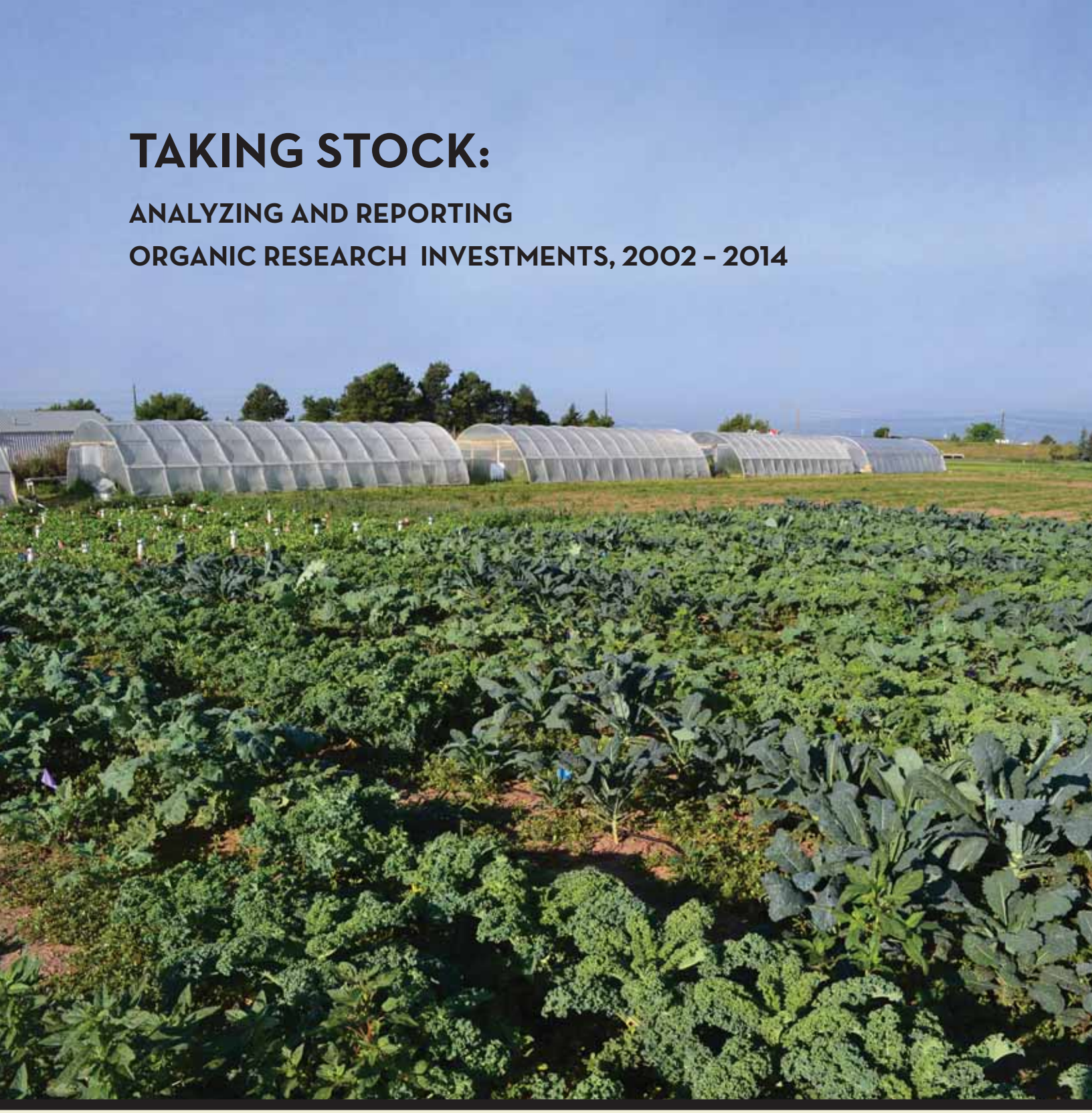
TAKING STOCK:

ANALYZING AND REPORTING ORGANIC RESEARCH INVESTMENTS, 2002 – 2014



ORGANIC FARMING RESEARCH FOUNDATION

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OREI PROJECT 2014-05348
ORGANIC FARMING RESEARCH FOUNDATION FINAL REPORT

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ORGANIC FARMING RESEARCH FOUNDATION

Santa Cruz, CA

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EXECUTIVE SUMMARY

The Organic Farming Research Foundation (OFRF) analyzed 189 organic agriculture research, education, and extension projects funded by the USDA Organic Research and Extension Initiative (OREI) and Organic Transitions (ORG) competitive research grant programs from 2002-2014. This assessment provides information on the progress these programs have made in addressing critical research needs as well as recommendations for enhancing program efficacy. To evaluate the projects, we reviewed the project abstracts in the USDA Current Research Information System (CRIS) database, further explored 47 selected projects by visiting project websites and other sources, and conducted interviews with principal investigators (PIs) and farmer participants.

Key Research Questions

Have OREI and ORG addressed organic producers' research needs?

Were producers and other stakeholders effectively engaged as partners in funded research projects?

Did the projects yield practical outcomes for organic farmers, ranchers, and processors?

Were project outcomes effectively delivered to farmers, researchers, farm advisors, other end users, universities, producers' organizations, and other entities?

Results

With a total investment of $142.2M during 2002-2014, the OREI and ORG programs have developed a substantial body of research-based information on a range of organic farming topics. Many projects delivered valuable information and tools to organic producers, while others laid groundwork for future outcomes, including research data, new methods, and advanced plant breeding lines. OREI and ORG represent a long-term investment that needs to be sustained with increased funding, as well as refinement of program administration and delivery.

Funding by region and entity

Of the four USDA regions, the North Central region received the most OREI and ORG funding (35%), followed by the Northeast (26%) and Western (25%), and the Southern region the least (14%). Primary funded entities consisted mostly of 1862 Land Grant Universities (90% of funding), with USDA Agricultural Research Service (ARS) receiving 8%, and other entities 2%. However, many projects included 1890 Land Grants, other universities and colleges, nongovernmental organizations, and other entities as partners.

Funding by amount

During 2002-2008, most OREI and ORG awards ranged from $250K to $750K. From 2009-2014, OREI funded larger projects, with awards over $1M representing 81% of funding. During those years, OREI also offered small grants (up to $50K) for conferences and project planning.

Funding by commodity

About three-quarters of OREI and ORG funding supported research on organic crop production, with the remainder going to livestock, crop-livestock systems, and general topics (Figure 1). Crop studies addressed a wide range of agronomic and specialty crops, while livestock studies emphasized dairy, which accounts for 20% of US organic sales. Rice, cotton, tree nuts, cut flowers, herbs, beef, and pork were underrepresented relative to their importance in US agriculture and commerce.

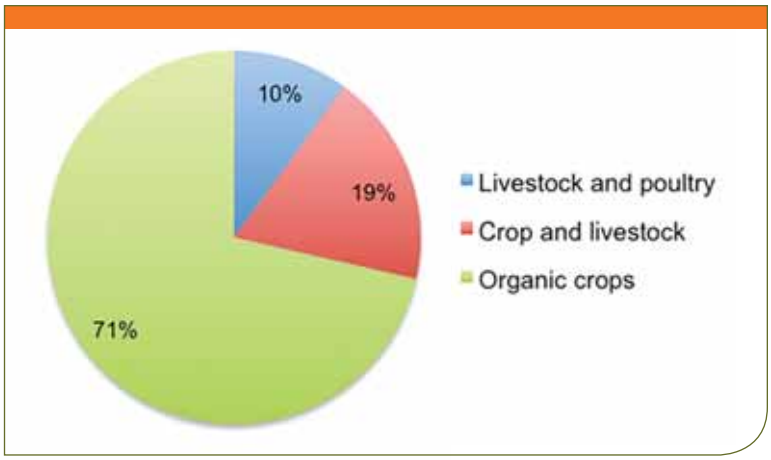

FIGURE 1. OREI and ORG funding by commodity type.

Funding of high priorities

Most OREI and ORG projects reflected organic research priorities identified in the OFRF National Organic Research Agenda (NORA) (Sooby, 2007). Over half (123) addressed soil health, soil biology, or nutrient management; and 129 projects included systemic approaches to crop pest, disease, and weed management. Of these, 36 tackled the organic dilemma of how to manage weeds adequately to sustain crop yields while protecting and building soil health.

The NORA priority of plant breeding was addressed by the establishment of several ongoing farmer-participatory breeding networks. Twenty plant breeding projects produced several dozen new publicly held cultivars and developed hundreds of breeding lines with disease resistance, nutrient efficiency, and other priority traits for organic systems. Another 32 projects evaluated existing cultivars for organic production systems and markets.

Livestock system projects addressed several NORA priorities, including pasture management, animal nutrition and health, product quality, and crop-livestock integration. However, no projects undertook animal breeding for organic systems.

OREI and ORG requests for applications invited proposals addressing economic, environmental and policy issues, as well as organic production challenges. One hundred seventy-eight projects (94%) addressed one or more requests for applications priorities for their funding year, 91 (48%) included economic analyses, and 82 projects (43%) evaluated environmental impacts of organic systems. During 2009 - 2014, ORG priorities shifted to a specific focus on greenhouse gas (GHG) mitigation and other ecosystem services, while OREI priorities covered production and economics, with increased emphasis on crop and livestock breeding and genetics.

Producer engagement, dissemination, and outreach

Most projects engaged producers in hosting on-farm trials or field days, collecting research data, evaluating outcomes, or serving on an advisory committee. A few projects emphasized experiment station or lab research, and engaged producers mainly as end users of outcomes.

Project outcomes were disseminated to producers, service providers, and other audiences via oral presentations, field days, written materials, web sites, and other venues. Most projects published articles, manuals, videos, or webinars for producers and/or researchers, and about 25% established research or learning networks of producers and agricultural professionals. The eOrganic communities of practice, launched in 2007 with OREI funding, provided a platform through which 60 other OREI and ORG projects delivered outcomes to producers, other stakeholders, and the general public. OREI-funded conferences and symposia offered additional venues for dissemination and exchange of ideas and findings among project teams.

Project outcomes

Many projects produced valuable results, including some with smaller budgets ($30K-300K) and simple experimental methods. Examples include field evaluation of 500 potato clones for organic systems ($140K), grazing hogs in apple orchard for pest control ($33K), an organic weed management manual ($106K), organic flea beetle control tactics ($74K), and an Organic Seed Partnership that released 25 new vegetable cultivars ($894K).

Projects that tackle complex issues such as GHG mitigation or soil biology often require long-term research. Although some of these projects may not have produced farmer-ready outcomes, many provided valuable insights into topics such as soil health, weed management, and crop yield. GHG studies gave inconsistent results related to environmental and management variables.

Farmer/researcher collaboration

In interviews, most PIs reported positive experiences working with farmers. Farmers reported various levels of engagement, from hosting on-farm research to working as an equal partner in the project. Most farmers found relationships with researchers rewarding. Some projects inspired and supported farmers to conduct controlled trials based on their own ideas or practices.

Most of the PIs interviewed felt that OREI and ORG funded projects are as scientifically rigorous as other USDA funded research. Several PIs cited the great importance of practical outcomes from OREI and ORG projects.

Recommendations

Based on the review, OFRF recommends making several improvements in funding for priority areas and project administration. Strengthening the OREI and ORG programs based on the following recommendations will require additional funding for these programs. Increased organic research funding is urgently needed and would ensure the continued growth of the organic sector.

Increase research on underfunded and emerging priority areas.

- *Continue to address current, ongoing, and emerging organic research needs, including priorities identified by the National Organic Standards Board (updated annually), and the Organic Farming Research Foundation (Jerkins and Ory, 2016).*
- *Continue and expand long-term support for public crop cultivar development for organic systems, and farmer-participatory plant breeding and organic seed production networks.*
- *Invite and fund proposals to develop new and improved livestock and poultry breeds for pasture based organic production systems.*
- *Invite and fund proposals for meta-analysis of past OREI and ORG research on complex issues such as soil health, weed management, and GHG mitigation in organic systems.*
- *Invite and fund proposals on commodities under-represented in OREI and ORG during 2002-2014, including beef, pork, turkey, rice, cotton, tree nuts, herbs, and cut flowers.*

Balance funding for smaller proposals with simple goals and on-the-ground methods, with larger, more complex, and multi-institutional projects.

- *Continue to fund conferences, symposia, and planning projects.*
- *Continue to invite and fund proposals from underserved regions (the Southern region) and constituencies (minorities), 1890 LGUs, other smaller institutions, and non-government organizations (NGOs).*
- *Fund smaller, targeted projects (<$500 K) as well as larger, multi-disciplinary, multi-institutional projects.*

Improve project reporting, dissemination, outreach, and access to project outcomes.

- *Require and facilitate up-to-date reporting for all projects in the CRIS database, including clear summaries of key project outcomes, and links to farmer-ready products.*
- *Expand the CRIS database to enable producers and other end users to easily search for OREI and ORG project outcomes by commodity, region, or topic.*
- *Ensure ongoing funding of the eOrganic communities of practice to facilitate OREI and ORG project outreach via the eXtension website.*

INTRODUCTION

The goals of this review of the US Department of Agriculture (USDA) funding of organic research, education, and extension programs are to have a better understanding of how funds have been used, identify areas where the USDA has significantly invested, and highlight areas for further work. The project team developed recommendations for enhancing program efficacy with the goal of supporting the growth and success of the US organic agricultural sector. To this end, our project team conducted a review and analysis of projects in organic and transitioning-organic farming, ranching, and processing systems funded through two USDA programs between 2002 and 2014. We reviewed a total of 124 Organic Research and Extension Initiative (OREI) projects and 65 Organic Transitions Program (ORG) projects, and analyzed a selected subset of 47 projects in greater depth.

Organic agriculture has grown from a $1B industry to over $5.5B in 2014 (USDA, 2016). In order to support the growing needs of this expanding sector, the USDA created mechanisms to fund organic research. The USDA funds a wide variety of agriculture research, including organic research through the National Institute of Food and Agriculture (NIFA). Within NIFA there are several different funding mechanisms, including Agriculture, Food, and Research Initiative (AFRI), which was funded at $350M in FY2016. Just 0.2% of AFRI funding from 2011-2015 went to organic research.

In order to meet the research needs of existing organic farmers, NIFA instituted the OREI to fund research on critical organic agricultural issues. OREI was created in the 2002 Farm Bill due to advocacy work from OFRF and NSAC. The success of the program and high demand prompted the renewal and expansion of the program in the 2008 and 2012 Farm Bills. The 2012 Farm Bill provides OREI with annual funding of $20M until 2018, after which additional funding will be required for the program to continue.

To support farmers making the transition to organic practices, NIFA began the ORG program in 2002. The program has received about $3 – 5M per year in discretionary funds, which means that continuation of ORG remains contingent on the annual Appropriations process in Congress.

The research results from the OREI and ORG projects offer much needed support and farmer-ready tools to meet organic agriculture challenges. In order to provide the USDA with constructive recommendations to strengthen the programs, our analytical project had the following specific objectives:

- Summarize OREI and ORG project awards during 2002-2014 by commodity, region, research issue, and correspondence with organic research priorities.
- Assess producer involvement in project planning, execution, outreach, and evaluation.
- Assess practical benefits of project outcomes (informational materials, management decision tools, new crop varieties, etc.), and effectiveness of dissemination and delivery of project outcomes to producers and other stakeholders.
- Inform farmers and other stakeholders of our project findings, including practical OREI and ORG project outcomes, and engage stakeholders in the analysis and development of recommendations through workshops at regional conferences and meetings.
- Lay the groundwork for identifying current needs, priorities, and gaps in organic agricultural research, extension, and educational activities, and develop recommendations for future OREI and ORG priorities and program delivery.

METHODS

In the initial data collection phase, we reviewed the information available in the USDA CRIS abstracts online database for each project funded from 2002-2014. Abstracts downloaded from the CRIS assisted search page http://cris.nifa.usda.gov/cgi-bin/starfinder/0?path=crisassist.txt&id=anon&pass=&OK=OK included the Non-Technical Summary, Objectives, and Approach sections of project proposals, and the Progress, Impacts, and Publications sections of one or more annual and/or final reports. For grants awarded in 2014, assessments were based on proposal contents. Projects funded in 2015 were not part of the formal analysis, yet there is a summary discussion of these projects on page 41 and the titles and funding amounts are listed in Appendix A4 and Appendix A5.

The following information was extracted:

- Project number/year, principal investigator (PI), funded entity, amount of award, region
- Type of project
- Commodities studied (crops and livestock)
- Research issues addressed (production practices, socio-economic, environmental)
- Organic research priorities addressed
- Producer/stakeholder involvement in project
- Dissemination of project outcomes, i.e., methods and media, target audiences
- Project outcomes and products
- Project impacts and benefits for organic producers, processors, and other stakeholders
- Future research priorities

The emphasis OREI and ORG places on different organic commodities was also considered in relation to the economic importance of each commodity, based on the USDA National Agricultural Statistics Service (NASS) 2014 Organic Production Survey (USDA NASS, 2015).

The alignment of projects with organic research priorities was assessed in relation to program priorities listed in annual requests for applications (Appendix E) and organic producers' research needs identified in the 2007 National Organic Research Agenda (NORA) published by OFRF (Sooby et al, 2007), including:

- Soil microbial life, fertility management, and soil quality
- Systemic management of plant pests: weeds, insects, and diseases
- Organic livestock and poultry production systems: animal health, pasture management, crop-livestock integration, and NOP-compliant system
- Breeding and genetics: crop plants, livestock, and poultry

Producer engagement, outreach, and practical outcomes and benefits of 47 projects (listed in Appendix F) were explored further by visiting project websites, viewing informational materials or webinars, or interviewing project personnel. These projects represented diverse regions, commodities, research issues, research and outreach methods, and levels of stakeholder engagement. Questions used in interviews with project PIs and farmer participants are shown in Appendix B.

Recommendations for continuing and enhancing the work of the OREI and ORG programs were developed based on the above analysis.

RESULTS

Funding by entity and region, types of projects, and size of awards

USDA National Institute for Food and Agriculture (NIFA) awarded a total of $142.2M to 189 OREI and ORG projects during the 2002-2014 funding years. Based on the location of the primary funded entity, grants were awarded for more projects in the North Central and Western regions than in the Northeastern and Southern regions (Table 1). Total funding was greater in the North Central, and considerably less in the Southern region than other regions (Table 2). Of the four regions, the Southern region also has the fewest organic farms and the least share of organic farm sales (Table 3), perhaps due to intense pest, weed, and disease pressures; soil fertility limitations; and marketing challenges in this region. Thus, while the current audience for OREI and ORG appears smaller in the Southern region, there is a great need for research to overcome these barriers to profitable organic production.

States and regions also differ in their institutional capacity for organic research, education, and outreach. A few land grant universities (LGUs) host strong programs in sustainable and organic agriculture and have received multiple OREI and ORG grants. Examples include Cornell University and Pennsylvania State University in the Northeast; North Carolina State University in the Southern region; Ohio State University, Michigan State University, Iowa State University, University of Minnesota, and University of Wisconsin in the North Central region; and Oregon State University, Washington State University, and University of California in the Western region.

Many of these LGUs partner with strong regional non-profit nongovernmental organizations (NGOs) in sustainable agriculture. Examples include the Northeast Organic Farming Association and Pennsylvania Association for Sustainable Agriculture in the Northeast region; Midwest Organic and Sustainable Education Service (based in WI), Ohio Ecological Food and Farming Association, and Practical Farmers of Iowa in the North-Central; Oregon Tilth, California Certified Organic Farmers, Organic Seed Alliance, and Organic Farming Research Foundation in the Western region; and Carolina Farm Stewardship Association in the Southern region. Because some LGUs have received funding for several projects, faculty at smaller institutions have brought up the concern that a few institutions have garnered a disproportionate share of awards, leaving applicants from the South at a disadvantage.

Beginning in 2011, OREI requests for applications have specifically encouraged pest-management proposals from the Southern region. While only six out of 45 OREI awards in 2011, 2012, and 2014 went to applicants

from the Southern region, the 2015 OREI funding cycle included six awards (total $5.74M) to the region, which will help address the specific research needs of southern organic producers.

Table 1.
Numbers and percentages of OREI and ORG projects (2002-2014) by USDA region and by funded entity category.

	Funded entity (lead institution)					
Region	1862 LGU	USDA – ARS	Nonprofit/ NGO	Other[1]	Total by region	% of projects
Northeast	35	1	1	2	39	21
North Central	56	4	2	1	63	33
Southern	27	3	0	4	34	18
Western	45	2	6	0	53	28
Total by entity	163	10	9	7	189	100
% of projects	86	5	5	4	100	

1 Includes 1890 Land Grant Universities (2), other universities and colleges (3), state government agencies (1), and for-profit business (1).

Table 2.
Total OREI and ORG project funding (2002-2014) by USDA region and funded entity category.

	Funded entity (lead institution)					
Region	1862 LGU	USDA – ARS	Nonprofit/ NGO	Other	Total by region, $ Million	% of total funding
$ Million						
Northeast	35.52	0.76	0.05	0.25	36.58	25.7
North Central	41.94	6.98	0.16	0.43	49.52	34.8
Southern	16.32	2.50	0	1.38	20.20	14.2
Western	34.05	0.82	1.04	0	35.91	25.3
Total by entity	127.83	11.06	1.25	2.06	142.2	100
% total funding	89.9	7.8	0.9	1.4	100	

Table 3.
Numbers of organic farms and total organic farm sales for 2014[1].

