation Society Conference, Reno, NV 9. Type: Conference

Papers and Presentations Status: Published Year Published: 2013 Citation: Osmond, D., E. Larsen, J. Edgell, J. Grossman, D. Line, G. Hoyt, and G. Jennings. 2012. Update on Water Quality Evaluation of Long-Term Organic and Conventional Vegetable Production under Conservation and Conventional Tillage USDA-NIFA Grant. USDA-NIFA Project Director Meeting, Washington, DC

2011/09/01 TO 2012/08/31 No publications reported this period

2010/09/01 TO 2011/08/31 No publications reported this period

2009/09/01 TO 2010/08/31 No publications reported this period **ACCESSION NO:** 0223695 **SUBFILE:** CRIS **PROJ NO:** WYO-00617 **AGENCY:** NIFA WYO **PROJ TYPE:** OTHER GRANTS **PROJ STATUS:** TERMINATED **CONTRACT/GRANT/AGREEMENT NO:** 2010-51106-21805 **PROPOSAL NO:** 2010-03952 **START:** 01 SEP 2010 **TERM:** 31 AUG 2014 **GRANT AMT:** \$0 **GRANT YR:** 2013 **AWARD TOTAL:** \$700,000 **INVESTIGATOR:** Norton, U.; Norton, J. B.; Garcia y Garcia, A.; Ritten, J. P.; DelGrosso, S. J.; Hergert, G. W. **PERFORMING INSTITUTION:** Plant Sciences UNIVERSITY OF WYOMING 1000 E UNIVERSITY AVE DEPARTMENT 3434 LARAMIE, WYOMING 82071-2000 ***SOIL CARBON AND NITROGEN DYNAMICS IN ORGANIC CROP AND FORAGE PRODUCTION OF THE NORTHERN HIGH PLAINS ECOREGION, WYOMING AND NEBRASKA***

2012/09/01 TO 2013/08/31 1. Type: Other Status: Published Year Published: 2013 Citation: Peterson, B., U. Norton, J. Krall, and A. Islam. 2013. Summer Rainfall Effects on Greenhouse Gas Emissions from Dryland and Irrigated Alfalfa/Grass Hay Production. Wyoming Agricultural Experiment Station Field Days Bulletin 2. Type: Journal Articles Status: Published Year Published: 2012 Citation: Ghimire, R., J.B. Norton, U. Norton, J.P. Ritten, P.D. Stahl, and J.M. Krall. 2012. Long- term farming systems research in the Northern High Plains. Renewable Agriculture and Food Systems. November 2012: 1-11, doi: 101017/S1742170512000208 3. Type: Journal Articles Status: Accepted Year Published: 2013 Citation: Hurisso, T., J. B. Norton, and U. Norton. 2013. Soil profile carbon and nitrogen in prairie, perennial grass-legume cover and wheat-fallow production in the Central High Plains, USA. Agriculture, Ecosystem and Environment. Accepted. 4. Type: Journal Articles Status: Accepted Year Published: 2013 Citation: Ghimire, R., J.B. Norton, T. Hurisso and U. Norton. 2012. Dryland tillage and cropping system effects on soil profile carbon and nitrogen in the central High Plains, USA. Soil and Tillage Research. Accepted. 5. Type: Conference Papers and Presentations Status: Published Year Published: 2013 Citation: Bista, P, U. Norton and R. Ghimire. 2012. Greenhouse Gas Emissions and Soil Nitrogen Following the First Tillage Event in the Fallow Phase of Long-Term No-Till Winter Wheat. Abstracts ASA-CSSA-SSSA annual meetings in Cincinnati, OH. 6. Type: Conference Papers and Presentations Status: Published Year Published: 2012 Citation: Kaur, G., T. Persson, T. Kelleners, U. Norton and A. Garcia y Garcia. 2012. Water Use Productivity of Dryland Winter Wheat in the High Plains Ecoregion of Wyoming. ASA-CSSA-SSSA annual meetings in Cincinnati, OH. 7. Type: Other Status: Published Year Published: 2013 Citation: Meeks, J., and J. Norton. 2013. The longer the data harvest, the more valuable the crop. Reflections, College of Agriculture and Natural Resources Research Report. Pp 43-46. 8. Type: Other Status: Published Year Published: 2013 Citation: Norton, J. Norton, U., R. Ghimire, et al., 2013. Sustainable Agriculture Systems Project: results from four years after conversion from continuous irrigated corn to cash-crop and forage rotations under typical, reduced tillage and organic management. Wyoming Agricultural Experiment Station Field Days Bulletin 9. Type: Other Status: Published Year Published: 2013 Citation: Kaur, G., U. Norton, and A. Garcia y Garcia. 2013. Effects of Cropping System on Water Use Efficiency and Water Productivity of Dryland Winter Wheat. Wyoming Agricultural Experiment Station Field Days Bulletin 10. Type: Other Status: Published Year Published: 2013 Citation: Ghimire, R., U. Norton, J. Norton and P. Bista. Greenhouse Gas Emissions from Alternative Management Approaches of Irrigated Crop and Forage Production system. Wyoming Agricultural Experiment Station Field Days Bulletin 11. Type: Other Status: Published Year Published: 2013 Citation: Bista, P., U. Norton, R. Ghimire, J. Norton, and J. Meeks. 2013. Effect of Summer Tillage on greenhouse Gas Emissions from Organic, Conventional, and No-Till Fallows in Dryland Winter Wheat Production. Wyoming Agricultural Experiment Station Field Days Bulletin