Region	Number of organic farms	% of national total[2]	Organic farm sales, $M/yr	% of national total[3]
Northeast	3,371	23.9	701.2	12.9
North Central	4,309	31.2	901.2	16.5
Western	5,029	35.7	3,424.7	62.8
Southern	1,294	9.2	401.7	7.8

1 USDA NASS, 2015

2 National total of USDA certified and exempt organic farms responding to survey is 14,093.

3 National total organic sales in 2014 was $5,455M

Challenges to organic farming, like invasive insect pests and weeds, benefit from a multi-region approach. At least 32 OREI or ORG projects engaged partners or conducted activities across two or more regions or nationwide. For example, Rutgers University researched the management of brown marmorated stink bug (BMSB) (OREI 2012-02222) and the University of Georgia researched control of spotted wing drosophila (SWD) (OREI 2014-05378, full proposal awarded in 2015). Both of these projects engaged nationwide partner teams to tackle these widespread invasive exotic pests. Several research projects engaged partners in the Southern region in substantial ways. For example, Cornell University conducted research on breeding and integrated pest management (IPM) for cucurbit crops in both the Northeast and Southeast regions (OREI 2012-02292). The Organic Seed Alliance received a planning grant (OREI 2014-05325) to work with partners in the Southeast region to establish an organic plant breeding and seed production network. Other projects with nationwide applicability include a Farmers' Guide to Contracts (OREI 2010-01899, Farmers' Legal Action Group, MN), the eOrganic informational web site and community of practice (OREI 2007-01411 and 2009-01434, Oregon State University), and a project to develop alternatives to chlorination for food safety in leafy greens (OREI 2010-01945, University of Arizona).

"Adult female bug," Rutgers University, 2013

Funded entity type

Many different entities completed projects with funding from the OREI and ORG programs (See Appendix A). The 1862 Land Grant Universities (LGUs) were the primary funded entities, having received 163 awards representing nearly 90% of total funding (Tables 1 and 2). In contrast, 1890 LGUs received just two small awards, 1994 LGUs did not receive any, and non-LGU institutions of higher learning received three awards. The ten awards to USDA-ARS applicants represented a much higher percent of funds than the nine awards to NGOs (Table 2), because eight of the latter were small grants ($40K-110K).

Collaboration with several non-university entities was common among the LGU-led projects. Projects often included one or more farmers' organizations or other NGOs as major project partners. Some partnered with 1890 LGUs or other institutions of higher learning. In order to accurately assess the level of engagement of

NGOs, 1890 and 1994 LGUs, and other project partners, it would be necessary to have access to a complete listing of all the major partners for each project. Providing such listings in CRIS reports would also help producers and other stakeholders identify and access participants in projects of interest.

Funding category and amount

OREI and ORG funded awards focused on education, research, extension, project planning and conferences. Of the 189 grant awards, 153 (81%) funded projects integrated research with extension and/or educational components , three projects focused on research only, and six on outreach (extension and education) only (Table 4). OREI also funded 16 planning grants, ten conferences, and one analytical project with a conference component.

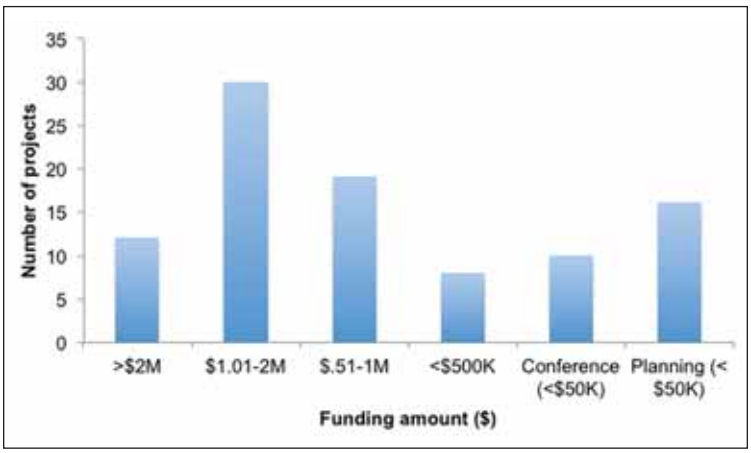

FIGURE 2. The number of OREI projects in different funding categories from 2009-2014.

There is a great need for projects that encourage organic transition and increase organic acres in the US. The ORG Transitions program consistently funded projects with budgets less than $1M, with most awards between $250K and $750K. Between 2002 and 2014, ORG awarded a total of $34.5M for 65 projects.

During its first five years, OREI also funded projects with budgets under $1M, with 29 awards totaling $14.18M. The 2008 Farm Bill authorized OREI at nearly $20M annually, enabling the program to undergo a major expansion. Beginning in 2009, requests for applications invited larger proposals for multi-disciplinary, multi-institutional, and multi-regional approaches to priority organic research needs. At the same time, OREI introduced two new project types, inviting small (up to $50K) proposals for conferences and symposia, and to support project teams in developing full integrated proposals (planning grants).

Between 2009 and 2014, larger integrated proposals (>$1M) received the majority of OREI awards, and represented 81% of total funding (Table 3; Figure 2). The 2014 requests for applications established two tiers for integrated proposals (≤$750K and $750K-2M), and two out of 12 awards fell into the smaller tier. The 2015 requests for applications offered three tiers: "multiregion" proposals ($1M-2M), "regional" proposals ($500K-1M), and "targeted" proposals (≤$500K). The request for applications also explicitly invited smaller and minority institutions to apply for targeted projects. However, the National Institute of Food and Agriculture (NIFA) did not set funding aside for any tier, and no awards in the "targeted" tier were funded in 2015.

All seven ORG awards in 2015 were less than or equal to $500K; however, the focus of ORG differs somewhat from OREI with greater emphasis on sophisticated measurements to evaluate ecosystem services. For example, four of the 2015 grants examined greenhouse gas mitigation. Two ORG awards made to 1862 LGUs in 2015 addressed specific organic practices (Asiatic carp as poultry feed protein and row covers for cucurbit pest control).

See Appendix C for further discussion of project types, funded entities, and geographic distribution of funding in relation to numbers of organic farms and total organic sales in each state and region.

Table 4.
Types of projects and funding levels for 29 OREI awards between 2004 and 2008, and 95 OREI awards between 2009 and 2014.

	Research, Education, and/or Extension Projects[1]				Conference	Planning
	> $2M	$1.01-2M	$ 0.51-1M	≤ $500K	≤ $50K[2]	≤ $50K
2004-2008						
No. projects			16	12	1	
Total $M			$10.48	$ 3.65	$0.05	
% of funding			73.9	25.7	0.4	
2009-2014[3]						
No. projects	12	30	19	8	10	16
Total $M	$30.18	$45.66	$14.29	$2.21	$0.48	$0.71
% of funding	32.2	48.8	15.3	2.4	0.5	0.8

1 Includes one research-only and three outreach-only projects in the ≤ $500K range, and one research-only and two outreach-only in the $0.51-1M range. All projects over $1M were integrated projects.

2 Includes one combined analytical and conference grant awarded at $100K.

3 Represents five funding cycles, as the program was suspended during 2013 because of a Congressional delay in Farm Bill reauthorization.

Commodities covered

The OREI and ORG funded projects focused on many different plant and animal commodities. Of the 189 OREI and ORG projects, 135 (71%) focused on organic crops, 19 (10%) focused on organic livestock and poultry, and the remaining 35 (19%) addressed both crop and livestock issues (Figure 3). Total funding for crops-only projects came to $107.26M (75.4% of total), compared to $10.41M (7.3%) for livestock-only, and $24.53M (17.3%) for crop-livestock projects. Crop-livestock projects include conferences and planning grants that address a wide range of commodities (9), studies of crop-livestock integrated production systems (16), educational projects covering both crops and livestock (5), and selection of grain and forage crops for improved animal nutrition (5).

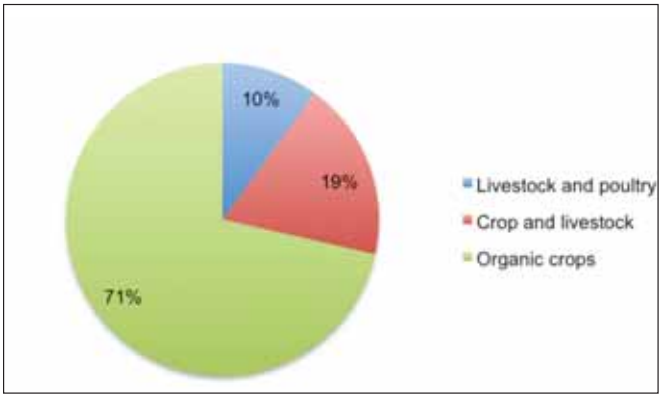

FIGURE 3. OREI and ORG funded projects on different plant and animal commodities.

OREI and ORG projects covered a wide range of agronomic and specialty crops (Table 5). Although vegetables led the pack, many projects addressed tree and small fruit crops; corn, wheat, and other grains; soybean and other dry legumes, and forages. Many projects addressed more than one crop category; for

example, vegetables and fruit or both horticultural and agronomic crops in diversified crop rotations or integrated systems. Notably under-represented relative to their importance in American commerce were rice, cotton, and tree nuts (one project each), and cut flowers and culinary herbs (no projects). In 2015, over half of organic farmers surveyed in the Northeast and Southern regions produced herbs and about one-third produced flowers (Jerkins and Ory, 2016). Although few organic farmers produced rice, cotton, or nuts and total organic sales for these products are low (USDA NASS, 2015), more research may help remove constraints on profitable organic production of these crops, and thereby open new market opportunities for the organic sector.

With organic livestock, poultry and their products representing about 35% of total organic farm product sales in 2014 (USDA NASS, 2015), and strong consumer demand for organic meat, dairy, and eggs, these figures indicate that USDA-funded organic animal agriculture research has lagged behind that for organic crops. It would be useful to evaluate whether this discrepancy is due to low numbers of livestock proposals submitted, or low percentage of organic livestock proposals funded. More awards went to crop and livestock projects, especially crop-livestock integration, during 2010-2014 than during 2002-2009 (Appendix D).

Most livestock projects focused on organic dairy cattle or livestock in general, with fewer projects on sheep, goats, and poultry (Table 5). With organic dairy comprising nearly 20% of all organic sales in 2014 (USDA NASS, 2015), the $15.37M investment of OREI and ORG funds in organic dairy research seems warranted. Despite strong market demand for organic pork and beef, these commodities garnered only two awards each; and no funded projects addressed organic turkey production. More research into organic pasture-based beef, pork, and turkey production could facilitate profitable organic meat enterprises.

See Appendix D for additional discussion of the economic importance of different organic crop and livestock based commodities in relation to OREI and ORG funded research to date.

Projects that addressed “crops in general” and/or “livestock in general” (Table 5) include eight conferences and six planning grants that covered a wide range of topics and commodities, as well as REE projects on topics such as ecosystem services of organic systems, financial risk in organic farming, food safety in crop-livestock integrated systems, sociological factors in farmers’ weed management decisions, and science-based organic animal care standards. Several education and extension projects also addressed a wide range of commodities, including a weed management manual, a farmers’ guide to organic contracts, and an expansion of eOrganic.

Table 5.
Crop and livestock commodities addressed in 188 OREI and ORG projects funded between 2002 and 2014.

	Number of projects	% of projects[1]
Crops:		
Vegetables (including potato)	65	34
Fruits (tree, cane, and other small)	31	16
Tree nuts	1	<1
Other specialty crops[2]	3	2
Grains, all / general	6	3
Corn (grain, silage)	34	18
Wheat	33	17
Rice	1	<1
Other grains and pseudo-grains[3]	18	10
Soybean (dry)	36	19
Other dry legumes[4]	11	6
Peanut	4	2
Oil seeds[5]	8	4
Forages	21	11
Cotton	1	<1
Crops in general	23	12
Livestock:		
Dairy (cattle)	19	10
Beef	2	1
Pork	2	1
Poultry (broilers and layers)	6	3
Sheep	9	5
Goats	4	2
Other[6]	2	1
Livestock in general	17	9

1 Percentage calculated by dividing number of projects by 189 and rounding to the nearest percentage point. Totals exceed 100 percent because many projects addressed more than one commodity.

2 Medicinal herbs, hops, and nursery stock (one project each).

3 Oats, barley, rye, spelt and other ancestral wheat, perennial wheat, sorghum, millet, buckwheat, amaranth, and quinoa.

4 Lentils, peas, southern peas, common beans, and other pulses.

5 Sunflower, safflower, canola, flax.

6 Bison, aquaculture (one project each).

Research topics and priorities addressed

Annual request for applications (RFA) for the OREI and ORG programs listed funding priorities for the current fiscal year, within the context of legislative goals established for each program. While the legislative goal of ORG is broadly stated as enhancing the competitiveness of organic and transitioning producers, OREI was established with eight legislative goals, which appear to have provided a framework for most annual requests for applications' priorities in both programs (Table 6).

OREI requests for applications for 2004-06 essentially paraphrased the first six legislative goals. In later years, requests for applications listed specific topics within the broad production goal, including organic fertility practices, and organic weed, pest, and disease management for crops and livestock, as well as plant breeding and genetic evaluation (legislative goal 8). ORG initially invited proposals on integrated pest management (IPM) specifically addressed to weeds subsequently expanding to all crop pests, then crop and livestock IPM.

The sixth legislative goal, "advanced on-farm research and development" addresses the approach of research rather than research topic, and has always been on the OREI requests for applications.

Many of the year-to-year changes in the priorities listed in the requests for applications reflected new and emerging priorities. For example, while OREI legislative goals included food safety as an example of a topic for advanced on-farm research, annual requests for applications began to highlight post-harvest handling and food safety as priorities in 2009. Similarly, with growing awareness of the threat of climate disruption and emerging carbon market opportunities, OREI and ORG began in 2009-10 to invite proposals on carbon (C) sequestration and greenhouse gas mitigation in agriculture. The emerging pollinator crisis and other biodiversity concerns are reflected in ORG priorities on ecosystem services, which were expanded to include biodiversity in 2013, and pollinators in 2016.

The spinach E.coli outbreak in fall 2006 led to the Food Safety Modernization Act.

Several high-profile foodborne illness outbreaks pushed the issue onto the nation's public policy agenda and it continues to be a high priority for organic farmers, especially with the creation of the Food Safety Modernization Act in 2011.

Direct feedback from the organic farming sector, including the content of proposals submitted to OREI and ORG, has also apparently guided the evolution of requests for applications' priorities. For example, during 2009-10, OREI invited proposals to "characterize and catalog" vegetable germplasm for future breeding programs for organic systems. Successful proposals during those years included several that initiated breeding efforts in grains, dry legumes, and cotton, as well as vegetables. In 2014, OREI modified and expanded this priority area to emphasize breeding of all crops. In another example, OREI funded an innovative project in 2010, in which agriculture students conducted on-farm research to address the host farmers' needs. In 2013-14, ORG invited proposals for education and outreach for producers and students, and funded four such projects.

Other changes in the emphasis listed in the requests for applications may reflect internal administrative decisions. During 2007-08, priorities in the requests for applications were the same for the OREI and ORG programs. Beginning in 2009, ORG focused primarily on environmental benefits of organic systems (OREI legislative goal seven), while OREI continued to fund production research, with increasing emphasis on plant breeding and organic livestock (Table 6). Educational proposals for agricultural professionals were invited during the first seven years of the ORG program, but only by OREI thereafter.

Table 6.
OREI legislative goals, annual OREI and ORG requests for applications' priorities, and approximate numbers of projects that address these priorities

Legislative Goal	OREI		ORG	
Requests for applications priority	Years[1]	Projects[2]	Years[1]	Projects[2]
1. Organic production, breeding & processing methods				
Legislative goal[3]	2004-06	16 (17)		
Soil microbiology, crop health & disease suppression	2004-06	2 (17)		
Organic fertility impacts on crop & livestock health[4]	2007-10	27 (61)	2002-08	14 (31)
Organic IPM for weeds, pests, diseases [5]	2004-14	65 (124)	2002-08	18 (31)
Livestock production and health	2011-14	9 (45)		
Catalogue animal genotypes for organic systems	2011-14	2 (45)		
Post-harvest handling and food safety	2009-14	7 (95)		
Alternatives to substances on NOP national list[6]			2013-14	3 (12)
2. Economic benefits of organic production systems				
Legislative goal[3]	2004-08	11 (29)	2007-08	0 (8)
3. International trade opportunities for organic				
Legislative goal[3]	2004-06	2 (17)		
4. Determine desirable traits for organic products				
Legislative goal[3]	2004-06	2 (17)		
Comparisons of organic with conventional products	2009-10	2 (50)		
5. Marketing and policy constraints on organic				
Legislative goal[3]	2004-06	2 (17)		
6. Advanced on-farm research & development				
Legislative goal[3]	2004-14	51 (124)	2007-08	3 (8)
7. Optimizing conservation & environmental outcomes				
Water quality and quantity			2009	3 (3)
Soil quality, C sequestration, greenhouse gas, other ecosystem services	2009-10	7 (50)	2010-12	18 (19)
Greenhouse gas, biodiversity, other ecosystem services			2013-14	8 (12)
8. New & improved seed varieties for organic systems				
Breed crops for disease resistance, organic fertility, etc.	2004-06	1 (17)		
Catalog vegetable germplasm for organic breeding program	2009-10	7 (50)		
Organic seed & transplant production & plant breeding	2011-14	12 (45)		

Education and training in organic production systems				
Training systems and tools for agriculture professionals	2007-14	11 (124)	2002-08	4 (31)
Outreach and education for producers and students			2013-14	4 (12)

1 Funding years during which the requests for applications priority was listed.

2 Number of projects addressing that priority and (total number of projects funded during those years).

3 Requests for applications priority list quoted or paraphrased legislative priority without limiting scope of priority.

4 Crop only (ORG 2002-04) or crop and livestock health (ORG 2005-08, OREI 2007-10).

5 Weed IPM (ORG 2002-03); livestock parasite IPM (ORG 2002-04), IPM for all crop pests (ORG 2004, OREI 2004-06 & 2011-14), IPM for crop & livestock pests (ORG 2005-08, OREI 2007-10).

6 Materials under consideration for removal from NOP National List by NOSB.

In 2013, ORG request for applications invited proposals to develop alternatives to materials currently on the NOP National List of allowed synthetics that may be removed in the future, such as antibiotics for fire blight, and methionine supplements for poultry.

Notably, and possibly of concern, is the disappearance of the terms "soil," "cover crop," "crop rotation," and "crop-livestock integration" from language in OREI requests for applications' priority lists from 2011-present. In earlier years, OREI request for applications' priorities emphasized soil health and practices that support it, such as cover cropping and rotation. During 2011-14, 20 out of 45 projects (44%) addressed soil issues, a decline from 2004-2010 (48 out of 79 projects, or 61%). Yet, soil health and fertility management remain top priority research topics for organic producers as of 2015, with many citing cover crops, rotations, reduced tillage, and livestock-crop integration as important soil-improving practices that merit further research (Jerkins and Ory, 2016).

Most funded proposals addressed one or more of the current year's request for applications' priorities, including 119 of 124 OREI and 59 of 65 ORG projects. Most of the remaining 11 projects addressed priorities listed in earlier or later years. Projects most commonly included production priorities, advanced on-farm research and development, ecosystem services (especially ORG), and plant breeding (especially OREI) (Table 6). Market, economic, and policy legislative goals received less emphasis in funded proposals, and have not been included in request for applications' priority lists since 2008. Nevertheless, over 50% of projects funded during 2009-2014 have included cost-benefit, market, enterprise budget, or other economic analyses. For more detail on annual OREI and ORG request for applications' priorities and numbers of projects addressing each priority, see Appendix E.

Meeting identified farmer needs for research

The 2007 National Organic Research Agenda (NORA) report published by OFRF was influential in guiding organic agriculture research (Sooby et al., 2007). The NORA report was published in an effort to inform funding agencies, university and farmer researchers, and other stakeholders about the research needs of organic farmers and ranchers. With few exceptions, OREI and ORG projects addressed at least one and often two or more of the major organic production research priorities cited in the OFRF report. Nearly two-thirds of projects addressed soil fertility and nutrient management, soil life, and/or soil quality, usually in conjunction with crop or livestock production objectives. This accurately reflects the central role of a healthy living soil in organic and sustainable farming.

A similar number of projects addressed crop pests, including weeds, insects, and plant pathogens, with nearly half including a weed management component (Table 7). This accurately reflects the high priority that organic producers place on developing more effective ways to deal with weeds without herbicides or intensive tillage. The majority of these projects tackled weeds, pests, and plant diseases with multi-component integrated strategies in alignment with the "systemic" approach recommended by OFRF (Sooby, 2007). Some projects focused on breeding or selecting crop varieties for resistance to diseases (15 projects), or pests (six projects), or competitiveness toward weeds (eight projects).

A few studies focused on single tactics, including flash grazing hogs in apple orchards for pest and weed control, rye cover crops to suppress aphids in a subsequent soybean crop, brassica seed meals against orchard pathogens, a yeast antagonist to the fire blight pathogen of apple, air-propelled abrasive grits for within-row weed control, and UVB light against powdery mildew pathogens. All of these tactics are compatible with the systemic approach, and could work additively or synergistically with other practices like crop rotation, cover crops, and sanitation.

Table 7.
Organic crop and livestock production research priorities identified by OFRF[1] and addressed in 188 OREI and ORG projects funded between 2002 and 2014.

	No. projects[2]	%[3]
Organic production issues (all)	**183**	**97**
NORA 2007 Research Priorities		
Soil management in organic production systems	**123**	**65**
Soil fertility and nutrient management·	107	57
Soil quality and soil health	83	44
Soil microbiology and soil food web	53	28
Systemic management of crop pests	**129**	**68**
Weeds	91	48
Insect pests	75	40
Diseases[4]	75	40
Organic livestock and poultry production systems	**50[4]**	**26**
Animal health	34	18
Management of diseases, parasites and pests	18	10
Animal nutrition	28	15
Pasture and grazing management	28	15
Crop-livestock integration	16	8
NOP compliant systems and livestock living conditions	12	6
Breeding and genetics for organic systems	58	31
Crop plants	52	28
Livestock and poultry	8	4

1 Sooby, 2007.

2 The total reflects the number of projects evaluated, but some projects are counted in multiple sub-categories and therefore the sum of the subcategories exceeds 183.

3 Percentages calculated as: (number of projects ÷ 189) ×100%. Totals exceed 100% because most projects addressed multiple research issues.

4 Includes diseases caused by fungi, oomycetes (water molds), bacteria, viruses, and root-feeding nematodes.

5 Does not include four livestock projects on economic, environmental, and policy issues.

The smaller pool of livestock projects addressed the NORA priorities of animal health and nutrition, pasture management, crop-livestock integrated systems, and NOP compliant systems for animal health care, housing, and living conditions. Re-integration of crop and livestock production can tighten nutrient cycles, diversify rotations, and reduce weeds and pest problems, and has long been considered a key component of sustainable organic agriculture. Thus, crop-livestock integrated systems may merit greater attention in future OREI and ORG requests for applications' priorities.

Regarding the fourth major NORA priority area of breeding and genetics, OREI and ORG supported a substantial effort for crops. Of the 52 projects that addressed crop genetic adaptation to organic systems, 12 established strong farmer-participatory breeding networks for various vegetable crops, potatoes, wheat and other grains, and dry beans. Eight projects supported university breeders to develop corn, wheat, cotton, hops and quinoa cultivars for organic farmers, and 24 projects included cultivar evaluation for disease and pest resistance or other traits prioritized by organic farmers. The remaining eight projects included two symposia on plant breeding and organic seed production, a planning grant, three organic research symposia whose agendas included plant breeding, and two grants for eOrganic, which includes a plant breeding community of practice.

Livestock and poultry breeding and genetics comprise the one NORA priority that has not thus far been effectively addressed by OREI and ORG. Beginning in 2011, OREI requests for applications' priorities have included: *"Catalog, characterize and/or select animal genotypes and breeds adapted to organic systems,"* yet no proposals have been funded on this topic. Between 2004 and 2011, seven projects evaluated two or more existing livestock or poultry breeds for disease resistance or other traits, but this project did not conduct livestock breeding. One planning project proposed a bison-breeding program, but the full proposal was not funded. Two projects (OREI 2005-04426 and OREI 2010-01884, USDA-ARS, Booneville, AR) documented genetic variation in parasite resistance in sheep, and indicated that selection for this trait could reduce the need for parasiticide medications by 75-100%. Future OREI or ORG funding for farmer participatory breeding of livestock and poultry for performance in organic, pasture-based systems could play a vital role in advancing organic animal agriculture.

In 2015, OFRF conducted a survey of organic producers to update the 2007 NORA. Based on responses from 1,403 organic farmers (about 10% of the nation's organic producers), soil health, quality, and nutrient management remain at the top, with 74% of respondents rating these topics a high priority for additional research (Jerkins and Ory, 2016). Weed management was second (67%), followed by fertility management (a subset of the soil topic, rated high priority by 66% of respondents), nutritional quality and integrity of organic food (55%) and insect management (51%). Although only about 35% of producers rated crop and livestock breeding for organic systems a "high" priority, most of the rest considered it a moderate priority, and many commented on the need for improved plant and animal genetics for organic systems, including pest, weed, and disease resistance as well as product quality. Research on organic livestock also emerged as high priority for many producers, especially in the North Central region.

Other organic production topics

Over one-third of projects addressed cover cropping and/or crop rotations (Table 8). This emphasis reflects the central roles these practices play in soil health and in organic management of nutrients, pests, and weeds; and the fact that NOP requires organic crop producers to include these practices in their Organic System Plans. Nearly one in four projects explored organic no-till or reduced-till practices to enhance soil health or prevent erosion.

A number of OREI projects tackled the challenges of organic production in semiarid climates, with focus on dryland wheat, water management, improved crop rotation, and soil building practices. Seven projects addressed crop pollination, a vital topic for all specialty crop producers. Dryland farming challenges emerged as a high priority among Western region organic growers in 2015, and nearly 50% of producers across the US rated pollinator health as high priority (Jerkins and Ory, 2016).

With the National Organic Program (NOP) tightening requirements for organic seeds and planting stock, organic farmers need viable systems for organic seed production and crop propagation. While 14 projects addressed organic seed production, often in conjunction with plant breeding, organic annual vegetable starts and perennial planting stock have received little attention (Table 8).

Over one-quarter of funded projects addressed product quality, especially in crops and plant-derived products such as bread flour, and a few investigated post-harvest handling and food safety issues (Table 8). These studies address significant farmer needs related to increasing food safety concerns, as well as market demands for high quality organic products. Research into nutritional quality, health benefits, and integrity of organic products were rated high priority by a majority of organic producers in the 2015 OFRF National Organic Farmer Survey (Jerkins and Ory, 2016).

Table 8.
Other organic production research issues addressed in 188 OREI and ORG projects funded between 2002 and 2014.

	No. projects	%[1]
Other soil, crop, and pest management issues		
Cover crops	71	38
Crop rotations and crop diversification	60	32
Organic reduced-till and no-till systems	45	24
Water management, irrigation, and drought tolerance	20	11
Crop pollination and pollinators	7	4
Organic crop propagation		
Organic seed production	14	7
Organic annual vegetable starts[2]	2	1
Organic perennial planting stock	3	2

Product quality and safety		
Product quality – crops and plant products	51	27
Product quality – meat, dairy, eggs	11	6
Food safety	16	8
Post-harvest handling	6	3

1 Percentages calculated as: (number of projects ÷ 188) ×100%. Totals exceed 100% because most projects addressed multiple research issues.

2 Includes one project on grafting tomato starts onto disease resistant rootstock.

Topics on priorities in the request for applications

In response to the request for applications' emphasis on "advanced on-farm research" and "systems" approaches to pest management and other issues, many projects took a holistic approach to multiple production challenges facing organic producers. For example, 36 projects (19%) addressed the persistent organic crop farmer's dilemma of how to manage weeds and nutrients adequately while maintaining soil quality and preventing erosion. Experimental designs integrated cover crops and often some form of organic minimum-till with other practices to address these issues. Many of these projects also examined nutrient management, soil biology, crop pests or diseases, soil carbon (C) sequestration, or net greenhouse gas emissions. Examples include:

- ORG-2003-04619 (Pennsylvania State University, $498K) – balancing weed management and soil quality in a transitioning system; different tillage and cover crop treatments.
- OREI-2009-01416 (Washington State University, $1.04M) – sustainable organic dryland farming systems – simultaneously addresses weeds, soil erosion, and fertility.
- ORG-2011-04958 (University of Missouri, $742K) – C sequestration and nitrous oxide emissions in organic systems with different tillage, cover crop, and manure or compost treatments.

Between 2002 and 2014, OREI and ORG invested some $33M (23% of total program funding) on endeavors to resolve the soil-weed management dilemma. The efficacy of this soil-weed cluster of integrated projects in helping farmers maintain soil health, weed control, and crop yield is explored further on page 50.

Other examples of multi-component systems studies include:

- OREI 2009-01366 (University of Maine, $1.32M) – organic production of bread wheat – variety evaluation; weed, disease, and nutrient management; post-harvest handling and baking quality; goal is to develop a locally supplied organic bread industry.
- OREI 2011-02002 (Ohio State University, $896K) – integrating pastured poultry and naked oats into organic crop rotations – study includes nutrient management and evaluation of oat varieties and poultry breeds for crop-livestock integrated system.
- ORG 2014-03389 (University of Maryland, $500K) – impact of cover crops, no till, and melon variety on soil food web, plant pathogens, and human foodborne pathogens.

Some projects addressed a single priority issue in a targeted approach. Examples include:

- OREI 2012-0222 (Rutgers University, $2.67M) – nationwide effort to develop organic IPM for the invasive exotic pest brown marmorated stink bug (BMSB).
- OREI 2014-05378 (University of Georgia planning grant, successful full proposal in 2015) – organic IPM for the invasive exotic Spotted Wing Drosophila (SWD).
- OREI 2011-01965 (Oregon State University, $476K); ORG 2013-03968 (Michigan State University, $464K); ORG 2014-03386 (Oregon State University, $497 K) – microbial antagonists as alternatives to streptomycin (being phased-out by NOP) to control fire blight in apple and pear.
- ORG 2004-05187 (University of Arkansas, $305K); and ORG 2014-03379 (U Georgia, $500K) – efforts to reduce methionine needs in poultry by using older breeds or promoting methionine biosynthesis, in response to NOP phasing-out synthetic methionine.
- OREI 2005-04426 (USDA-ARS Fayetteville, AR, $300K); OREI 2010-01884 USDA-ARS Fayetteville, AR, $968 K); OREI 2012-02290 (West Virginia, $1.85M) – management of gastro-intestinal nematodes (GIN) in organically managed sheep and goats, integrating tannin-rich forages with NOP-allowed anti-helminthic supplements.
- ORG 2004-05204 (University of Minnesota, $463K) – rye cover crops to suppress soybean aphid.
- OREI 2014-05376 (University of Illinois, $750K) – abrasive grits for within-row weed control.

Some of these projects utilized integrated, multi-tactic strategies against a targeted pest or pathogens, while the others developed and evaluated a single management tactic that complies with NOP rules and can be integrated into organic systems.

Economic topics

In addition to evaluating production systems, nearly half of all projects included some form of economic analysis (Table 9), such as enterprise budgets, cost/benefit analysis of experimental components or practices, or whole-farm budgeting. Three project teams conducted in-depth economic analysis of organic dairy production. Relatively few projects addressed marketing and organic certification, and sociological and policy issues affecting organic producers. Several projects addressed multiple issues.

Table 9.
Economic issues related to organic farming and ranching systems addressed in 189 OREI and ORG projects funded between 2002 and 2014.

	No. projects [1]	%[2]
Economic and social issues	**112**	**60**
Economic analysis[3]	91	48
Marketing and organic certification issues	31	16
Sociological and socio-economic analysis	13	7
Policy analysis	87	4

1 The total reflects the number of projects in evaluated, but some projects are counted in multiple sub-categories and therefore the sum of the subcategories exceeds 112.

2 Percentages calculated as: (number of projects ÷ 189) ×100%.

3 Enterprise budgets, cost-benefit analyses for a specific practice, or whole-farm economic analysis.

Environmental topics

More than one out of three projects specifically investigated environmental impacts or benefits of various organic farming systems, sometimes in comparison with non-organic (conventional) systems (Table 10, Figure 4). These projects aimed to test the hypothesis that organic systems provide greater ecosystem services or inflict less environmental damage than conventional systems; and to improve resource conservation and the environmental impacts of organic systems through crop rotation, reduced tillage, cover crops, livestock-crop integration, and other practices.

Table 10.
Environmental issues related to organic farming and ranching systems addressed in 189 OREI and ORG projects funded between 2002 and 2014.

	No. projects [1]	%[2]
Environmental impacts and ecosystem services	**82**	**43**
Soil conservation and soil improvement[3]	47	25
Water conservation[4]	14	7
Water quality[5]	34	18
Energy conservation	8	4
Carbon sequestration, greenhouse gas mitigation	35	19
Air quality[6]	4	2
Biodiversity and habitat preservation[7]	17	9

1 The total reflects the number of projects in evaluated, but some projects are counted in multiple sub-categories and therefore the sum of the subcategories exceeds 82.

2 Percentages calculated as: (number of projects ÷ 189) ×100%.

3 Reduced erosion losses or soil quality enhancement researched as an ecosystem service.

4 Reduced use of irrigation water, or enhanced water storage, or water availability within the farm ecosystem as a result of organic production or conservation practices.

Continued on pg. 26

Table 10, cont.

5 Prevention or mitigation of water pollution by nutrients, sediment, pathogens, or pesticides.

6 Prevention or mitigation of air pollution by ammonia or particulates.

7 Includes agroecosystem biodiversity, preservation of natural areas and endangered species, and habitat for pollinators and other beneficial organisms.

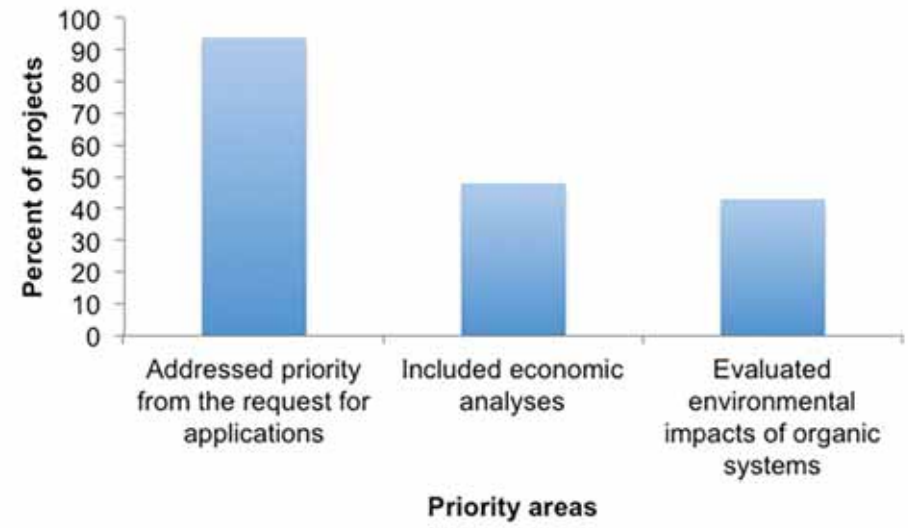

Figure 4. Funding of projects for different priority areas.

Historically, the ORG program has prioritized assessments of ecosystem services of organic systems. Between 2010 and 2014, ORG funded 18 projects that entailed in-depth comparisons of C sequestration or total greenhouse gas footprint including carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) of organic versus conventional, and/or tilled versus no-till systems. The efficacy of this effort, which entailed an investment of about $12M in ORG funds, and next steps in greenhouse gas evaluations is discussed further on page 49. An additional 17 OREI and ORG projects addressed some aspect(s) of greenhouse gas emissions or mitigation within a broader context of soil health, weed management, or farming systems research.

Soil conservation, water quality, water conservation, and biodiversity also received considerable attention, and a few projects evaluated energy conservation and air quality (Table 10).

See Appendix D for further discussion of research topics and priorities, and the efficacy of both multi-issue and single-issue projects.

Producer engagement, project products, outcomes, and impacts

During assessment of the degree of producer involvement, efficacy of dissemination of project findings and products, and overall practical impact of project outcomes from the CRIS abstracts our team encountered the following challenges:

- Reporting for some projects was not up to date. In spring 2015, at the end of our data collection process, 23 projects still lacked their final report or 2014 progress report. A few completed projects had posted no reports other than the proposal abstracts.
- When some other projects were updated with the most recent report, earlier annual reports were removed from the CRIS web site. In some cases, key early project outcomes are presented in these earlier reports but not the final report.
- Quality and thoroughness of reporting varied greatly among projects. Some reports detailed research procedures at length without presenting results or discussing practical implications. Many failed to present farmer-ready products, or references or links thereto. Some included extensive lists of publications; others report few or none. Outreach activities were emphasized for some projects, and under-reported for others.
- Because of the length of abstracts (5 to 20 pages per project), and inconsistent presentation, retrieving accurate data on farmer engagement and outcomes proved difficult and time consuming. Some projects repeated the same language in subsequent annual reports, and this redundancy increased the time needed to extract relevant data.

Additional information obtained through project web sites, eOrganic, and interviews with project participants allowed us to garner a more accurate assessment of 47 selected projects. However, it was beyond the capacity of our analytical project to do so for all 189 projects. Therefore, data presented in Tables 11, 12, and 13 (below) should be considered approximate.

Most OREI and ORG project teams engaged organic farmers, ranchers, and processors in one or more aspects of the project (Table 11). Based on CRIS reports, producers played meaningful roles in about two thirds of projects, from participating in research and outreach to serving on project advisory committees. Producer involvement in grant applications varied from providing input on research and outreach priorities to participating in project goal setting, developing experimental procedures, or shaping the proposal itself.

Producers participated in research by collecting or providing data, testing new tools and techniques, or working with researchers to interpret results. Many hosted and helped conduct on-farm trials of new tools, practices, systems, or crop varieties. Farmers contributed to dissemination of results by hosting farm field days, co-presenting at conferences or workshops, co-authoring written materials, or participating with agricultural professionals in learning groups or networks. Evaluation activities ranged from filling out post-event surveys or completing six month follow-up surveys, to testing and evaluating decision tools or other project products.

Table 11.
Producer and processor involvement in projects.

	No. projects	%[2]
Application: identify priorities, set project goals and procedures	112	60
Research: collect or provide data, help with research	91	48
On-farm Research: host and help conduct on-farm trials	31	16
Dissemination: host farm field days, other outreach activities	13	7
Evaluation: post event surveys, trial and evaluate project products	87	4

1 Percentages calculated as: (number of projects ÷ 189) ×100%.

Some projects that seemed especially effective and innovative in their approaches to producer engagement include:

- Several farmer-participatory breeding and seed production networks – see Appendix G for more on organic plant breeding projects.
- OREI 2005-04473 – Michigan State University – Partnering for Organic Agriculture in the Midwest. A group of 15 farmers discussed priority issues in monthly teleconferences with scientists.
- OREI 2007-01417 – Michigan State University – Integrated Weed Management: fine-tuning the system. This project produced a manual (132 pp) based on organic farmer input, case studies, and on-farm trials (Michigan State Extension, 2008).
- OREI 2008-01247 – Washington State University – Organic Strategies for Stewardship and Profit. Farmers hosted 39 farm walks for a total of 900 participants. In their follow-up survey, 75% of 228 respondents reported applying project related findings on their farms.
- ORG 2010-03990 – Texas A&M University – Integrating Students and Farmers in Organic Vegetable Research. Students conducted on-farm research into farmer-identified priorities.
- ORG 2013-03973 – University of Minnesota – Transitioning to organic farming. Farmers and researchers collaborate to develop educational materials on transitioning to organic, including decision case studies.

Some projects outlined a more extensive producer role in the proposal than was evident in project reports. A few projects consisted primarily of research conducted in the lab or agricultural experiment station(s), and did not involve farmers as active partners. For example:

- OREI 2004-05153 and OREI 2008-01245 – Orchard Replant Disease. This project led to ongoing research in soil biology, clarified mechanisms by which crucifer seed meals suppress diseases, and laid groundwork for practical applications.
- OREI 2005-04484 – Iowa State University – Organic Management of Soybean Rust. Research at the university led to practical outcomes widely disseminated to farmers.

- ORG 2011-04960 – Montana State University – Targeted Sheep Grazing to Reduce Tillage Intensity. Using sheep to terminate cover crops was not successful (low crop yields).
- ORG 2009-05488 – North Carolina State University – Water Quality in Vegetable Systems. Evaluating "organic" system of continuous sweet corn and high poultry litter rates.

In the last two examples, greater producer engagement in the planning phase may have yielded more successful experimental organic systems and more practical outcomes.

Project outreach

Outreach played a major role in nearly all OREI and ORG projects. Primary target audiences included organic producers and processors, researchers, and service providers (Table 12). Outcomes of many projects were also delivered to educators and students at all levels from elementary school through university. Some projects offered college level internships or funded graduate students to complete a master's degree or PhD on project topics.

Over one-quarter of project teams reached out to home gardeners, organic consumers, and other members of the general public, while smaller numbers cited organic certifiers, NOP personnel, or other policy makers as target audiences. In a creative example of public outreach, the BMSB organic integrated pest management (IPM) project (OREI 2012-02222, Rutgers University) engaged 200 mid-Atlantic residents in "citizens research." These citizen scientists monitored and reported BMSB activity on their houses. Their observations helped the team design overwintering traps to aggregate the pest for easy destruction.

Table 12.
Target audiences for OREI and ORG project outcomes.

	No. projects	%[2]
Farmers and ranchers (organic, transitioning, conventional)	187	99
Processors (millers, bakers, canners, etc.)	50	26
Marketers and distributors	8	4
Research scientists, including plant breeders	164	87
Extension, NRCS, and other service providers	142	75
Teachers and educators (elementary school through college)	72	38
Students (elementary school through graduate school)	89	47
General public, consumers, home gardeners	55	29
Organic certifiers, NOP personnel	8	4
Policy makers	27	14

1 Percentages calculated as: (number of projects ÷ 189) ×100%. The total exceeds 100% because most projects reached out to multiple audiences.

Project outcomes were disseminated through farm tours, field days, and pasture walks; talks at sustainable agriculture conferences, farmers' meetings, or professional meetings; workshops, training events and courses; project web sites and e-mail listserv; and written communications. OREI has funded two key outreach venues: eOrganic and organic farming research conferences.

Established in 2007 (OREI 2007-01411) and expanded with additional funding (OREI 2009-01434 and 2010-01944), the eOrganic website and communities of practice provide a platform for OREI and ORG project teams and others to develop written information, videos, webinars, decision tools, and other products for producers. After thorough review for scientific soundness, practical accessibility, and compliance with NOP rules, articles and other materials are published on eXtension at http://www.extension.org/organic_production. Webinars presented through eOrganic remain permanently available to the public after they take place. At least 60 OREI and ORG projects have utilized eOrganic to develop and publish informational products.

For a report from the eOrganic team on dissemination of research outcomes and other eOrganic outreach activities, see Appendix H.