2011/09/01 TO 2012/08/31 1. Ghimire, R., J.B. Norton, U. Norton, J.P. Ritten, P.D. Stahl, and J.M. Krall. 2012. Long-term farming systems research in the central High Plains. Renewable Agriculture and Food Systems. Published Abstracts of Conference presentations. 2. Bista, P, U. Norton and R. Ghimire, and J. Norton. 2011 Greenhouse Gas Emission and Crop Productivity From the Contrasting Management Approaches, In Dryland Winter Wheat-Fallow of the Northern High Plains. ASA-CSSA-SSSA annual meetings in San Antonio, TX. 3. Peterson, B., U. Norton, and J. Krall. 2011. Soil and Nitrogen Budgets and Greenhouse Gas Emissions from

Irrigated and Dryland Alfalfa Hay in the Northern high Plains. ASA-CSSA-SSSA annual meetings in San Antonio, TX. 4. Peterson, B., U. Norton, and J. Krall. 2012. Summer Water Pulse Effects on Soil C and N and GHG Fluxes from Irrigated and Dryland Alfalfa/Grass Hay Production in Eastern Wyoming. ESA annual meetings in Portland, OR. 5. Kaur, G., and A. Garcia y Garcia. 2012. Enhancing Water-Holding Capacity of Soils with Organic and No-till Production Practices. 6. Ghimire, R., U. Norton, and J. Norton. 2012. GHG Emissions during Transition to Integrated Crop Livestock Production Systems in Eastern Wyoming. Western region ASA-CSSA-SSSA annual meetings in Davis, CA. 7. Bista, P, U. Norton and R. Ghimire. 2012. Greenhouse Gas Emissions and Soil Nitrogen Following the First Tillage Event in the Fallow Phase of The Long-Term No-Till Winter Wheat. ASA-CSSA-SSSA annual meetings in Cincinnati, OH. 8. Kaur, G., T. Persson, T. Kelleners, U. Norton and A. Garcia y Garcia. 2012. Water Use Productivity of Dryland Winter Wheat in the High Plains Ecoregion of Wyoming. ASA-CSSA-SSSA annual meetings in Cincinnati, OH. 9. Published Abstracts of Field Days presentations: Norton, J.B., R. Ghimire, U. Norton, J. Meeks, S. Paisley. 2012. The Sustainable Agriculture systems Project. Sustainable Agriculture Research and Education Center (SAREC) Field Days, August 2012, Lingle, WY. 10. Peterson, B., U. Norton, and J. Krall. 2012. Symbiotic and Non-Symbiotic Biological N2 Fixation in Dryland and Irrigated Alfalfa/Grass Hay Production. Sustainable Agriculture Research and Education Center (SAREC) Field Days, August 2012, Lingle, WY. 11. Lay media: Meeks, J., J. Norton, R. Gebauer-King, R. Ghimire, U. Norton, P. Bista, J. Ritten, D. Peck. 2012. Long-term project begins yielding results. University of Wyoming College of Agriculture and Natural Resources Reflections magazine.