The eleven conferences and symposia funded by OREI between 2007 and 2014 created an opportunity for farmers, researchers, and service providers to share breaking research news, project information, ideas, and perspectives. This provided a fertile breeding ground for new innovations and hypotheses, and an excellent way to facilitate advances in organic research and practice. In addition, publication of conference proceedings or recordings through eOrganic or project websites has made outcomes of OREI, ORG, and other relevant research widely available.

OREI and ORG-funded research generated diverse products (Table 13). Nearly two-thirds of the projects published information sheets, Cooperative Extension bulletins, manuals, reports, videos, or other outreach materials for producers, and more than one in four offered webinars or short courses for producers and service providers. A few projects created decision-support tools, released new crop cultivars, or developed new NOP-compliant input materials or production methods for organic systems.

Table 13.
Project products from 189 OREI and ORG projects during 2002-2014.

	No. projects	%[2]
Informational materials for producers (info sheets, videos, etc.)	121	64
Online courses or webinars, available beyond the life of the grant	56	30
Interactive web site for information exchange or technical assistance	14	7
Decision tools for producers or processors	24	13
New, farmer-ready public crop cultivars	12	6
New input materials or production methods	16	8
Networks linking farmers, processors, and agricultural professionals	44	23
Scientific papers in refereed journals	91	48
PhD dissertations and MS theses	23	12
Educational curricula (elementary school through university)[2]	28	15

1 Percentages calculated as: (number of projects ÷ 189) ×100%. Total exceeds 100% because many projects yielded two or more products.

2 Project outcomes used to create new courses or integrated into existing course curricula.

Project impacts

At least 43 projects established networks linking producers with processors, plant breeders, researchers, Co-operative Extension, and/or other service providers. Many projects launched their own websites and some offered an interactive function to promote information exchange or provide technical assistance. Some networks and websites remained active beyond the life of the initial grant. For example, the University of Wisconsin maintains an Organic Potato Project website at http://labs.russell.wisc.edu/organic-seed-potato/, established through OREI grant 2009-01429 and other funding. A 2015 posting invited organic farmers to participate in disease-free potato seed production and variety evaluation. The University of Maine's organic bread wheat project (OREI 2009-01366) built a strong network of farmers, millers, bakers, and scientists, and received additional OREI funding in 2015 to continue production and nutrient management research, boost organic grain production capacity, and build the local organic bread industry.

Projects also yielded academic products such as articles in scientific journals, completion of PhD or Masters' degrees, graduate or undergraduate internships, and educational curricula (Table 13). While a few projects created entire new college level courses, a larger number contributed material to enhance existing college curricula or public school lesson plans.

Practical outcomes from many projects remain available to farmers beyond the life of the grant, especially those disseminated through eOrganic. Other examples include the Michigan State weed IPM manual (Michigan State Extension, 2008), and the Cornell University organic website, http://www.hort.cornell.edu/extension/organic/ocs/index.html, established under a Systems Research and Education Partnership (OREI 2004-05218), with research results from 2004-2011.

Other outcomes seem less accessible, sometimes because project teams do not yet consider their findings ready for wide dissemination to producers. Examples include brassica seed meals against orchard replant disease (OREI 2008-01245, USDA ARS Wenatchee, WA), and some of the greenhouse gas mitigation studies that have yielded complex or inconsistent results.

In a few cases, valuable practical information or outcomes seem to have been lost or "stuck on the shelf". In *Partnering for Organic Agriculture in the Midwest* (OREI 2005-04473, Michigan State University), farmers and scientists shared information and observations in monthly teleconferences linked to a New Agriculture Network website, details of which our team could not find. In a March, 2015 conversation, one project co-PI confirmed that these teleconferences were extremely valuable to both producers and agricultural professionals, but much of the information shared is not available because the web site is no longer active. Disseminating the information through Extension would have kept it available beyond the scope of the grant.

At least 169 projects (89%) appear to offer at least potential benefits to organic producers, including improved production (82%), profitability (64%), or environmental impact (50%). A similar number (161 projects, 85%) provided agricultural professionals with practical information that improves their capacity to assist organic producers, or research data or materials (such as advanced plant breeding lines) that provide a foundation for future research. Forty projects (21%) linked organic processors with producers or provided processors with information on availability, quality, and safety of local organic farm products.

Benefits to rural or urban communities, and to the general public, are more difficult to document. Community level economic, social, or health benefits likely accrued from at least a few projects, such as the organic bread wheat network developed through University of Maine (OREI 2009-01366).

Reports from 79 projects (42%) indicated that farmers were already putting project outcomes into practice or that decision tools, new varieties, or other products were ready for farmers to use. Other projects do not appear to have reached this point, possibly because:

- Experimental treatments or systems did not successfully achieve their goals. Practical outcomes cannot be expected from 100% of projects.
- Project outcomes are of an "intermediary" nature and require additional research or refinement before they are ready for implementation by farmers.
- CRIS reports did not document products available via eOrganic or project websites.
- The project is still in progress.

Some larger projects, notably those that undertook plant breeding and public cultivar development, investigated C sequestration or greenhouse gas footprints of different farming systems, or tackled multiple issues (e.g., weed management, soil quality, cover crops, crop rotation, reduced tillage) did not yield clear, farmer-ready outcomes. These complex issues generally require more than a single three or four-year grant to achieve practical outputs. OREI and ORG have awarded additional funding to several of these teams, often enhancing the team's capacity to bring practical outcomes to fruition. Examples include:

- The Northern Vegetable Improvement Collaborative (OREI 2010-03392 and 2014-05402).
- USDA-ARS public corn breeding project (OREI 2010-02363 and 2014-05340).
- Oregon State University effort to develop a biocontrol alternative to streptomycin against fire blight (OREI 2011-01965 and 2014-03386).
- Pennsylvania State University team that has grappled with the soil quality, weed management dilemma since 2003 (ORG-2003-04619 and four OREI grants in 2009 – 2015), and developed excellent guidance on selecting cover crops (OREI 2011-01959).

For additional discussion of farmer engagement, outreach, and project impacts, see Appendix F.

Interviews with project principal investigators

A total of 13 interviews with principle investigators (PIs) of selected projects were conducted, using the questionnaire shown in Appendix B. PIs were generally satisfied with the application and review process, and most were also happy with program administration, and how their USDA-funded research, extension, and education endeavors proceeded. A few noted that NIFA reporting procedures have improved and become less burdensome, and a few others noted challenges related to changes in program leadership.

Differences in PI orientation toward agricultural research and outreach definitely influenced their assessment of OREI and ORG in the interviews. For example, two PIs expressed their preference to focus on

research only, and found the education and extension requirements of an OREI project burdensome; one "would not apply for another OREI grant." Another felt urged by the requests for applications to utilize eOrganic and social media to get project results out to growers promptly, and preferred to wait until robust project outcomes are ready for producer application before disseminating through these venues. However, the majority of PIs interviewed clearly enjoyed working with farmers in both research and educational endeavors, and had very positive experiences overall with OREI and ORG. One PI noted that OREI offers a "good process to ensure that [projects] are farmer relevant, more so than other grants."

OREI requirements for conducting research on certified organic farms created constraints on working with interested growers that use organic methods but are not certified, and on researching crops that few farmers grow organically, such as pecan crops.

One interviewee commented on the short interval between award notification for planning grants and the due date for full proposals, and recommended earlier notification for planning grants to allow more time to develop the full proposal.

PI interviews provide "ground truth" on farmer engagement and project impacts.

For about half of the projects, PI comments confirmed our initial impressions of farmer engagement, practical outcomes, and benefits for producers and other stakeholders. In the other half, PIs indicated either lesser or greater farmer engagement and practical impacts than we had surmised from the CRIS abstracts. These discrepancies related to:

- Over-statement in some project reports of farmer engagement or project impacts.
- Missing information or under-reporting of farmer activities or project impacts in other reports.
- Difficulty interpreting information in CRIS abstracts.
- Variations among PIs in attitudes regarding the extension and education components of OREI and ORG projects, and in approaches to engaging farmers in research.

These discrepancies underline the importance of conducting interviews and otherwise exploring beyond the CRIS reports to better assess project outreach and impacts. For example, CRIS reports mentioned a "product" for crop disease management, but gave no further information. In the PI interview, we learned that the material is still undergoing research to determine mechanisms and optimize application protocols, and a Google search located an excellent PowerPoint presentation on this research (Mazzola, 2011).

Big projects spread too thin

Several PIs felt that project teams are spread too thin because they are expected to do multi-component projects (research, extension, and/or education), to engage several diverse stakeholders, and to address multiple aspects of a given problem or production system. One interviewee stated that "we made the project too big and it would be good to simplify [it]"; another noted that large, diffuse, overly complicated projects may not yield the desired benefits for farmers. The latter added that several partners in the project did not have the staff or capacity to participate in the project as originally planned. At least one

PI indicated that university faculty are pressured to take on too many projects, and should be allowed to focus effectively on fewer projects.

Coordinating many partners over a wide geographical area proved challenging, especially when some partners are themselves juggling too many competing responsibilities. One PI suggested that USDA place less emphasis on multi-state projects, and provide more support to single-state projects that might operate more effectively. Another PI noted challenges in working with a large number of partners with contrasting professional backgrounds. In the experience of one interviewee, starting with a planning grant facilitated effective collaboration among more than 15 co-PIs in a nationwide project.

Working with producers

A majority of PIs reported very positive experiences working with farmers, whom they found innovative, progressive, eager to learn from and work with the team, and welcoming. One referred to "spectacular growers we are working with," and several others described working with farmers as a "great experience," or a "very positive interaction."

A few cited challenges in finding and recruiting certified organic producers, establishing good working relationships with producers, doing controlled experiments in the context of a working farm, or arranging off-farm project activities with busy farmers. A few noted farmers' reluctance to host a trial with an untreated control that may attract pests or other problems. Building long-term relationships with farmers seems important, and one PI recommended "continued involvement of the same farmers in follow-up projects."

One project encountered challenges when experimental treatments resulted in poor yields and inadequate weed control. Faced with the need to deal effectively with weeds, two farm participants departed from experimental protocols and two others who stuck with it became discouraged and gave up on the techniques under investigation. Faced with the need to make a living and struggles with weeds, farmer participants did not see the greenhouse gas footprints of their operations as a research priority. The PI noted that "you need to keep on-farm research more straightforward," yet added that the project yielded information that helped shape future research by the team.

Another PI noted that farmers may face larger constraints on adoption of sustainable practices: "we need to look at what is driving farmer behavior. [Farmers] … feel they are being driven into intensifying and degrading the environment by larger market forces. They recognize the degradation of their communities. We put so much focus on the power of individual farmer decision-making when so much is out of their hands (like ethanol policy)."

Two PIs indicated that their research projects did not engage farmers because the experimental approaches required the controlled conditions at agricultural experiment stations. A third observed that, had the organic community been engaged more effectively during project planning, experimental protocols and outcomes might have been better. Yet another PI would have preferred greater farmer engagement in planning and conducting the research, but encountered constraints related to the structure of seed markets and to policies of different stakeholders.

Project impacts and benefits

PI interviews revealed that the projects had many impacts and outcomes. For example, the PI of an integrated systems study of organic berry production noted several project outcomes: higher yields on raised beds with plant-based vs. manure compost, and with feather meal rather than fish products for nitrogen (N). One farmer participant offered a simple innovation: laying weed mat in two strips that meet in the crop row, rather than a solid piece with planting holes, thus facilitating later compost applications. Many organic and conventional berry farmers in the region have adopted these practices. Another project led to "an increased appreciation of the importance of site specificity in the use of cover crops, considering soil type and farming system."

In a November, 2015 webinar, Drs. Earl Creech and Jennifer Reeve (OREI 2014-05324, Utah State University) shared preliminary data on substantial, long term (>10 years) benefits to organic dryland wheat yield and soil quality from a single heavy compost application. The OREI project will fine tune the system and address net returns on the technique in a region where low and erratic yields raise major barriers for organic wheat growers.

Research on plant breeding has led to new varieties, a contribution with far reaching impacts for organic farmers. A PI for an ongoing plant breeding program noted that OREI funded work to date has provided the groundwork for release of new public varieties, and an opportunity to support smaller seed companies who want to work with and serve organic farmers. Another breeding project has demonstrated soil and water quality benefits of perennial grains. Although further work is needed to develop reliably productive varieties, the project has established a community of practice including producers eager to continue this long-term endeavor.

Two innovative projects partnered farmers with university students to test organic practices in southern Texas. In addition to the immediate benefits of farmers adopting improved irrigation, mulching, and pest control practices, the PI on one of these projects noted that it was the first to bring organic research into this part of the Southern region. This project also attracted interest from farmers in Kansas and Mexico.

Planning grants can have significant impacts as well. PIs cited the strong producer-scientist networks created through the planning process. In one case, producers adopted improved sustainable practices even though the full proposal was not funded.

Even projects that encountered challenges or had limited data from which to create outcomes yielded useful results. For example, practical outcomes from one integrated pest management project were limited by inconclusive results and widely varying populations of the target pest, which complicated both the research itself and farmers' assessments of the benefits and costs of experimental IPM strategies. Another project encountered challenges owing to a dearth of organic producers of the commodity studied; and consequent difficulty in finding farmers to host organic trials. Nevertheless, project outcomes included IPM guidance for both organic and non-organic producers.

PI recommendations for future priorities

Interviews with PIs revealed the need for funding research that will have particular benefits. For example, one interviewee stated the need for research that will help Native Americans adopt organic agriculture, adding that "Native American agriculture needs additional support. Funding for these communities can have an impact on community well-being. We should prioritize projects that have the potential for the greatest impact for underserved and economically disadvantaged people." Other researchers emphasized the need for long term research for organic farming. For example, one interviewee stated that "organic research is relevant to conventional agriculture, but the reverse is not true. There is a particular demand for organic agriculture research with broad applications."

Are OREI and ORG projects scientifically sound?

One interviewee stated that "it is a very effective program that fills a niche that has been deeply lacking. I would like to see OREI funded at higher levels. Farmers are happy with this program because they get a real benefit." Another interviewee considered OREI projects to be "more rigorous because they are more farmer relevant. For me, relevance is part of rigor. We are publishing in top journals." Another PI commented on the great benefit of OREI funded research, and stated, "Our research is very applied. It is very rigorous but very different from a basic research program. We do applied science to research goals rather than discover new knowledge." Of the 13 PIs interviewed, seven believed that research funded by these programs is as scientifically rigorous as other NIFA-funded projects, while three thought it was less so with some projects of poor quality. The remaining three also found OREI-funded research a bit less rigorous, but adequate for research aiming for practical outcomes and drawing on a limited pool of certified organic farms. Two acknowledged a tradeoff between scientific rigor and efficacy in yielding farmer-ready practical outcomes, and thought that OREI is striking a good balance.

Interviews with participant farmers and NGO representatives

Our team interviewed 14 farmer participants representing ten OREI and ORG projects, and two representatives of NGOs who have worked closely with their states' LGUs on several OREI and ORG projects over the past 15 years. Producer roles in research ranged from providing certified organic fields for trials or sample collection, to managing on-farm trials, collecting data, and (for two farmers) designing experiments.

- Seven helped identify priorities or plan project activities.
- Five served on advisory committees.
- Six hosted field days, co-presented at conferences, and/or shared project outcomes one-on-one with other farmers.
- Four projects were still in progress or had inconclusive results, and had not engaged producers in outreach activities at the time of interviews.

Farmer goals for participation

Most producer interviewees (13 of 14) participated in order to learn more about the subject matter of the project, acquire practical information to apply to their farms, and contribute to scientific understanding that could lead to improved organic systems or practices.

- Five sought access to new or existing crop varieties that better meet organic farming challenges in their regions.
- One stated a primary goal of improving farm profitability.
- Five wanted to explore the economic viability of the project's experimental practices or strategies.

Most participants felt that their goals had been met or would be met by the end of the project. Some specific benefits that farmers cited include:

- Acquiring plant breeding skills and helping develop a new crop cultivar.
- Adopting new crop varieties for their farm, based on project findings.
- Nitrogen-efficient, high-methionine corn varieties to be released in near future offering a viable alternative to synthetic methionine in poultry feed.
- Scientific evaluation of innovative weed management strategy designed by the farmer.
- Deeper understanding of the benefits and optimum planting dates for cover crop mixes.
- "Learning what not to do" based on economic analysis of experimental treatments.

Farmer-scientist collaboration

Producer interviewees from nine projects reported satisfying experiences working with PIs and other scientists on project teams. Most farmers said that their questions, ideas, and concerns were heard and understood by scientists on the team, and several expressed appreciation for the two-way learning process. About half felt that they were treated as equal partners while a few reported having a more passive role of hosting on-farm research. Three reported highly effective collaboration with their LGU on several projects over a 10-15 year period. Comments included:

- "It was a wonderful group to work with."
- "It was easy to get in touch with others on the projects and get questions answered."
- "The team is good about relying on farmer knowledge and practice. The scientists take our input combined with their knowledge about what works in our region."
- "Scientists and farmers worked together really well."
- "The LGU scientists and grad students are very easy to work with – they talk with me about the project when I am available, and let me be when I am really busy."

In contrast, one project appeared less successful in building farmer-researcher collaboration. The team proposed to engage 60 producers in a "learning community" to address a priority issue for growers in the region. However, during the first year (2015), farmer engagement appeared limited to brief visits by the research team to collect soil samples. As of April 2016, none of the four growers interviewed had received soil test results for their farms (information they planned to use to fine-tune practices). Producers were not linked in a learning network; instead, the names of other participants were kept confidential. Two interviewees seemed confident that results would be forthcoming, while the other two wondered if the project was still taking place.

One other project, which drew mostly positive comments by the interviewee, also failed to link the many producer participants. In both cases, the projects would benefit from creating strong producer networks to foster a true learning community.

In recent years, OREI request for applications have strongly encouraged applicants to engage actively with producers in project planning, proposal development, and project execution to ensure relevance to producer needs. Outcomes of our farmer interviews (both the success stories and the concerns cited above) point out the importance of this guideline. Farm advisors might offer additional guidance on how to protect sensitive information (e.g., farm business financial details) while fostering effective networking among project participants.

Other challenges encountered in collaborations were mainly logistical: keeping up with complex experiments, integrating small-plot trials into larger scale field crops, learning plant breeding skills and isolation distances, and adverse weather.

Outreach and dissemination

Seven interviewees felt that project outcomes had been effectively disseminated, two were not sure, and five noted that their projects are still in progress and not ready for dissemination. Suggestions for improved dissemination included communications in accessible language through farmers' publications, Cooperative Extension bulletins, and conference talks; and a user-friendly website to provide access to all USDA organic research project outcomes. One interviewee made a recommendation to create a searchable database specific to the OREI and ORG projects. This database would be in addition to, or refinement of, the CRIS database. It would give users ready access to all projects funded through OREI and ORG, searchable by commodity, topic, region, or other parameters.

Farmer innovation supported by research collaboration

Farmer interviews illustrated the tremendous potential for substantive and cost-effective research based on farmer innovation. One grain farmer noted that he periodically swaps fields with a neighboring vegetable grower to mutual benefit. Rotating from vegetables to grains can disrupt life cycles of certain weeds that build up in vegetable systems, and vice versa; and clover underseeded in the final grain crop provides nitrogen for a following vegetable crop. Another grain farmer proposed a modified crop rotation to reduce weed pressure, and the OREI project team conducted a replicated trial to prove the concept. A third grower has worked since 1995 with the LGU to explore long term yield and soil quality benefits of compost applications to an arid region soil.

A small-scale vegetable farmer who hosted OREI-funded pest management trials conducted his own experiment with a simple soap solution that proved highly effective against the target pest. He also integrated one of the project's experimental pest trap crops (pearl millet) into a summer cover crop (with cowpea). This cover crop, terminated by mowing and a two-day solarization for no till organic fall brassicas, gave outstanding broccoli yields without additional N.

In all of these examples, participation in OREI or ORG funded research has facilitated farmer innovations and sound on-farm trials that led to substantive practical outcomes.

Farmer recommendations for future OREI and ORG research priorities

Interviewees expressed appreciation for the benefits these programs offer to the organic farming community. One noted that it has been "good to see the project address the dearth of information for our region," and another "appreciates what seems like unbiased research at the LGU." Six specifically recommended increased funding for USDA organic research.

Farmer research priorities for the future include weed management (6 interviewees), cultivar development for organic systems in their region (4), organic grain production (4), crop rotation for weed control, soil quality, and biodiversity (4), fertility and N management (3), and financially viable systems (2). Plant tissue analysis and foliar feeding, crop-livestock integration, soil building, use of indigenous plants, and C sequestration were each mentioned by one interviewee. One producer also cited a need to revisit NOP rules for arid regions, where current NOP requirements for cover cropping can be hard to meet with an 8-12 inch annual rainfall.

Several OREI and ORG projects on cover crop based organic no-till have encountered tradeoffs between soil quality, weed control, and crop yield. Future research might integrate NOP-compatible thermal and mechanical control tactics (including abrasive grits, OREI 2014-05376) with cover crops and minimum till to enhance the practicality of soil-enhancing organic cropping systems. The OREI program might invite such integrated weed management proposals, as well as conference proposals on this topic.

NGO-LGU collaboration: several perspectives

Different NGOs have collaborated with LGUs to develop and execute effective organic agricultural research projects. For example, the Rodale Institute has had a long and productive working relationship with Pennsylvania State University in five OREI and ORG projects funded between 2003 and 2015. In particular, for OREI 2009-01377 (Improving Weed and Insect Management in Organic Reduced-Tillage Cropping Systems), the partnership between the Rodale Institute and Penn State has:

- Strengthened the long-term working relationship and made the project collaboration stronger.
- Expanded the use of cover crops and cover crop management with reduced tillage. The project goals were met by reaching a broader audience of organic and non-organic farmers through the university system, with presentations within the region, nationwide, and internationally.