2010/09/01 TO 2011/08/31 1. Bista, P. and U. Norton. 2011. Greenhouse Gas Emissions and Crop Productivity from the Contrasting Management Approaches In Dry Land Wheat Farming System of the Northern High Plains. Western CSSA-ASA-CSSA meetings, June, 2011 Laramie, WY (http://a-c-s.confex.com/crops/ws2011/webprogram/Paper69113.html) 2. Bista, P., U. Norton, R. Ghmire, and J. Norton. 2011. Greenhouse Gas Emissions from Dryland Winter Wheat Fallow System under Conventional, No-Till, Organic and Transition to Organic Management. University of Wyoming College of Agriculture and Natural resources Agricultural Experiment Station 2011 Field Days Bulletin; 3. Ghmire, R., P. Bista, U. Norton and J. Norton. 2011. Trace gas emission from conventional, reduced-input, and organic approaches of crop-range-livestock farming in Wyoming. Field Days Bulletin. University of Wyoming College of Agriculture and Natural resources Agricultural Experiment Station 2011; 4. Ghmire, R., J. Norton, U. Norton and N. Ward. 2011. More than one way to raise a crop. Reflections 2011. University of Wyoming College of Agriculture and Natural Resources. **ACCESSION NO:** 0223831 **SUBFILE:** CRIS **PROJ NO:** NHW-2010-03957 **AGENCY:** NIFA NH.W **PROJ TYPE:** OTHER GRANTS **PROJ STATUS:** EXTENDED **CONTRACT/GRANT/AGREEMENT NO:** 2010-51106-21834 **PROPOSAL NO:** 2010-03957 **START:** 01 SEP 2010 **TERM:** 31 AUG 2014 **GRANT AMT:** \$0 **GRANT YR:** 2013 **AWARD TOTAL:** \$700,000 **INVESTIGATOR:** Varner, R. K.; Li, C. **PERFORMING INSTITUTION:** UNIVERSITY OF NEW HAMPSHIRE DURHAM, NEW HAMPSHIRE 03824 ***GREENHOUSE GAS EMISSIONS IN THE TRANSITION FROM TRADITIONAL TO ORGANIC DAIRY FARMING: AN EDUCATION AND RESEARCH COLLABORATION***

2011/09/01 TO 2012/08/31 No publications reported this period

2010/09/01 TO 2011/08/31 No publications reported this period **ACCESSION NO:** 0223710 **SUBFILE:** CRIS **PROJ NO:** TEXN-0049 **AGENCY:** NIFA TEXN **PROJ TYPE:** OTHER GRANTS **PROJ STATUS:** EXTENDED **CONTRACT/GRANT/AGREEMENT NO:** 2010-51106-21803 **PROPOSAL NO:** 2010-03990 **START:** 01 SEP 2010 **TERM:** 31 DEC 2014 **GRANT AMT:** \$0 **GRANT YR:** 2014 **AWARD TOTAL:** \$697,012 **INVESTIGATOR:** Villanueva, R. T.; Ribera, L. A.; Storz, B. A.; Villalon, D. K. **PERFORMING INSTITUTION:** Weslaco - TAMU Agr Res & Ext Center TEXAS COOPERATIVE EXTENSION COLLEGE STATION, TEXAS 77843 ***INTEGRATING COMMUNITY COLLEGE STUDENTS & ORGANIC FARMERS THROUGHOUT FEASIBILITY STUDIES IN PEST MGMT, & HORTICULTURE PRODUCTION IN SO. TX.***

2010/09/01 TO 2011/08/31 No publications reported this period **ACCESSION NO:** 0223698 **SUBFILE:** CRIS **PROJ NO:** IOW05278 **AGENCY:** NIFA IOW **PROJ TYPE:** OTHER GRANTS **PROJ STATUS:** EXTENDED **CONTRACT/GRANT/AGREEMENT NO:** 2010-51106-21857 **PROPOSAL NO:** 2010-03956 **START:** 01 SEP 2010 **TERM:** 31 AUG 2015 **GRANT AMT:** \$0 **GRANT YR:** 2014 **AWARD TOTAL:** \$691,969 **INVESTIGATOR:** Delate, K.; Cambardella, C.; Chase, C. **PERFORMING INSTITUTION:** Horticulture IOWA STATE UNIVERSITY 2229 Lincoln Way AMES, IOWA 50011 ***EFFECT OF