- Benefited both entities by having another research site in which to put into practice the technology developed at Rodale. In addition, more scientists were involved in evaluating and generating new information on how the techniques work.
- Promoted collaboration between project managers and all partners in designing treatments. Everyone had a chance to be heard and all were kept informed.
- Produced project outcomes that are highly relevant to organic producers.

Our team interviewed the Executive Director of a NGO that has worked with the state LGU since 1990 to expand organic research and education programs. Over the past 12 years, the LGU has asked the NGO to support several OREI and ORG projects by identifying farmer participants, serving on an advisory committee, and providing outreach. Relationships with several of the scientists have been excellent, and the university has recently launched a farmer-interactive organic research web site. Yet, several challenges remain:

- NGO resources are "stretched" by the added responsibilities related to the grants.
- Some researchers set priorities before approaching producers or the NGO; and in one project, seemed to have a mission of "correcting" farmer perspectives, thereby creating a "top-down" relationship. The director thought that the problem may stem from researchers feeling overburdened with responsibilities, as well as structural aspects of the university research community, and expectations placed on scientists.
- OREI and ORG request for applications require engagement of NGOs in outreach, a role traditionally assigned to Cooperative Extension. Occasionally, this has led to some tensions, though the LGU and NGO are working together to build extension capacity to work with organic producers.
- Some producer members of the NGO express enthusiasm about OREI and ORG project collaboration, while others are unsure how to apply project outcomes to their farms. Part of the challenge is designing workshops and webinars for an audience with widely varying experience, from beginning to highly experienced farmers.
- The NGO continues to work with the university to build a stronger collaboration.

Staff members of a third NGO, who provided our team contact information for farmer interviewees, reported an excellent working relationship with the state LGU, and expressed great appreciation for the project PI who worked with producers and processors as equal partners. The quality of this collaboration was confirmed in the producer interviews.

NGO partners have recommended future program emphasis on an integrated approach to soil health that includes crop-livestock integration as well as cover crops and reduced till. This body of research can also provide the scientific basis for improving some other USDA programs. For example, two programs that would benefit are the USDA crop insurance program provisions that mandate early termination of cover crops (already undergoing review and modification), and NRCS practices that "put cows under roof" to avoid nutrient pollution, rather than improving nutrient cycling through advanced rotational grazing systems and crop-livestock integration.

Finally, there is an opportunity to tap into research that farmers are already conducting on their own farms. The OFRF 2015 National Organic Farmer Survey (Jerkins and Ory, 2016) found that 66% of respondents reported conducting on-farm experiments on their own. These experiments ranged from comparing different crop rotations, cover crops, and mulches, to crop variety evaluation and animal breeding. This further illustrates the great opportunity and potential value of NGO involvement with engaging producers as active partners in organic farming research.

Summary of USDA OREI and ORG 2015 organic funding

The projects funded in 2015 by both OREI and ORG have addressed particular high priority areas identified in this report. For example, the projects that focus on soil health, climate, livestock health and weed management all address important topic areas identified by farmers in the 2015 OFRF organic farmer survey (Jerkins and Ory, 2016). This most recent round of funding in 2015 demonstrates the relevance of OREI and ORG funding to the practical needs of organic farmers, and the need to build and strengthen these influential programs.

In 2015, OREI funded 20 projects totaling $17,580,309. These projects, listed in Appendix A4, cover research, education, and extension based projects. Among others, the projects funded in 2015 involved research on organic grain production, insect and disease management, and herd health and productivity on organic dairies. The new projects address particular needs stated in this report, especially projects that tackled issues on dairy production, plant breeding, and projects that combined agronomic research and economic analysis. For example, the project "Leveraging long-term agroecological research to improve agronomic, economic, and environmental performance of organic grain production" is a good example of a project that approaches a top organic production issue from a comprehensive viewpoint. The education and outreach projects include a grant to UC Davis for the Organic Agriculture Research Symposium (OARS) and a grant to the University of Wyoming titled, "A modular curriculum to teach critical concepts in organic agriculture across regions."

The ORG program funded seven new projects in 2015. The total funding from ORG totaled $3,364,829. Several of the research projects funded focus on climate change impacts on organic systems and how different management practices affect the production of green house gasses. For example, one project based at Montana State University is looking at the resiliency of crop-livestock systems under current and predicted climate. Another project addresses at soil carbon sequestration and greenhouse gas emissions in organic pastures under intensive grazing. Other projects include such topics as new fertilizer sources, weed management decision-making, and protection of curcurbit crops.

DISCUSSION

Our review of 189 projects funded through OREI and ORG between 2002 and 2014 revealed a treasure-trove of research findings for the organic farming and ranching sectors, as well as some innovative approaches to engaging producers in research and outreach activities, and to disseminating project outcomes. The OREI and ORG programs have advanced the cutting edge of organic and sustainable agricultural systems in several ways by providing:

- New information, tools, techniques, seeds, and materials for organic producers.
- New outreach venues or methods to deliver project outcomes to producers and other stakeholders.
- Intermediary research outcomes that are not yet ready for delivery to farmers but provide a foundation for additional research and development of new tools or practices.
- New or strengthened networks or communities of practice comprised of producers, researchers, service providers, and other stakeholders.

Evaluating the "return on investment" of $142.2M in tax dollars for 13 years of OREI and ORG funded research raises some challenging questions. Like any investment, putting money, brainpower, and other resources into any field of research entails risk. The nature of research is that not all creative ideas "work," experiments to test hypotheses often give negative or inconclusive results, and promising new technologies may not fulfill their promise or may require many years and iterations of fine-tuning before they become practical and cost effective. This is especially true for research into relatively uncharted waters, such as organic and sustainable agriculture, whose research history in both USDA and land grant universities essentially began in 1988 with the founding of the SARE program. This is in contrast with the much larger investment in conventional agriculture research since the end of World War II.

Research findings, new tools, and educational materials developed through ORG and OREI have helped many farmers and ranchers, and have significantly advanced the state-of-the-art of organic agriculture. However, some projects may fall short of their potential if:

- The project team addresses a high priority issue, generates inconclusive or intermediary results that require more work to develop practical guidance for farmers, but does not receive additional funding to continue.
- The project is too complex in its design so that the team's resources are spread too thin.
- Two or more teams working separately on a given problem or issue are not aware of one another's endeavors and findings, and thus miss an opportunity to weave complementary components or tactics into a more effective integrated strategy.
- The project yields practical outcomes, but does not disseminate them adequately.
- Practical outcomes are effectively disseminated or shared during the project, but are not retained in durable and accessible form beyond the life of the grant.

- Experimental treatments do not accurately represent or relate to sustainable organic production systems in the project's target region.

The following sections explore some of the greatest successes of OREI and ORG, as well as some areas in which NIFA might improve program efficacy.

Plant breeding and cultivar development

Loss of crop genetic diversity has emerged as a nationwide agricultural and food security concern. Organic farmers in particular, face a dwindling availability of vegetable, grain, and other crop varieties suited to their regions, production systems, and market needs. With genetic engineering and other "high tech" approaches yielding privately held patented seed, funding for classical plant breeding has dried up, and the public plant breeder has become an endangered species. Thus, one of the most inspiring findings of our analysis has been the OREI and ORG investment in farmer-participatory plant breeding and cultivar development. Examples include:

- *Organic Seed Partnership (OSP*) (OREI 2004-05205, Cornell University, $894K) engaged 217 farmers in on-farm plant breeding and variety evaluation. OSP trialed 290 named varieties and 300 breeding lines of 29 vegetable crops, and released 26 new public cultivars with disease resistance, superior flavor, or other desired traits (three bell pepper, two tomato, seven summer squash, three butternut squash, four cucumber, four melon, and three broccoli). At least 80 OSP producer participants adopted one or more new varieties, and most wanted to maintain the plant breeding network beyond the life of the grant.

- *Northern Vegetable Improvement Collaborative or NOVIC* (OREI 2010-03392, Oregon State University $2.31M) engaged farmers and university breeders around four hubs (OR, WA, WI, and NY) in breeding and trialing snap and snow pea, dry bean, broccoli, kale, carrot, table beet, tomato, sweet pepper, sweet corn, and winter squash. Outputs include a new multiple-disease-resistant tomato "Iron Lady," several other vegetable varieties, increased markets for existing sweet pepper and other vegetable varieties that performed well in on-farm trials, many advanced breeding lines with improved tolerance to temperature extremes and other desired traits, and a vibrant network ready to continue work under NOVIC II (OREI 2014-05402, Oregon State University, $2.00 M). NOVIC has also produced two books: *Organic Crop Breeding* and *The Organic Seed Grower.*

- *Critical Pest Management Challenges in Organic Cucurbits* (OREI 2012-02292, Cornell University, $1.96M) includes farmer-participatory breeding as a major component of integrated pest and disease management. Cornell plant breeders are working with producers in the Northeast and Southeast regions to develop cucumber, melon, and winter squash varieties resistant to downy and powdery mildews, cucumber beetle, and aphid-vectored viruses.

- *Potato Clones for Organic Production* (ORG 2002-03799, University of Wisconsin, $140K), and *Organic Certified Seed Potato Production in the Midwest* (OREI 2009-01429, University Wisconsin, $541K). Although not plant breeding per se, these projects engaged farmers in evaluating hundreds of potato varieties for organic systems, developed improved practices for organic production of disease-free

potato seeds, and established an ongoing network and website, *The Organic Potato Project*. In 2015, activities included farmer-participatory breeding (making crosses with true seed) a notable accomplishment in tetraploid crop that normally reproduces asexually by tubers.

- *Developing Wheat Varieties for Organic Agriculture* (ORG 2006-02057, Washington State University, $691K) engaged producers and bakers in evaluating varieties and breeding lines for organic production in the Pacific Northwest, considering baking quality as well as disease resistance and other important agronomic traits. In three years, the project developed 20 elite lines under consideration for release as new varieties.

- *Improving Soybean and Dry Bean Varieties and Rhizobia for Organic Systems* (OREI 2012-01942, University of Minnesota, $1.45M) is working with producers to develop and evaluate new bean varieties with vigorous root systems for enhanced weed competitiveness, drought tolerance, and nodulation and N fixation. Several promising breeding lines and several superior Rhizobium strains have been identified.

For more information on plant breeding and a list of OREI and ORG funded projects that include plant breeding or substantial crop variety evaluations that can provide a basis for future breeding efforts, see Appendix G.

Return on investment: small and simple versus large and multifaceted projects

Certain OREI and ORG funded projects stood out as yielding a large return on investment in terms of practical benefits to organic producers and society as a whole. Among these are several projects with relatively small budgets, including:

- *Potato Clones for Organic Systems* (ORG 2002-03799, University of Wisconsin, budget $140K). Evaluated 500 clones on organic farms using simple field methods. Project grew into ongoing Organic Potato Project with farmer-participatory breeding and seed production.

- *Strategies [for] the Transition [to] Organic Dryland Grain Production* (ORG 2002-03805, Washington State University, $16K). Nine crop rotations evaluated during transition; much practical information on best rotations for soil quality, weed control, and yields.

- *Flea Beetle Control Demonstration* (ORG 2007-01391, Washington State University, $74K). Eight farms hosted demo trials of seven simple tactics against crucifer flea beetle; several proved effective; farmers at field days added these tactics to their organic IPM.

- *Integrating Organic Apple and Pork* (OREI 2007-01418, Michigan State University, $33K). Grazing hogs in apple orchards reduced major pests and weeds; hogs thrived on dropped apples. Project outcomes elicited considerable interest among apple and pork producers.

- *Building Integrated Weed Management Knowledge in Organic Systems* (OREI 2007-01417, Michigan State University, $106K). Developed 132-page Extension bulletin on organic weed management with substantial farmer input (Michigan State University Extension, 2008).

- *Organic Farmers' Guide to Contracts* (OREI 2010-01899, Farmers Legal Action Group, $109K) published a Guide with toolkit to help producers review and negotiate contracts.

Conference grants, funded at $50,000 or less, allow producers, scientists, educators, and other stakeholders to share new research developments, ideas, resources, and perspectives; and to re-evaluate research priorities. They provide an opportunity for several teams working on different aspects of a given problem to identify potential synergisms, propose new hypotheses, or develop integrated strategies to address the problem. Examples of OREI funded conferences include:

- *Working Group, Symposium, and Action Plan for Organic Seed Systems* (OREI 2009-01343, Organic Seed Alliance) convened farmers, plant breeders, and other stakeholders to develop a *State of Organic Seed Report and Action Plan*, updated every five years. The first update was completed and published in 2016.
- *Organic Agricultural Research Symposia* (OREI 2007-01384, Midwest Organic and Sustainable Education Service; OREI 2011-01982, Northeast Organic Farming Association of New York; OREI 2014-05388, University of Wisconsin), provided a venue for disseminating OREI, ORG, and other research outcomes.

Planning projects also bring scientists, producers, and other stakeholders together to share information and perspectives, and identify priorities. Of the 16 OREI planning grants between 2009 and 2014 (budgets $31-50K), 14 yielded full OREI proposals, of which six were awarded. Several planning projects whose full proposals were not funded appear to represent missed opportunities to further organic research, yet the planning process itself had significant impacts:

- *No-till Organic Vegetables* (OREI 2009-01327, Washington State University, $47K). Planning began with a symposium on organic no-till vegetables, attended by 39 farmers and 36 agriculture professionals. Farmers modified practices based on what they learned at the symposium.
- *Organic Tribal Bison Production* (OREI 2010-01916, South Dakota State University, $44K). The planning process led to improved pasture and herd health management.
- *Functional Agricultural Biodiversity* (OREI 2011-02005, Oregon State University, $47K). The planning project led to a review of conservation programs in CA, ID, and OR; and helped NOP update guidance on biodiversity and natural resources for certified organic farmers.
- *Planning for Organic Plant Breeding and Seed Production in the Southeast* (OREI 2014-05325, Organic Seed Alliance, $43K). Surveys and grower forums identified vegetable breeding priorities and developed a strong team, which plans to re-apply in 2016.

Given the importance of functional agricultural biodiversity for pest and disease management, resource conservation, and the overall ecological stability of agroecosystems, we believe that failure to fund the full proposal submitted by the highly effective planning team (OREI 2011-02005) was a missed opportunity to advance this cutting edge research in sustainable organic agriculture.

Some larger projects also stood out as particularly cost-effective. Examples include:

- *Organic Seed Partnership* (OREI 2004-05205, Cornell University, $894K) and other farmer-participatory breeding projects, as noted above.
- *Milk Quality and Safety in Transitioning Dairy* (ORG 2004-05169, Cornell University, $518K) developed a rapid, accurate method to detect six major foodborne pathogens in raw milk, a test now widely used among dairy farmers in the Northeast.
- *Enhancing Farmers' Capacity to Produce High Quality Bread Wheat* (OREI 2009-01366, University of Maine, $1.32M) integrated variety evaluation, nutrient and weed management for yield and quality; developed a network of producers, millers and bakers; and began to build a local organic bread industry. Additional OREI funding was awarded in 2015.

Projects with a "negative" outcome can also be cost-effective if they help producers avoid ineffective or counterproductive practices. For example:

- *Crop Plant Nutrition and Insect Response* (ORG 2006-02048, University of Wisconsin, $374K; and OREI 2010-01998, $659K), evaluated the "base cation saturation ratio" (BCSR) system of soil nutrient balancing in relation to crop health and pests. BCSR had no effect on crop performance, except when gypsum was used to raise Ca levels, resulting in higher corn tissue sulfur levels and accelerated growth in the European corn borer pest. Thus, producers can save money (and sometimes corn) by not using BCSR; they can also benefit from an excellent corn IPM webinar published by the project
- *Effects of Cover Crops on N2O Emissions, N Availability, and C Accumulation in Organic vs. Conventional Systems* (ORG 2011-04952, Michigan State University, $749K). An organic system incorporating green manure with poultry litter emitted a huge burst of N2O from the soil after heavy rain, a caution that heavy use of N-rich organic inputs can increase the risk of N2O emissions. This outcome may have stimulated additional ORG applications to study management impacts on N2O in organic systems (three awards in 2015).

Some large-budget projects did not seem as cost-effective in terms of practical tools or information that farmers can use. Many of these projects tackled complex issues like greenhouse gas impacts or the soil quality/weed management dilemma (see the following section). A few projects invested considerable sums in what seem like lower priority research issues, or questions that might be adequately addressed with a smaller budget. For example:

- *Milk and Meat Residues of Organic Therapies for Mastitis* (OREI 2014-05326, North Carolina State University, $1.42M). Risks of plant-based NOP-allowed remedies causing off-flavor, triggering antibiotic residue tests, or compromising food safety were studied by dosing then euthanizing cattle. Other than garlic flavor in milk leading to market losses but no human health risks (a problem which should not require such a high cost in dollars and sacrificed animals), these seem like remote risks.

- *Mental Models for Weed Management* (OREI 2009-01420, Ohio State University, $2.23M). Psycho-sociological study on farmers' weed management decisions and strategies was an interesting study, but the price tag seems high. A follow-up study funded by ORG in 2015 ($499K) seeks to quantify ecological weed management impacts to facilitate adoption, which may enhance return on the initial investment, especially if it leads to wider adoption of soil-conserving ecological weed management in organic systems.

A few projects appear to have utilized non-optimum treatments, or "organic" systems that do not accurately reflect the spirit of the NOP standards. Examples include:

- *Water Quality in Organic and Conventional Vegetables under Conservation and Conventional tillage* (ORG-2009-05488, North Carolina State University, $659K). The "organic" system of continuous sweet corn (incompatible with NOP standards), fertilized heavily with poultry litter (180 lb. N/ac-yr.) on a field with conventional management history, yielded poorly because of intense weed competition, and harmed water quality with excess phosphorus (P). Depleted soil biology, poor soil quality, and unbalanced nutrient inputs, may have contributed to these problems. Study outcomes favored the non-organic no-till treatment over organic, which the experimental protocol did not accurately represent.

- *Summer Cover Crops for Weed Suppression and Soil Quality* (OREI 2009-01311, Cornell University, $894K). Sudangrass, mustard, and buckwheat tested singly as late-summer weed-suppressive covers in MI, IL, and NY performed so poorly that farm trials were canceled. Multispecies covers are well known to perform better against weeds because they fill the niche more completely, and a sudangrass-broadleaf mix may have given better results.

- *Vermicompost-based Media for Organic Vegetable Seedling Production* (OREI 2009-01405, University of Hawaii, $351K). Vermicompost was used at 25-100 % of mix. Earlier research and farmer experience has shown that vermicompost gives best results at 10% of mix; higher rates can cause salt stress as well as increasing the cost of the mix.

Sophisticated, high tech analytical methods may be warranted for some objectives, such as clarifying mechanisms of plant disease suppression in biologically active soils, characterizing the genetic basis of plant disease resistance, or quantifying net greenhouse gas impacts of a farming system. These methods inevitably add to the cost of a project, yet may be needed to fully address some organic research priorities and objectives. On the other hand, lower-cost experimental methods and measurements can often yield valuable data, and based on PI interview findings, simpler, more focused projects can be easier to run efficiently. Thus, NIFA should consider the value of both simple, low-budget projects and larger projects that entail sophisticated methods and/or multi-disciplinary multi-institutional approaches, and seek to strike an appropriate funding balance between small and large projects.

Addressing top organic challenges: weeds, nitrogen, soil health, and environment

At least 36 OREI and ORG funded projects tackled the weed management/crop nutrition/soil health dilemma with integrated approaches that emphasized cover crops, diversified crop rotations, and reduced tillage. Many of these projects also addressed nutrient management, crop pests, and diseases. In addition to field assessments of soil quality, weeds, and crop yields, many project teams analyzed soil microbiological communities or weed seed banks, soil C sequestration, or net greenhouse gas impacts including CH4, and N2O, as well as CO2.

A few examples of these ambitious projects include:

- *Cropping intensity and organic amendments in transitioning farming systems: effects on soil fertility, weeds, diseases, and insects* (ORG 2003-04618, University of Illinois, $483K).
- *Building on success: a research and extension initiative to increase the prosperity of organic grain and vegetable farms* (OREI 2009-01340, Cornell University, $1.43M).
- *Environmental and economic costs of transitioning to organic production via sod-based rotation and strip tilling in the south coastal plain* (ORG-2010-03958, University of Florida, $624K).

This holistic approach to addressing multiple, top-priority, inter-related organic production issues with multiple practices, reflects the heart and soul of organic farming itself. Our team had anticipated that USDA's substantial investment in these endeavors would yield a lot of valuable practical information and guidance to help organic farmers simultaneously improve their soil, weed, and nutrient management in annual cropping systems. However, our review of project reports available on the CRIS database left us with little knowledge of such practical guidance. Possible constraints include:

- Tradeoffs among soil quality, weed control, and crop yield remained severe, especially in colder climates and shorter growing seasons, in which maximizing cover crop biomass and minimizing tillage slashed crop yields. For example, this occurred in studies of field crops in Iowa (ORG 2008-01284), corn and soybean in Pennsylvania (OREI 2009-01377), tomato in Indiana (OREI 2010-01913), and late summer cover crops for weed control in the Great Lakes and Northeast regions (OREI 2009-01311).
- Results have been inconsistent among projects and often among site-years within a project. This may reflect the site- and season-specific nature of crop-weed-soil-microbe dynamics. Solutions developed for field crops in Pennsylvania might not work for vegetables in North Carolina, much less dryland wheat in Montana. They might even fail in Pennsylvania during an extremely dry or wet year.
- Another source of inconsistency among project outcomes may be in the details of experimental treatments, including inputs, tillage, crop rotation, etc.

- Many project reports present experimental procedures in detail, but give limited information about results (e.g., OREI 2006-02047, crop diversification, pests, and beneficials, University of Florida; and ORG 2011-04960, targeted sheep grazing to reduce tillage, Montana State University).
- Reporting for some projects was not up to date at the time of our analysis.
- As noted in PI interviews, some project teams tried to do too much and were not able to explore any one aspect of the system in sufficient depth to obtain useful answers.

Results from the 2015 National Organic Farmer Survey indicate that weed control, soil health, and fertility remain top research priorities for organic producers (Jerkins and Ory, 2016). Similarly, USDA NIFA clearly recognizes that the weed/soil health dilemma requires a long-term commitment, and has awarded two or more grants each to several teams grappling with it. For example, Pennsylvania State University has received funding for five projects, each building upon earlier results and refining the team's approach:

- *Organic weed management: balancing pest management and soil quality* (ORG 2003-04619, $498K).
- *Weed and insect management in organic reduced-tillage systems* (OREI 2009-01377, $2.54M).
- *Multi-functional cover crop cocktails for organic systems* (OREI 2011-01959, $2.30M).
- *A reduced-tillage toolbox integrating cover crops and reduced tillage in organic system*s (OREI 2014-05377, $2M).
- *Making diversity functional: farm-tuning cover crop mixtures to meet grower needs* (OREI 2015 award, $1M) .

The eOrganic page of the eXtension website contains additional practical information on cover crops and reduced tillage for soil quality and weed management. For example, Charles White, Mary Barbercheck, and colleagues on OREI 2011-01959 posted an excellent article, *Making the Most of Mixtures: Considerations for Winter Cover Crops in Temperate Climates*, that walks the farmer through the process of selecting the best cover crop mixture for their goals, farming system, crop rotation, climate, and soil type. A number of webinars and articles have been posted by other OREI and ORG funded teams that address this complex of issues.

During the 2010-2014 funding cycles, the ORG program focused on evaluating and comparing soil C sequestration, total greenhouse gas mitigation (CO_2, CH_4, N_2O), water quality, and other ecosystem services from organic *versus* non-organic, and conventionally tilled versus no/reduced till farming systems. ORG funded 18 projects on greenhouse gas (total $12.7M); seven of which are among the 36 that addressed the soil quality/weed management dilemma. Projects had one or more of three overall objectives:

- Test the hypothesis that organic systems sequester more C, emit less greenhouse gas (in CO_2 equivalents), or otherwise have more benign environmental impacts than conventional.
- Identify ways that organic producers can improve their C sequestration or greenhouse gas footprint.
- Develop or improve tools and models for estimating C sequestration, net greenhouse gas emissions, or water quality (nutrient) impacts, for use in NRCS programs or carbon markets.

Based on the CRIS abstracts, these projects encountered a familiar set of challenges: tradeoffs between yield and environmental protection; inconsistent or inconclusive results; soil, site, and season-specific factors that regulate soil biology and thereby net greenhouse gas emissions; and consequent difficulty in developing clear, reliable guidelines for producers. In addition, a few projects showed high N_2O emissions, higher risks to water quality, or other potentially adverse impacts from organic treatments. Depending on how these surprising outcomes are communicated, they could either offer important guidance for organic and transitioning producers or deter adoption of organic systems.

The large investment in addressing the soil-weed conundrum and greenhouse gas footprint analyses (total of 47 projects, $41M) raises the question of how cost-effective these endeavors have proven. One factor contributing to the cost and the long timelines is that quantitative assessments of soil microbial communities and biological processes, soil C and N dynamics, and net C sequestration or greenhouse gas emissions of farming systems, require fairly sophisticated equipment and procedures, some of which require further refinement before reliable outputs can be assured. A second factor is that the large volume of data generated from these procedures, plus field assessments, may require extensive analysis to identify trends and practical guidelines for producers. Finally, a meta-analysis of multiple projects may be needed to gain a better understanding or more accurate interpretation of findings to date.

Given the high priority and inter-locked nature of the soil, weed, nutrient, and pest challenges that organic producers face, overlaid by the global challenges of climate change and water quality, it seems essential for NIFA to continue funding integrated work in this area. However, some adjustments in approach may help these endeavors move toward the ultimate objective of developing practical information and tools for organic producers. These might include:

- In lieu of expecting each project team to address the full gamut of these issues, fund some projects that address one or two components in depth.
- Encourage project teams working on different components of these issues to interact, share outcomes and perspectives, and thereby develop holistic assessments and practical solutions. Continue to fund organic research conferences and symposia, and explore other possible venues to foster sharing and synergism among OREI, ORG, and other organic research teams.
- Invite proposals for meta-analyses of projects that address soil quality and weed management, and projects that address C sequestration, greenhouse gas footprint, and other environmental impacts of organic, reduced-till, and conventional systems.

Dissemination and long-term availability of project outcomes

The Organic Agriculture page of eXtension (http://www.extension.org/organic_production), developed and maintained by the eOrganic Communities of Practice, offers an extensive array of practical information based on organic research, including many OREI and ORG projects. In addition to hundreds of articles and videos and 130 archived webinars, eOrganic has hosted several project websites such as NOVIC (OREI 2010-03392 and 2014-05402, Oregon State University), grain corn breeding (OREI 2010-02363 and 2014-04350, ARS-Ames, IA), IPM for brown marmorated stink bug (OREI 2012-02222, Rutgers University), IPM for spotted wing drosophila (ORE 2014-05378, University of Georgia), and organic cucurbit pest manage-

ment (OREI 2012-02292). Some projects that seemed to offer little in the way of outcomes in their CRIS reports, delivered valuable information and products via eOrganic.

Between 2007 and 2014, at least 59 other OREI and ORG projects (40% of awards during these years) have utilized eOrganic to deliver outcomes to producers and other end users through webinars, articles, videos, project websites, and other media. Initially, eOrganic communities of practice focused on aspects of organic vegetable crops (cover crops, soil quality and fertility, weed-pest-disease management, cultivar development, marketing, etc.) and dairy (animal nutrition and health, pasture management, etc.). However, eOrganic has also posted webinars and other informational materials from OREI and ORG funded work in fruits (10 projects), grains and other field crops (14), poultry (2), crop-livestock integrated systems (3), and topics that apply to multiple commodities such as greenhouse gas mitigation (3) and functional biodiversity (3).

Three OREI grants (OREI 2007-01411, OREI 2009-01434, and OREI 2010-01944) funded the eOrganic launch and early content development. In recent years, ongoing eOrganic content development, webinars, and other activities have been funded through other sources, including sub-awards within other OREI and ORG grants. Some additional funding has been provided by eXtension; but in 2015, eXtension discontinued financial support for communities of practice.

For several years, OREI request for applications "strongly encouraged" applicants to coordinate online development with eOrganic and eXtension. Applicants planning "substantial collaborative activities" with eOrganic were required to include funding for eOrganic in their budgets. One PI interviewed by our project raised concerns about being required to pay for eOrganic services throughout the project when farmer-ready materials were not ready for dissemination until near the end. In 2015, OREI request for applications language regarding the use of eOrganic was softened to "encouraged but not required." Language regarding inclusion of funding from eOrganic in project budgets was removed from the Purposes and Priorities section of the requests for applications, though it is still mentioned under Evaluation Criteria for proposal quality.

Conferences and symposia funded through OREI also offer a vital means to get organic research outcomes out to producers, researchers, and the public; proceedings or recordings are available through eOrganic or project websites. For example, presentations at the 2015 Organic Agricultural Research Symposium (OREI 2014-05388, University of Wisconsin), included important practical outcomes that were not as clearly stated in the most recent CRIS reports. These include:

- *Successful use of NOP-compatible natural supplements (caprylic acid and essential oils) to reduce pathogen loads in poultry* (OREI 2011-01955, USDA ARS Fayetteville AR).
- *Successful farmer-participatory breeding of ancestral and modern wheat varieties for organic systems* (OREI 2009-01936, University of Maine; and OREI 2011-01994, Cornell University).
- *Substantial (15-20%) increases in milk production and omega-3 content in cattle grazed on birdsfoot trefoil, versus grass in a semiarid environment* (OREI 2010-01869, Utah State University).
- *Advances toward nitrogen-efficient corn cultivars.*

Other potential outreach channels for OREI and ORG projects include the National Sustainable Agriculture Information Service (ATTRA), and publications such as Northeast Organic Farming Association newspaper, *The Natural Farmer*, or the nationwide monthly, *Growing for Market*. However, it was beyond the scope of this project to track down all ORG and OREI project outcomes through these channels.

In conclusion, it appears that delivery of farmer ready project outcomes has been substantially more effective than initially surmised from the data collection phase based on the CRIS abstracts, especially during the latter seven years of the programs, when many projects utilized eOrganic. Remaining concerns include:

- At least half of the projects funded since the 2007 launch of eOrganic have not used this venue and have not indicated plans to do so in their proposals.
- Given the difficulty in locating practical information and project products via the CRIS reports, a farmer seeking such products from a specific project may have difficulty finding them, especially for projects that did not utilize eOrganic.
- In addition, farmers, researchers, or service providers seeking practical information or research data based on OREI and ORG funded work on a particular topic, commodity, or issue may not find it easy to locate all that is available. A "one-stop shop" consisting of a searchable database leading to links to key practical outcomes or research findings on any topic or commodity, would assist searches by producers and agricultural professionals, thereby facilitating both future research efforts and producer adoption of existing outcomes. The CRIS database does not currently provide this function.
- At least a few projects funded during the early years of OREI and ORG (before eOrganic) developed excellent practical information or products that may be lost or "stuck on the shelf" because of inadequate dissemination or failure to publish products in a durable and accessible form.
- It is not clear how the eOrganic communities of practice will be sustained financially in the future. On one hand, toning down request for applications language regarding eOrganic may remove pressure on project teams to utilize and budget for eOrganic every year of their project. On the other hand, if eOrganic funding via sub awards under other ORG and OREI projects dwindles, it is absolutely vital that alternative means be identified to fund the ongoing development and utilization of eOrganic as a tool for development and dissemination of webinars, decision tools, and other project products.

Retention and dissemination of valuable project outcomes and tools might be improved by:

- Implementing a system that encourages all OREI and ORG projects to access eOrganic, and that ensures sufficient funding to sustain eOrganic itself over the long term without imposing undue budgetary or logistical burdens on project teams, and
- Requiring each project to submit a succinct, prominently displayed list of key project outcomes in its final report for the CRIS database. The list should include web links or other resource references so that producers can rapidly access any farmer-ready information, tools, seeds, or other project products.

RECOMMENDATIONS TO USDA NIFA REGARDING OREI AND ORG

Our team documented many wonderful examples of important organic research advances through the OREI and ORG programs, and identified several ways that the programs could be further strengthened through improvements in funding for priority areas and project administration. Enhancing the OREI and ORG programs based on the following recommendations will require additional funding for these programs. Increased organic research funding is urgently needed and would ensure the continued growth of the organic sector. We recommend the expansion of USDA funding for organic research and development to become at least commensurate with the market share of organic agricultural products in US commerce.

Increase research on underfunded and emerging priority areas.

- Continue to address ongoing and emerging organic research priorities, including those identified by the NOP National Organic Standards Board (updated annually), and the Organic Farming Research Foundation (Jerkins and Ory, 2016).
    - Examples of ongoing priorities include soil health and fertility; weed, pest, and disease management; crop-livestock integration; and economic issues.
    - Examples of emerging priorities include pollinators and pollinator habitat, functional agricultural biodiversity, food safety in organic systems, preventing GMO contamination in organic crops, and application of advanced data systems (GPS based field tracking, precision technology, etc.) to organic production.
    - Invite projects that integrate new NOP-compatible weed and pest control technologies (mechanical, thermal, etc.) with cover crops, rotations, and organic no-till.
- Continue to fund projects on a wide range of agronomic and specialty crops; invite and fund proposals for commodities that were under-represented in OREI and ORG awards between 2002-2014, including rice, cotton, tree nuts, herbs, and cut flowers.
- Continue to prioritize development of public crop cultivars for organic systems, continue to support farmer-participatory plant breeding and organic seed production networks, and provide an option for long-term funding.
    - Continue to address organic breeding priorities such as regional adaptation, nutrient use efficiency, durable (multi-gene) disease and pest resistance, weed-competitiveness, performance in resource-conserving systems such as organic minimum-till, and market traits such as flavor, nutritional value, and milling quality, etc.
    - Address remaining gaps, such as vegetable crop varieties for the Southern region.
- Increase funding for organic livestock and poultry production; invite and fund proposals for under-represented commodities, especially beef, pork, and turkey.

- Invite and fund proposals to identify traits and develop new and improved livestock and poultry breeds for organic production, with emphasis on disease and parasite resistance, overall ability to thrive in lower-input systems, performance on pasture and rotational grazing systems, and other priorities for organic systems. Provide an option for long-term funding for livestock breeding endeavors.

- Invite and fund proposals for meta-analysis of past and ongoing OREI and ORG research on complex issues such as soil health, integrated organic weed management, and C sequestration and greenhouse gas mitigation in organic systems. Encourage applicants to include conferences, symposia, teleconferences, or other opportunities for researcher and producer representatives of project teams to share data and perspectives, and exchange ideas on the topic of meta-analysis.

- Continue to require that practices tested as the primary experimental hypothesis or system be compliant with current NOP rules. In addition, make alignment of experimental organic treatments with principles of sustainable agriculture a criterion for proposal review.

Balance funding for smaller proposals with simple goals and on-the-ground methods, with larger, more complex, and multi-institutional projects.

- Continue to fund conferences, symposia, and planning projects to bring farmers, researchers, and other stakeholders together to disseminate and share OREI and other organic research outcomes, as well as ideas and perspectives on future research.

    - Encourage proposals for symposia on challenging issues like co-management of weeds and soil quality, organic minimum till, greenhouse gas estimation and mitigation, dryland organic grain production, poultry nutrition, parasite management in small ruminants, and effective alternatives to materials that may be removed from the NOP National List.

    - Announce planning grant awards early enough in the annual funding cycle to allow teams time to develop and submit full proposals in the next funding year.

    - Periodically adjust the $50,000 funding cap for conference and planning grants for changes in cost of living (currency inflation).

- Fund smaller, targeted OREI projects (<$500 K) as well as larger, multi-issue, multi-disciplinary, and multi-institutional projects.

    - Retain the three-tier structure for integrated projects adopted in the 2015 and 2016 OREI requests for applications, and consider adopting a 20% funding set-aside for targeted projects.

    - Instruct proposal review panels to consider the efficacy of simple, well-designed, lower-budget, targeted projects, as well as the power of sophisticated methods and the scope of large, holistic projects that tackle multiple issues simultaneously. Panels should also weigh the costs and benefits of including many versus fewer partners, and not automatically prioritize the most "multi-institutional" projects.

Increase research funding to underserved entities, regions, and constituencies

- Continue to invite and fund proposals from underserved regions (the Southern region) and constituencies (Native American and other ethnic minorities), 1890 LGUs and other smaller universities and colleges, and non-governmental organizations engaged in organic agriculture research, education, and outreach.

- Instruct review panels to evaluate and select proposals on the basis of scientific merit, relevancy to organic producer and processor priorities, NOP compliance, and cost efficacy, rather than size, endowment, and infrastructure of the applicant institution.

- Eliminate the match requirement for all applicants for OREI and ORG funding, to make the programs more accessible to NGOs and other entities.

Increase producer engagement

- Continue to encourage the engagement of producers in all phases of a project from goal setting and proposal development through planning, execution, outreach, and evaluation.

- Encourage projects to link producer participants with one another and with project scientists in learning networks; and provide guidance on how this might be achieved while ensuring confidentiality of any sensitive producer information (such as business data).

Improve project reporting, dissemination, outreach, and access to project outcomes.

- Require and facilitate consistent and up-to-date reporting for all projects on the CRIS database:

    - Require final project reports to provide a clear and prominently displayed summary of key project outcomes, including new crop varieties, new NOP-compatible pest controls, decision tools, manuals, information sheets, videos, and other farmer-ready products (with web links or other sources through which farmers and service providers can access each), as well as intermediary research findings and emerging research questions intended for the scientific community.

    - Require a complete listing, in the project proposal and/or final report, of all major project partners, to allow producers and other stakeholders to identify and access partners in projects of interest, and allow the public to assess engagement of NGOs, 1890 and 1994 LGUs, and other entities in OREI and ORG research.

- Remove redundancy among successive annual reports, but retain unique material in earlier progress reports that is not included in later reports.

- Develop a searchable database, similar to that already available on line for the SARE program, through which producers and other end users can readily access OREI and ORG project summaries and outcomes by commodity, production system, region, or topic.

- Continue to utilize OREI funded conferences and symposia as a dissemination venue for both intermediary research outcomes and farmer-ready project products and information.
- Ensure ongoing funding of the eOrganic communities of practice to facilitate OREI and ORG project outreach via the eXtension website. Continue to encourage (but not require) project teams to utilize eOrganic for development and delivery of project products.
- Explore ways to restore and make available valuable products and outcomes from past OREI and ORG projects that are currently inaccessible.

For additional rationale in support of the above recommendations, see Appendix I.

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APPENDIX A1. Data entry: PI, region, and funded entity

Key to Numerical Codes Used in Data Collection Spreadsheet

Abstracts for each project, including non-technical summary, objectives, and approach from the proposal, and progress and impacts sections of annual and final reports, were downloaded from the CRIS website: http://cris.nifa.usda.gov/cgi-bin/starfinder/0?path=crisassist.txt&id=anon&pass=&OK=OK.

Abstracts were reviewed and the following data were logged onto the Excel spreadsheet (Appendix A), using numerical and alphabetical codes for categories of project type, commodity, topics addressed, producer engagement, dissemination, project products, and project impacts, as shown in the following key.

Key to Appendix A1

Project Number: The Proposal number.

Program and Year: OREI or ORG, followed by the year in which the grant was awarded.

PI: Principal Investigator or Project Director, when more than one person was listed on the Abstract, the first investigator named was entered on the spreadsheet.

Award Amount: Total award for duration of the project.

Location/Region: State(s), USDA region (south, northeast, north central, west), or national/international scope indicated.

Primary Funded entity: Applicant institution to whom grant was awarded.

Entity Type (codes entered as follows):

1. Land Grant Universities (a. 1862, b. 1890, c. 1994)
2. Other universities/colleges
3. USDA (a. ARS, b. NRCS, c. ERS, d. other)
4. Local or state governmental agency
5. Non-governmental organization (NGO), non-profit organization, or individual
6. For-profit organization
7. Individual farmers

Type of Project (codes entered as follows):

1. Integrated (research plus extension and/or education)
2. Research only
3. Outreach only (education and/or extension)
4. Conference and/or symposium
5. Planning grant
   a. leading to successful full grant proposal
   b. leading to full grant proposal but not funded
   c. not leading to full proposal
   d. full proposal in preparation or submitted; funding decision pending
6. Analytical project (*OREI 2014-05348, the project generating this spreadsheet and report, was the only one in this category*)
7. Research that entailed work on conventional or transitional as well as certified organic land:
   a. studies on transition to organic production
   b. comparisons of conventional vs. organic systems or practices

Response to 2007 NORA priorities (codes entered as follows):

1. Soil microbiology, fertility, and quality
   a. nutrient management, budgeting, balance, availability to crops
   b. evaluation and enhancement of soil life and soil quality
2. Systems approaches to pest management
   a. weeds
   b. insects
   c diseases
3. Organic livestock and poultry production systems
   a. animal health
   b. pasture management and animal nutrition
   c. crop-livestock integration
   d. NOP-compliant production systems including livestock housing and living conditions
4. Breeding and genetics – includes variety / breed evaluation for traits addressing organic producer needs
   a. plants
   b. animals

Additional Comments

Response to NIFA RFA priorities - Annual RFA priorities and numbers of projects addressed to each are summarized in Appendix E.