COVER CROPS, SOIL AMENDMENTS AND REDUCED TILLAGE ON CARBON SEQUESTRATION AND SOIL HEALTH IN A LONG-TERM ORGANIC VEGETABLE SYSTEM***

2012/09/01 TO 2013/08/31 1. Type: Conference Papers and Presentations Status: Published Year Published: 2013 Citation: Delate, K., and C. Cambardella. 2013. Compost, cover crops, and mulch effects in organic vegetable systems. American Society for Horticultural Science Annual Conference, Palm Desert, CA, ASHS, Alexandria, VA. 2. Type: Conference Papers and Presentations Status: Published Year Published: 2013 Citation: Huang, Y., X. Zhao, C.A. Chase, and J.M. Neumann. 2013. Effects of cover crops and reduced tillage on yield and weed population in organic lettuce production. Southern Region ASHS Meeting, Orlando, FL. 3. Type: Conference Papers and Presentations Status: Published Year Published: 2013 Citation: Zhao, X., K. Delate, and C. Cambardella. 2013. Vegetable yield and soil quality as affected by organic cropping systems. American Society for Horticultural Science Annual Conference, Palm Desert, CA, ASHS, Alexandria, VA.

2011/09/01 TO 2012/08/31 1. Delate, K., and C. Cambardella. 2012. Organic no till production in Iowa: Effects on crop productivity and soil quality. American Society of Agronomy Annual Meetings, October 23, 2012: http://scisoc.confex.com/scisoc/2012am/webprogram/Paper75770.html. 2. Delate, K., C. Cambardella and X. Zhao. 2012. Effect of cover crops, soil amendments and reduced tillage on carbon sequestration and soil health in a long term organic vegetable system. p. 22-26. In S. Smith, M. Peet and M. O Reilly (eds.). Proceedings of Organic Programs Project Directors Meeting, October 2012. USDA NIFA, Washington, D.C. 3. Delate, K., C. Cambardella, C. Shennan, C. Cogger, E. Silva, and X. Zhao. 2012. Organic vegetable research: Twenty years of progress across the U.S. American Society for Horticultural Science Annual Conference, Miami, FL, ASHS, Alexandria, VA. 4. Huang, Y., X. Zhao, C.A. Chase, and C.R. Hamilton. 2012. Influence of management practices on lettuce yield and weed population in organic production. American Society for Horticultural Science Annual Conference, Miami, FL, ASHS, Alexandria, VA. 5. Marose, B.H., M. Cavigelli, K. Delate, E. Mallory, C. Shapiro, L. Kolb, C. Reberg Horton, J. Maul and S. Mirsky. Growing the eOrganic grains Community of Practice. American Society of Agronomy Annual Meetings, October 22, 2012: http://scisoc.confex.com/scisoc/2012am/webprogram/Paper73223.html.

2010/09/01 TO 2011/08/31 Delate, K. and C. Chase. 2011. Horticultural and economic performance of organic no till tomatoes in Iowa. HortScience 46. American Society for Horticultural Science Annual Conference, Waikoloa, HI, ASHS, Alexandria, VA. **ACCESSION NO:** 0223693 **SUBFILE:** CRIS **PROJ NO:** FLA-NFC-005068 **AGENCY:** NIFA FLA **PROJ TYPE:** OTHER GRANTS **PROJ STATUS:** EXTENDED **CONTRACT/GRANT/AGREEMENT NO:** 2010-51106-21866 **PROPOSAL NO:** 2010-03958 **START:** 01 SEP 2010 **TERM:** 31 AUG 2014 **GRANT AMT:** \$0 **GRANT YR:** 2014 **AWARD TOTAL:** \$624,148 **INVESTIGATOR:** Andersen, P. C.; Wright, D. L.; Mizell III, R. F.; Marois, J. J.; Olson, S. M.; Treadwell, D. D.; Blount, A. R.; Funderburk, J. E.; Rich, J. R.; Richardson, V. H.; Mackowiak, C.; Boyhan, G. **PERFORMING INSTITUTION:** North Florida Research and Education Center, Quincy UNIVERSITY OF FLORIDA G022 MCCARTY HALL GAINESVILLE, FLORIDA 32611 ***ENVIRONMENTAL AND ECONOMIC COSTS OF TRANSITIONING TO ORGANIC PRODUCTION VIA A SOD-BASED ROTATION AND STRIP-TILLING IN THE SOUTHERN COASTAL P***

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