Appendix A1. Data entry: PI, region, and funded entity

Project number	Program & Year	PI	Award amount ($)	Location/region	Primary funded entity	Entity type (1-7)	Type of Project (1-7)	2007 NORA priorities (1a-4b)	Additional Comments and Questions
2002-3796	ORG 2002	Jacob	$197,641.00	Midwest (experiments in MN)	University of Minnesota	1a	2	3b	
2002-3798	ORG 2002	Kleinhenz	$398,447.00	Ohio	Ohio State University	1a	1, 7a	1a, 1b, 2a, 2c	
2002-3799	ORG 2002	Rouse	$140,144.00	Wisconsin	University of Wisconsin	1a	1	1a, 2b, 2c, 4a	
2002-3804	ORG 2002	Mizell	$93,454.00	South, zones 7-9	University of Florida	1a	1	2b, 2c	
2002-3805	ORG 2002	Gallagher	$164,701.00	Dryland Northwest	Washington State University	1a	1, 7a	1a, 1b, 2a	
2002-3806	ORG 2002	Sheaffer	$424,091.00	North-central (experiments in MN)	University of Minnesota	1a	1	1a, 1b, 2a, 4a	
2003-04559	ORG 2003	Stinner	$493,343.00	Ohio / east-central	Ohio State University	1a	1, 7a	1a, 1b, 2a, 2b	
2003-04602	ORG 2003	Drummond	$175,128.00	Far northeast (ME & E. Canada)	University of Maine	1a	1, 7a	1a, 2a, 2b, 2c	
2003-04618	ORG 2003	Eastman	$482,576.00	Midwest	University of Illinois	1a	1, 7a	1a, 1b, 2a, 2b, 2c	
2003-04619	ORG 2003	Barbercheck	$498,335.00	Eastern (PA)	Pennsylvania State University	1a	1, 7a	1a, 1b, 2a, 2b	
2003-04625	ORG 2003	Morse	$346,420.00	Southeast (trials in VA, GA)	Virginia Tech	1a	1	1a, 1b, 2a, 2b, 2c	
2004-05131	OREI 2004	Parsons	$301,161.00	Northeast (VT and ME)	University of Vermont	1a	1, 7a, 7b	3 (general)	Economic analysis of dairy farms
2004-05136	OREI 2004	Gliessman	$571,902.00	California	University of California - Santa Cruz	1a	1	1a, 1b, 2a, 2b, 2c	
2004-05151	ORG 2004	Epstein	$186,624.00	California	University of California - Davis	1a	1, 7b	1b, 2b, 2c	
2004-05153	OREI 2004	Mazzola	$303,267.00	Northwest	USDA-ARS Tree Fruit Ctr	3a	1	1a, 1b, 2a, 2c	
2004-05169	ORG 2004	Garrison-Tifoskey	$518,306.00	Northeast	Cornell University	1a	1, 7a	3a	
2004-05187	ORG 2004	Owens	$305,015.00	South / nationwide application	University of Arkansas - Fayetteville	1a	1, 7a	3b, 3d, 4b	
2004-05204	ORG 2004	Heimpel	$463,645.00	North Central/ soybean areas	University of Minnesota	1a	1, 7a	2b	

Appendix A1. Data entry: PI, region, and funded entity

Project number	Program & Year	PI	Award amount ($)	Location/region	Primary funded entity	Entity type (1-7)	Type of Project (1-7)	2007 NORA priorities (1a-4b)	Additional Comments and Questions
2004-05205	OREI 2004	Jahn	$894,450.00	Nationwide (NY, NM, WV, MS, CA	Cornell University	1a	1	2c, 4a	
2004-05207	ORG 2004	Jackson	$297,814.00	California	University of California - Davis	1a	1	1a, 1b, 2c	
2004-05216	OREI 2004	Lockeretz	$197,768.00	Northeast / nationwide application	Tufts University	2	1	3a, 3d	
2004-05218	OREI 2004	Charles A. Mohler	$575,028.00	Northeast / New York	Cornell University	1a	1, 7a	1a, 1b, 2a, 2b, 2c	
2005-04426	OREI 2005	Joan M Burke	$299,632.00	South - trials in AL, AR, GA, LA, TX	USDA-ARS Southern Plains	3a	1	3a, 3b, 4b	
2005-04461	ORG 2005	Anita Nina Azarenko	$435,020.00	Pacific Northwest	Oregon State University	1a	1, 7b	1a, 1b	
2005-04473	OREI 2005	Sieglinde Snapp	$754,442.00	Great Lakes & upper Midwest	Michigan State University	1a	1, 7a	1a, 1b, 2b	
2005-04474	ORG 2005	Richard Kersbergen	$827,058.00	New England	University of Maine	1a	1	1a, 2a, 3b, 3c	
2005-04477	ORG 2005	Perry Miller	$471,111.00	Northern High Plains, semiarid areas	Montana State University	1a	1, 7b	1a, 1b, 2a, 2c	
2005-04484	OREI 2005	Jerald R. DeWitt	$483,542.00	Midwest, Northeast, South, International	Iowa State University	1a	1, 7a	2c, 4a	
2005-04494	OREI 2005	Joseph W. Kloepper	$561,828.00	Alabama	Auburn University	1a	1	1a, 1b, 2a, 2b, 2c, 4a	
2005-04497	OREI 2005	Charles A. Shapiro	$762,949.00	Nebraska	University of Nebraska	1a	1	1a, 2a, 4a	
2006-02010	OREI 2006	Craig Sheaffer	$615,840.00	Minnesota, with wider applicability	University of Minnesota	1a	1	1b, 2a, 3b	
2006-02014	OREI 2006	John Cardina	$545,102.00	Midwest	Ohio State University	1a	1, 7a	1a, 1b, 2a, 4a	
2006-02018	OREI 2006	Peter C. Andersen	$364,156.00	Florida and south Georgia	University of Florida	1a	1	1a, 2a, 2b, 2c, 4a	Listed on line as 2006-04971 - which is correct??
2006-02028	OREI 2006	John W. Leffler	$431,203.00	South	SC Department Natural Resources, Marine Res Division	4	1	3b, 3d	C. L. Browdy listed PI on abstract, who is PI?
2006-02030	ORG 2006	Laurie Drinkwater	$374,627.00	Northeast	Cornell University	1a	1	1a, 1b	
2006-02047	OREI 2006	Carlene A. Chase	$226,139.00	Tropical / subtropical South Florida	University of Florida	1a	1	1a, 1b, 2a, 2b, 2c	Same title as ORG 2007-03671 - prequel??

Appendix A1. Data entry: PI, region, and funded entity

Project number	Program & Year	PI	Award amount ($)	Location/region	Primary funded entity	Entity type (1-7)	Type of Project (1-7)	2007 NORA priorities (1a-4b)	Additional Comments and Questions
2006-02048	ORG 2006	Eileen M Cullen	$374,478.00	North central (upper Midwest)	University of Wisconsin	1a	1, 7a	1a, 2b	
2006-02051	OREI 2006	Lorraine P. Berkett	$666,839.00	New England and South (AR)	University of Vermont	1a	1, 7a	2a, 2b, 2c, 4a	
2006-02052	ORG 2006	Marc W. Van Iersel	$313,515.00	Southeast	University of Georgia	1a	1	2b, 2c	
2006-02057	ORG 2006	Stephen Scott Jones	$690,557.00	Pacific Northwest "all areas" for wheat	Washington State University	1a	1, 7b	1a, 2a, 2c, 4a	
2007-01380	ORG 2007	David M Francis	$858,507.00	OH, MN, NC, WV, PA	Ohio State University	1a	1	1a, 1b, 2c, 4a	
2007-01384	OREI 2007	Jody Padgham	$50,000.00	Midwest (multistate, whole region)	Midwest Organic & Sustainable Ed. Ser.	5	4	1a, 1b, 2a, 2b, 2c, 3a, 3b, 3d	
2007-01391	ORG 2007	Craig MacConnell	$74,394.00	Western Washington State	Washington State University	1a	1	2b	
2007-01398	OREI 2007	Channa B Rajashekar	$500,698.00	Midwest/ central Plains	Kansas State University	1a	1, 7b	1a, 2b, 2c	Abstract lists T. Carey as 1st PI, Rajashekar 3rd
2007-01405	ORG 2007	Stellos Michael Tavantzis	$297,100.00	Maine / Northeast	University of Maine	1a	1, 7b	1a, 1b, 2c	
2007-01411	OREI 2007	Alexandra G Stone	$611,985.00	Nationwide	Oregon State University	1a	3	All	
2007-01412	ORG 2007	Regine Mankolo	$152,010.00	Southeast	Alabama A & M University	1b	1	1a, 1b, 2a, 2b, 2c	
2007-01417	OREI 2007	Karen A. Renner	$106,335.00	North central (upper Midwest)	Michigan State University	1a	3	2a , 3c	
2007-01418	OREI 2007	David Epstein	$33,478.00	North central (upper Midwest)	Michigan State University	1a	1	2a, 2b, 3b, 3c	
2007-01437	OREI 2007	Peter S. Baenziger	$755,937.00	Nebraska - 3 agro-ecoregions	University of Nebraska	1a	1	1a, 1b, 2a, 2b, 2c, 4a	
2007-01441	OREI 2007	Francisco Diez-Gonzalez	$747,993.00	North central, nationwide applicability	University of Minnesota	1a	2		
2007-03671	ORG 2007	Carlene A. Chase	$414,591.00	Tropical / subtropical South Florida	University of Florida	1a	1	1a, 2a, 2b, 2c	Same title as OREI 2006-02047 - continuation??
2008-01237	OREI 2008	Bernadine C Strik	$469,851.00	Pacific northwest - WA, OR	Oregon State University	1a	1	1a, 2a	
2008-01245	OREI 2008	Mark Mazzola	$517,798.00	Northwest (WA, ID) also Spain	USDA-ARS Tree Fruit Research lab	3a	1	1a, 1b, 2c	2c - pest nematodes, replant disease

Appendix A1. Data entry: PI, region, and funded entity

Project number	Program & Year	PI	Award amount ($)	Location/region	Primary funded entity	Entity type (1-7)	Type of Project (1-7)	2007 NORA priorities (1a-4b)	Additional Comments and Questions
2008-01247	OREI 2008	Craig George Cogger	$644,232.00	Pacific Northwest	Washington State University	1a	1	1a, 1b, 2a, 3c	
2008-01251	OREI 2008	Curt Rom	$757,882.00	South	University of Arkansas	1a	1	1a, 1b, 2a, 2b, 2c	
2008-01265	ORG 2008	David Orr	$347,815.00	North Carolina	North Carolina State University	1a	1	2a, 2b	
2008-01278	OREI 2008	Donald M Jaworski	$434,925.00	Wisconsin	Northeast Wisconsin Technical College	2	3	1a, 1b, 3b	
2008-01281	ORG 2008	Pamela L Ruegg	$987,048.00	N-east (NY) N-Central (WI), N-west (OR)	University of Wisconsin	1a	1, 7b	3a	Listed on line as 2010-03514, award $436,894
2008-01284	ORG 2008	Kathleen Delate	$855,629.00	N-east - N-Cent (ND, IA, WI, MN, MI, PA)	Iowa State University	1a	1	1a, 1b, 2a	
2009-01311	OREI 2009	Thomas Bjorkman	$894,069.00	Great Lakes - Northeast (NY, IL, MI)	Cornell University	1a	1	1b, 2a	
2009-01322	OREI 2009	Mark L Gleason	$1,047,024.00	Eastern half of US, sites in PA, IA, KY	Iowa State University	1a	1	1a, 1b, 2a, 2b, 2c	
2009-01325	OREI 2009	Lorraine P. Berkett	$946,675.00	New England (VT, ME trial sites)	University of Vermont	1a	1	1a, 1b, 2b, 2c, 4a	
2009-01327	OREI 2009	Colleen Burrows	$46,794.00	Western Washington State	Washington State University	1a	5b	1b, 2a, 2b	
2009-01330	OREI 2009	Bradley J Heins	$38,466.00	North Central nationwide applicability	University of Minnesota	1a	5a	3a, 3b, 4b	Not clear if full proposal was ever submitted
2009-01332	OREI 2009	Sieglinde Snapp	$1,049,674.00	Western US (trials in WA, KS, TX, MI)	Michigan State University	1a	1	1a, 1b, 4a	
2009-01333	OREI 2009	S. Chris Reberg-Horton	$1,174,942.00	Southeastern US	North Carolina State University	1a	1	2a, 2c, 4a	
2009-01338	OREI 2009	Jennifer Reeve	$637,519.00	Intermountain west - semiarid region	Utah State University	1a	1, 7a, 7b	1a, 1b, 2a, 2b, 2c	
2009-01340	OREI 2009	Laurie E Drinkwater	$1,431,591.00	Northeast	Cornell University	1a	1	1a, 1b, 2a, 2b, 2c	
2009-01343	OREI 2009	Matthew Dillon	$46,281.00	Nationwide	Organic Seed Alliance	5	4	4a	
2009-01346	OREI 2009	Leroy Robert Barber	$41,616.00	Pacific Islands - Guam	University of Guam	1a	3, 4	1a, 1b, 2b, 3d	
2009-01361	OREI 2009	Michel Cavigelli	$759,480.00	Mid-Atlantic	USDA-ARS Beltsville	3a	1	1a, 2a	

Appendix A1. Data entry: PI, region, and funded entity

Project number	Program & Year	PI	Award amount ($)	Location/region	Primary funded entity	Entity type (1-7)	Type of Project (1-7)	2007 NORA priorities (1a-4b)	Additional Comments and Questions
2009-01366	OREI 2009	Ellen Mallory	$1,320,378.00	Northeast	University of Maine	1a	1	1a, 2a, 2c, 4a	
2009-01371	OREI 2009	Charles A. Shapiro	$1,419,710.00	Nebraska (3 agro-ecoregions)	University of Nebraska	1a	1, 7a	1a, 1b, 2a,4a	
2009-01377	OREI 2009	Mary Ellen Barbercheck	$2,547,279.00	Mid-Atlantic and Upper South	Pennsylvania State University	1a	1, 7a	1a, 1b, 2a, 2b	
2009-01383	OREI 2009	Kevin M. Murphy	$410,077.00	Across northern US (WA, CO, MI, VT)	Washington State University	1a	1	1a, 1b, 2a, 2b, 2c, 4a	
2009-01389	OREI 2009	Hector R Valenzuela	$47,500.00	Hawaii / Pacific Islands	The Kohala Center, Inc.	5	4, 7b	4a	
2009-01402	OREI 2009	Brian B McSpadden-Gardener	$1,089,190.00	Ohio (not clear if extends beyond OH)	Ohio State University	1a	1	1b, 2c	
2009-01405	OREI 2009	Theodore Radovich	$351,028.00	Pacific Islands - HI, Amer. Samosa	University of Hawai`i	1a	1	1b, 2b	
2009-01415	OREI 2009	Louise Jackson	$372,135.00	California	University of California	1a	1, 7b	1a, 1b	
2009-01416	OREI 2009	Ian C. Burke	$1,040,210.00	Inland Pacific Northwest (WA, OR, ID)	Washington State University	1a	1, 7b	1a, 1b, 2a, 4a	
2009-01420	OREI 2009	Douglas Doohan	$2,227,235.00	Nat'l (CA, OH, IN, New Eng), Int'l (Holl.)	The Ohio State University	1a	1	2a	Listed on line as 2010-03393
2009-01422	OREI 2009	Jayne E Stratton	$69,806.00	North central, nationwide applicability	University of Nebraska	1a	2		
2009-01429	OREI 2009	Amy Charkowski	$541,172.00	Midwest	University of Wisconsin	1a	1	2a, 2b, 2c, 4a	Listed on line as 2009-05689
2009-01434	OREI 2009	Alexandra G Stone	$317,182.00	Nationwide	Oregon State University	1a	3	All	
2009-01435	OREI 2009	Victor E Cabrera	$574,621.00	Wisconsin	University of Wisconsin	1a	1, 7a, 7b	1a, 3b	
2009-01436	OREI 2009	Jay B. Norton	$574,621.00	Wyoming, western Nebraska (semiarid)	University of Wyoming	1a	1, 7b	1a, 1b, 2a	
2009-05488	ORG 2009	D. L. Osmond	$658,769.00	Western North Carolina (Appalachia)	North Carolina State University	1a	1, 7b	1a, 1b	
2009-05497	ORG 2009	S. C. Loerch	$659,527.00	Ohio / Midwest	Ohio State University	1a	1, 7a, 7b	1a, 3b	
2009-05499	ORG 2009	Kathleen Delate	$599,027.00	Midwest	Iowa State University	1a	1, 7b	1a, 1b	

Appendix A1. Data entry: PI, region, and funded entity

Project number	Program & Year	PI	Award amount ($)	Location/region	Primary funded entity	Entity type (1-7)	Type of Project (1-7)	2007 NORA priorities (1a-4b)	Additional Comments and Questions
2010-01869	OREI 2010	Jennifer W. MacAdam	$1,019,411.00	West - Mountain region	Utah State University	1a	1	1a, 1b, 3b	
2010-01870	OREI 2010	Jane K. Dever	$661,437.00	South	Texas A&M University	1a	1	2b, 4a	
2010-01884	OREI 2010	Joan M Burke	$967,916.00	Midwest, East, South	USDA-ARS Small Farms Research Ctr	3a	1	3a 3b, 4b	
2010-01899	OREI 2010	Lynn A. Hayes	$109,200.00	Nationwide	Farmers' Legal Action Group, Inc	5	1		
2010-01904	OREI 2010	Karen A. Renner	$963,762.00	Michigan / upper Midwest	Michigan State University	1a	1	1a, 2a, 2b, 2c, 4a	
2010-01905	OREI 2010	Gregory Alan Lang	$616,492.00	Michigan / upper Midwest	Michigan State University	1a	1	1a, 1b, 2a, 2b, 2c, 4a	
2010-01913	OREI 2010	Kevin Gibson	$1,288,010.00	Indiana / Midwest	Purdue University	1a	1	1a, 1b, 2a, 2b, 2c, 4a	
2010-01916	OREI 2010	Scott W. Fausti	$43,809.00	Northern High Plains	South Dakota State University	1a	5b	3b, 3d, 4b	
2010-01927	OREI 2010	John R Schramski	$45,713.00	Nationwide	University of Georgia	1a	5b		
2010-01929	OREI 2010	Martin J. Shipitalo	$49,666.00	Midwest / N-east (WV, PA, WI, OH, NH)	USDA-ARS N. Appalachia Exp. Watershed	3a	5b, 5d	1a, 1b	5d - proposal resubmitted, outcome not stated
2010-01932	OREI 2010	Andre F. Brito	$31,372.00	Northeast	University of New Hampshire	1a	5a	3a, 3b, 3d	Research topics TBD based on needs assessment
2010-01940	OREI 2010	Bernadine C Strik	$2,428,677.00	OR, NC (Northwest, South blackberry areas)	Oregon State University	1a	1	1a, 2a, 2c, 4a	
2010-01943	OREI 2010	Erik J Wenninger	$108,815.00	Western (ID)	University of Idaho	1a	1	2b, 4a	
2010-01944	OREI 2010	Heather Darby	$759,516.00	Nationwide - hubs VT,NC, WI, OR/Ca	University of Vermont	1a	3, 7a	1b, 3a, 3b, 3d	
2010-01945	OREI 2010	Sadhana Ravishankar	$2,907,354.00	Nationwide applicability	University of Arizona	1a	1	1b	
2010-01954	OREI 2010	Cerruti R.R. Hooks	$526,781.00	Mid-Atlantic	University of Maryland (College Park)	1a	1	1b, 2a, 2b, 2c	
2010-01965	OREI 2010	Lynne Carpenter-Boggs	$1,538,115.00	Washington (? Trial locations not stated)	Washington State University	1a	1	1a, 1b	

Appendix A1. Data entry: PI, region, and funded entity

Project number	Program & Year	PI	Award amount ($)	Location/region	Primary funded entity	Entity type (1-7)	Type of Project (1-7)	2007 NORA priorities (1a-4b)	Additional Comments and Questions
2010-01970	OREI 2010	James Kotcon	$31,344.00	Northeast (RI, CT, MA, VT, NY, WV)	West Virginia University	1a	5a	3a, 3b	
2010-01975	OREI 2010	Robert King	$1,273,250.00	N-Central? (location of farms not stated)	University of Minnesota	1a	1, 7a, 7b		Economic analysis of organic dairy farms
2010-01988	OREI 2010	Federico Harte	$50,000.00	South, nationwide applicability	University of Tennessee	1a	1, 5b		Initial experiments as well as proposal (thus 1 and 5b)
2010-01998	OREI 2010	Eileen M Cullen	$658,735.00	Wisconsin and upper Midwest	University of Wisconsin	1a	1	1a, 1b, 2b	
2010-02363	OREI 2010	Paul Scott	$2,864,478.00	Nationwide - variety trials in 11 states	USDA-ARS - Ames, IA	3a	1	2b, 2c, 3b, 4a	
2010-03392	OREI 2010	James R Myers	$2,308,246.00	Nationwide - across northern half of US	Oregon State University	1a	1	2c, 4a	
2010-03952	ORG 2010	Urszula Norton	$700,000.00	Eastern WY, western NE (semiarid)	University of Wyoming	1a	1, 7a, 7b	1a, 1b, 3c	
2010-03954	ORG 2010	Michelle M. Wander	$649,883.00	Illinois	University of Illinois	1a	1, 7b	1a, 1b	
2010-03956	ORG 2010	Kathleen Delate	$691,969.00	Iowa, Florida (subtropical region)	Iowa State University	1a	1	1a, 1b, 2a, 2b	
2010-03957	ORG 2010	Ruth K Varner	$700,000.00	Northeast (in-depth studies in NH)	University of New Hampshire	1a	1, 7a, 7b	1a, 1b, 3c	
2010-03958	ORG 2010	Peter C. Andersen	$624,148.00	South coastal plain of FL, AL, GA	University of Florida	1a	1, 7a	1a, 1b, 2a, 2b, 2c	
2010-03990	ORG 2010	Raul T. Villanueva	$697,012.00	South Texas - Rio Grande - dry subtropic	Texas A&M University - Extension	1a	1, 7a, 7b	1a, 1b, 2a, 2b	Education/outreach focus w/ substantial student research
2010-04008	ORG 2010	Julie Grossman	$650,906.00	South	North Carolina State University	1a	1, 7a, 7b	1a, 1b	Website lists first PI as S. Hu, Grossman not included
2011-01942	OREI 2011	James H. Orf	$1,450,922.00	Minnesota	University of Minnesota	1a	1	1a, 1b, 2a, 2c, 4a	
2011-01950	OREI 2011	Andre F. Brito	$2,863,915.00	Northeast - trials in NH, VT, ME, PA	University of New Hampshire	1a	1	3b, 4a	
2011-01955	OREI 2011	Ann Marion Donoghue	$1,226,840.00	South? (not stated)	USDA-ARS Fayetteville, AR	3a	1	3a, 3b, 3d, 4b	
2011-01959	OREI 2011	Jason Kaye	$2,296,803.00	Pennsylvania	Pennsylvania State University	1a	1, 7a	1a, 1b, 2a, 2b	

Appendix A1. Data entry: PI, region, and funded entity

Project number	Program & Year	PI	Award amount ($)	Location/region	Primary funded entity	Entity type (1-7)	Type of Project (1-7)	2007 NORA priorities (1a-4b)	Additional Comments and Questions
2011-01962	OREI 2011	Philipp W. Simon	$2,097,770.00	Carrot growing reg - WA, WI, IN, and CA	USDA-ARS - Peoria, IL	3a	1	1a, 1b, 2a, 2c, 4a	also pest nematodes, focus on sandy soils (carrot production areas)
2011-01965	OREI 2011	Kenneth B Johnson	$475,835.00	California, Oregon, Washington	Oregon State University	1a	1	2c	
2011-01969	OREI 2011	Carol Shennan	$2,608,205.00	California	University of California - Santa Cruz	1a	1	1a, 1b, 2a, 2b, 2c	
2011-01979	OREI 2011	Henry Y. Fadamiro	$881,829.00	South - AL, GA, FL	Auburn University	1a	1	2b, 2c	
2011-01982	OREI 2011	Kate Mendenhall	$49,663.00	Northeast (PA, NY, NJ, VT, CT, RI, NH, MA)	Northeast Organic Farming Assoc. NY	5	4	1a, 1b, 2a, 2b, 2c, 3a, 3b, 4a, 4b	Based on review of Proceedings table of contents
2011-01983	OREI 2011	David Granatstein	$45,239.00	Nat'l & Int'l, focus on humid regions	Washington State University	1a	4	1b, 2b, 2c	
2011-01985	OREI 2011	Evan Hansen	$50,000.00	West Virginia / central Appalachia	Downstream Strategies, LLC	6	5c, 7a, 7b		Full prop not submitted - low potential for cert org in WV
2011-01987	OREI 2011	Kokoasse Kpomblekou-A	$49,886.00	South - AL, also FL, NC, GA	Tuskegee University	1b	5d		research issues and full proposal outcome not stated
2011-01989	OREI 2011	Matthew J. Grieshop	$45,695.00	Nationwide	Michigan State University	1a	5a	2b	
2011-01990	OREI 2011	Omololu John Idowu	$36,102.00	New Mexico, Texas (97% of org peanuts)	New Mexico State University	1a	5c	1a, 2a, 2c	OREI prop not written because funding suspended 2013
2011-01994	OREI 2011	Mark Earl Sorrells	$2,356,999.00	Northeast (NY, PA) No. hi Plains (ND)	Cornell University	1a	1	1a, 2a, 2c, 4a	
2011-02000	OREI 2011	Lynne Carpenter-Boggs	$28,891.00	Pacific Northwest (OR, WA, ID) drylands	Washington State University	1a	4, 7a	1a, 1b, 2a	
2011-02002	OREI 2011	Michael S Lilburn	$896,092.00	Ohio	The Ohio State University	1a	1	1a, 3b, 3c, 4a, 4b	
2011-02005	OREI 2011	Gwendolyn Ellen	$46,580.00	Western - Ca, OR, WA, ID	Oregon State University	1a	5b	2b	
2011-04944	ORG 2011	Guihua Chen	$736,493.00	Maryland, Hawaii	University of Maryland (College Park)	1a	1, 7a	1a, 1b, 2a, 2b	

Appendix A1. Data entry: PI, region, and funded entity

Project number	Program & Year	PI	Award amount ($)	Location/region	Primary funded entity	Entity type (1-7)	Type of Project (1-7)	2007 NORA priorities (1a-4b)	Additional Comments and Questions
2011-04948	ORG 2011	Ann-Marie Fortuna	$745,493.00	Washington, North Dakota?, Indiana?	Washington State University	1a	1	1a, 1b, 3c	Not clear where field trials were actually done - WA, ND, IN?
2011-04952	ORG 2011	Dean Garry Baas	$749,106.00	Michigan / upper Midwest	Michigan State University	1a	1, 7a, 7b	1a, 2a	
2011-04958	ORG 2011	Tim Reinbott	$742,217.00	Missouri	University of Missouri	1a	1, 7a	1a, 1b, 2a	
2011-04960	ORG 2011	Patrick Hatfield	$742,907.00	Montana	Montana State University	1a	1, 7a, 7b	1a, 1b, 2a, 3c	
2012-02201	OREI 2012	Bradley J Heins	$1,924,693.00	Upper Midwest (experiments in Minnesota)	University of Minnesota	1a	1	3a, 3b	
2012-02222	OREI 2012	Anne Nielsen	$2,672,327.00	Nationwide	Rutgers, State University of New Jersey	1a	1	2b	
2012-02236	OREI 2012	S. Chris Reberg-Horton	$1,262,855.00	Southeast	North Carolina State University	1a	1	2a, 2c, 4a	
2012-02244	OREI 2012	Fabian Menalled	$1,499,815.00	Northern Great Plains (ND, MT)	Montana State University	1a	1, 7b	1a, 1b, 2a, 2b, 2c, 3a, 3b, 3c	
2012-02247	OREI 2012	Qixin Zhong	$1,990,879.00	South, applicable nationwide	The University of Tennessee	1a	1		
2012-02270	OREI 2012	Kevin M. Murphy	$1,603,653.00	Northwest - WA, ID, UT, OR	Washington State University	1a	1	1a, 2a, 2b, 2c, 4a	
2012-02290	OREI 2012	James Kotcon	$1,850,360.00	Northeast - WV, NY, RI	West Virginia University	1a	1, 7a	3a, 3b, 4a	
2012-02292	OREI 2012	Michael R. Mazourek	$1,962,562.00	Northeast and Southeast	Cornell University	1a	1	2b, 2c, 4a	
2012-02965	ORG 2012	John Reganold	$695,078.00	Palouse region of Washington State	Washington State University	1a	1, 7a, 7b	1a, 1b, 2a, 3b, 3c	
2012-02977	ORG 2012	Stephanie Yarwood	$716,773.00	Maryland	University of Maryland (College Park)	1a	1, 7b	1a, 1b	
2012-02978	ORG 2012	Shuijin Hu	$742,583.00	North Carolina (NCSU Ctr Environment Farming Sys)	North Carolina State University	1a	1, 7b	1a, 1b	
2012-02980	ORG 2012	Laurie Drinkwater	$676,385.00	Northeast (main experiments in New York)	Cornell University	1a	1, 7b	1a, 1b, 2a	

Appendix A1. Data entry: PI, region, and funded entity

Project number	Program & Year	PI	Award amount ($)	Location/region	Primary funded entity	Entity type (1-7)	Type of Project (1-7)	2007 NORA priorities (1a-4b)	Additional Comments and Questions
2012-02981	ORG 2012	Parwinder S Grewal	$749,170.00	Ohio (3 study sites in state)	Ohio State University	1a	1, 7a	1a, 1b, 2a, 2b	
2012-02983	ORG 2012	Fugen Dou	$726,892.00	Texas (Beaumont)	Texas A&M University	1a	1, 7b	1a, 1b, 4a	
2012-04472	ORG 2012	Anne-Marie Fortuna	$736,224.00	North Central & West (ND, IN, WA)	North Dakota State U	1a	1, 7a	1a, 1b, 3c	
2013-03943	ORG 2013	Alexis Racelis	$746,973.00	South Texas	The University of Texas - Pan American	2	1, 7a	2a, 2b, 2c, 4a	
2013-03950	ORG 2013	William Emerson Snyder	$749,661.00	Pacific Northwest - WA, ID, OR, no. CA	Washington State University	1a	1, 7a	1b, 2b	
2013-03968	ORG 2013	George Sundin	$464,482.00	Eastern US - east of Mississippi	Michigan State University	1a	1	2c	
2013-03971	ORG 2013	Russell F Mizell	$460,937.00	Southeast - trials in FL, GA	University of Florida	1a	1, 7b	2b, 2c, 4a	
2013-03973	ORG 2013	Craig Sheaffer	$718,225.00	MN - North Central	University of Minnesota	1a	3, 7a	1a, 1b, 2a, 2b, 4a	
2014-03354	ORG 2014	William Emerson Snyder	$298,706.00	California, Oregon, Washington	Washington State University	1a	1	1b, 3c	
2014-03365	ORG 2014	David William Crowder	$499,991.00	Washington / Pacific Northwest	Washington State University	1a	1, 7a		
2014-03378	ORG 2014	Paul Gutierrez	$499,191.00	Southern New Mexico	New Mexico State University	1a	1, 7a	1a, 2a, 3b	
2014-03379	ORG 2014	Samuel Egyir Aggrey	$500,000.00	Southeast, nationwide applicability	University of Georgia	1a	1	3b, 3d	
2014-03385	ORG 2014	Matthew R. Ryan	$499,932.00	New York, Pennsylvania, Maryland	Cornell University	1a	1, 7a	1a, 1b, 2a	
2014-03386	ORG 2014	Kenneth B Johnson	$496,557.00	Western US / Oregon	Oregon State University	1a	1	2c	
2014-03389	ORG 2014	Shirley A Micallef	$499,995.00	Mid-Atlantic / Maryland	University of Maryland	1a	1, 7a	1b, 2c, 4a	
2014-05324	OREI 2014	J. Earl Creech	$1,555,053.00	Utah, Washington, Wyoming - dry areas	Utah State University	1a	1, 7b	1a, 1b, 2a, 4a	
2014-05325	OREI 2014	Jared Zystro	$42,951.00	Southeast	Organic Seed Alliance	5	5d	4a	
2014-05326	OREI 2014	Steven P. Washburn	$1,415,833.00	North Carolina, nationwide applicability	North Carolina State University	1a	1	3a	

Appendix A1. Data entry: PI, region, and funded entity

Project number	Program & Year	PI	Award amount ($)	Location/region	Primary funded entity	Entity type (1-7)	Type of Project (1-7)	2007 NORA priorities (1a-4b)	Additional Comments and Questions
2014-05340	OREI 2014	Paul Scott	$1,968,656.00	Midwest/corn belt - trials in IL, IA	USDA-ARS (corn insects & crop genetics res.)	3a	1	2a, 2b, 2c, 4a	
2014-05341	OREI 2014	Timothy Reinbott	$922,889.00	Missouri	University of Missouri	1a	1	1b, 2a	
2014-05348	OREI 2014	Brise Tencer	$100,000.00	Nationwide	Organic Farming Research Foundation	5	4, 6	All	
2014-05354	OREI 2014	Jeff Schahczenski	$749,963.00	Nationwide - 10 farms in each of 9 states	National Center for Appropriate Technology	5	1	3c	
2014-05355	OREI 2014	Sarah Rose Brown	$49,881.00	Northwest	Oregon Tilth	5	4	1b	
2014-05376	OREI 2014	Sam Wortman	$749,927.00	Illinois, South Dakota, Minnesota	University of Illinois	1a	1	2a	
2014-05377	OREI 2014	Mary Ellen Barbercheck	$1,999,760.00	Pennsylvania	Pennsylvania State University	1a	1	1a, 1b, 2a, 2b	
2014-05378	OREI 2014	Ashfaq Ahmad	$49,933.00	South with nationwide applicability	University of Georgia	1a	5a	2b	
2014-05381	OREI 2014	Anusuya Rangarajan	$1,996,783.00	Northeast and upper Midwest	Cornell University	1a	1	1a, 1b, 2a, 2b, 2c	
2014-05388	OREI 2014	William F Tracy	$49,846.00	Nationwide and international	University of Wisconsin	1a	4	All	
2014-05396	OREI 2014	Ellen Mallory	$21,686.00	Nationwide and international	University of Maine	1a	4	All, but may not incl. breeding	
2014-05402	OREI 2014	James R Myers	$1,997,986.00	Nationwide - across northern half of US	Oregon State University	1a	1	2c, 4a	
2014-05405	OREI 2014	Lori A. Hoagland	$1,987,150.00	Nationwide; trials in IN, WI, NC, OR	Purdue University	1a	1	1b, 2c, 4a	
2014-05407	OREI 2014	David M. Gadoury	$49,887.00	Northeast - OH, ME, NH, NY, PA	Cornell University	1a	5a	2c	
2014-05408	OREI 2014	Douglas Doohan	$1,996,381.00	Ohio - 2 trials in OH, outreach beyond OH	Ohio State University	1a	1	1a, 1b, 2a, 2b	
2014-05411	OREI 2014	Kathleen Delate	$1,276,536.00	Northeast (PA) & North Central (IA, MN)	Iowa State University	1a	1	1a, 1b, 2b, 3a, 3b, 3c	

APPENDIX A2. Research topics addressed

Key to Appendix A2

Project Number: The Proposal number.

Commodities:

Crops – codes entered as follows:

1. Vegetable (type given in Column C)
2. Fruits (type given in Column C)
3. Tree/shrub nuts (type given in Column C)
4. Grains
   a. wheat
   b. corn
   c. rice
   d. other (includes oats, barley, rye, triticale, sorghum, millet, spelt and other ancestral wheat, buckwheat, amaranth, quinoa, etc.)
5. Legumes
   a. lentils, peas, southern peas, common beans, other pulses
   b. soybeans
6. Forages
7. Oil seed (sunflower, safflower, canola)
8. Other Commodity
   a. cotton
   b. sugarcane
   c. sugarbeet
   d. peanut
   e. other
9. Crops grown to produce organic seed (Note, this category was not used. Organic seed production was listed as a Production Practice, code 15a in Column F)
10. Cut flowers
11. Other specialty crops
    a. culinary herbs
    b. medicinal herbs
    c. mushrooms
    d. ornamentals
    e. other
12. All/crops in general

Crops Comments: Types of vegetables, fruits, nuts; other comments

Livestock (codes entered as follows):

1. Dairy
2. Beef
3. Pork
4. Poultry/eggs
5. Equines
6. Aquaculture
7. Small ruminant
   a. sheep
   b. goats
   c. alpacas
   d. llamas
   e. other
8. Other
   a. rabbits
   b. ratites
   c. other
9. All/livestock in general

Livestock Comments

Research Issues:

Production practices (codes entered as follows):

1. Crop breeding/genetics (includes plant breeding using classical and non-GMO techniques, variety evaluation, conservation of germplasm and genetic diversity, and protecting organic seed from unintended GMO content)
2. Quality of crops and plant-based products
3. Crop pest management (insects, mollusks, mammals, birds, nematodes)
4. Crop pollination and pollinators (honey bees, wild bees, etc.)
5. Crop disease management
6. Animal breeding/genetics (includes livestock breeding, breed characterization and evaluation, and conservation of germplasm and genetic diversity)
7. Livestock diseases, pests, and parasites
8. Livestock nutrition, health, living conditions, and well being
9. Pasture and grazing management
10. Crop-livestock integration
11. Soil management
    a. biology and soil food web
    b. fertility, nutrient cycling, and nutrient management
    c. soil quality and soil health
    d. organic reduced tillage and no-till systems to prevent oil erosion or degradation
12. Cover crops
13. Crop rotations and crop diversification
14. Weed management
15. Seed and seedling management
    a. production of organic crop seed
    b. transplant production, including grafted annual starts (e.g. tomato)
    c. perennial planting stock including grafting and nursery stock
    d. protection of direct-sown seed with NOP allowed materials
16. Quality of milk, meat, and other animal products
17. Post-harvest handling
18. Food safety
19. Moisture management, irrigation, and crop drought tolerance
20. Other (listed in column G)

Production Practices Comments

Social/Economic (codes entered as follows):

1. Economic analysis (such as cost-benefit analysis, enterprise budgets, and whole farm economic analysis)
2. Marketing (including organic certification issues)
3. Socio-economic analysis
4. Policy analysis

Social/Economic Comments

Environmental (codes entered as follows):

1. Conservation
   a. soil
   b. energy
   c. water (reduction in groundwater or stream water usage through improved use efficiency, irrigation management, rainwater collection and use)
   d. other – comment
2. Preservation (natural areas, native plants and plant communities, threatened and endangered species, sensitive habitats and ecosystems)
3. Ecosystem services
   a. biodiversity
   b. water quality (protecting surface and ground water resources from excess nutrients, pesticides, pathogens, other contaminants, or remediating degraded water resources)
   c. water storage and water availability (enhanced through farm and landscape management practices)
   d. air quality (e.g., reduced ammonia or particulate emissions)
   e. soil improvement
   f. carbon sequestration and greenhouse gas mitigation
   g. recreational
   h. other

Environmental Comments

Appendix A2. Research topics addressed

Project number	Crops (1-12)	Crops comments	Livestock (1-9)	Livestock comments	Production practices (1-20)	Production practices comments	Social/ economic (1-4)	Social/ economic comments	Environmental (1-3h)	Environmental comments
2002-3796			4		8, 9	Alt. organic poultry feeds				
2002-3798	1	Tomato (test crop)			5, 11a, 11b, 11c, 12,13,14	Compare transition strategies	1		3e	
2002-3799	1	Potato			1, 2, 3, 5, 11b	Focus: variety evaluation for organic sys				
2002-3804	11d	Nursery stock			2, 3, 5, 15c	Nursery stock prod, potting media	1, 2		3b	Reduce pesticide use to protect the environment.
2002-3805	4a, 5a, 6				2, 11b. 11c, 11d, 12,13,14	Dryland organic challenges	1		1a	
2002-3806	4b, 5b				1, 2, 11b, 11c, 11d, 12, 13, 14		1		1a, 3e	
2003-04559	5b				2, 3, 11b, 11c, 13, 14	Focus: soil OM & pests				
2003-04602	2	Lowbush blueberry			3, 5, 11b, 14		1	cost/benefit, risk, partial budgets		
2003-04618	1, 4a, 4b, 5b	Various crops; tomato, pepper, edamame			3, 5, 11a, 11b, 11c, 11d, 12, 13,14	Compare 9 transition strategies				
2003-04619	4b, 5b	Field corn-soy rotation			3, 11a, 11b, 11c, 11d, 12, 14		1			
2003-04625	1	Sum. Squash, pepper, broccoli			3, 5, 11b, 11c, 11d, 12, 13, 14	Focus: reduced till organic systems	1		1a, 3e	
2004-05131			1				1	Extensive economic analysis		
2004-05136	1, 2	Broccoli, strawberry			3, 5, 11b, 11c, 14		1		3b	N and water quality
2004-05151	1, 4b	Tomato and corn			3, 5, 11a, 11d				1a	
2004-05153	2	Apple			5, 11a, 11b, 14	Replant disease management				
2004-05169			1		7, 8, 16, 18	Health / mastitis management in org trans.				

Appendix A2. Research topics addressed

Project number	Crops (1-12)	Crops comments	Livestock (1-9)	Livestock comments	Production practices (1-20)	Production practices comments	Social/ economic (1-4)	Social/ economic comments	Environmental (1-3h)	Environmental comments
2004-05187			4	Broilers	6, 8, 16	Evaluate existing slow-growing breeds				
2004-05204	5b				3, 12	Rye cover to reduce soybean aphid				
2004-05205	1	Cucurbits, tomato, pepper, broccoli			1, 2, 5, 15a	Participatory breeding, disease resistance.				
2004-05207	1	Tomato as test crop			5, 11a, 11b, 12, 20	20 = effects of climate change on biodiversity, etc.	3	Motivation for building biodiversity	2, 3a, 3b, 3c, 3f	Emphasis: functional biodiversity, water, GHG
2004-05216			9	livestock in general	8	Science-based organic studies for animal meds	2, 4	Reconcile diff international organic animal studies		
2004-05218	1, 4	Vegetables & grains in general			3, 5, 11a, 11b, 11c, 11d, 12, 13,14	Comparison of transition strategies				
2005-04426			7a, 7b		6, 7, 9	Sericia lespedeza against GI nematodes	1			
2005-04461	2	Cherry			2, 11a, 11b	Soil life & N mineralization; orchard floor management			3b	N and water quality
2005-04473	1, 4b, 5b	Tomato, cucumber			3, 11b, 11c, 12, 13		2			
2005-04474	6		1		8, 9, 10, 11b, 13, 14	Strategies to minimize off-farm grain input	1			
2005-04477	4a, 5a	peas, lentils as cash or cover crops			5, 11b, 11c, 11d, 12, 13, 14, 19	Production challenges in semiarid region	1		1a, 1b, 3b, 3c, 3f	Environmental challenges in dryland agriculture
2005-04484	5b				1, 5, 13	Soy rust NOP allowed traits, limited variety evaluation.				
2005-04494	1	Tomato, pepper			1, 3, 5, 11a, 11b, 11c, 11d, 12, 14, 19	Variety evaluation for yield & disease resistance				
2005-04497	4a, 4b, 5b	Emphasis on wheat			1, 2, 11b, 12, 13, 14	Extensive wheat var. evaluation for org. sys.	1, 3		2, 3a	"Environ. Impacts" in general

Appendix A2. Research topics addressed

Project number	Crops (1-12)	Crops comments	Livestock (1-9)	Livestock comments	Production practices (1-20)	Production practices comments	Social/ economic (1-4)	Social/ economic comments	Environmental (1-3h)	Environmental comments
2006-02010	4a, 4b, 4d, 5a, 5b, 7	4d -many grains, 5a -field pea, 7-flax, sunflower.	3	Pork feeding trials / methionine	2, 8, 11c, 13, 14	crop diversification, org feed prod.	1	Cites econ benefits, limited analysis		
2006-02014	1	Tomato, potato, wider applicability			1, 11b, 11c, 11d, 12, 13, 14	Organic trans strategies w/ perennial weeds	1	Econ returns during transition		
2006-02018	2	Rabbiteye blueberry			1, 3, 5, 11b, 14		1	enterprise budgets		
2006-02028			6	shrimp	8, 16, 18		1	economic viability	3b	Nutrient management
2006-02030	4d, 5a, 5b, 6	Millet, sudex, buckwheat, legumes as covers			11a, 11b, 12	N fixation, soil biology & cover crop species	1			
2006-02047	1	Various vegetable crops			3, 5, 11a, 11b, 12, 13, 14	pest, weed, disease management w/o winter				
2006-02048	4a, 4b, 4d, 5b, 6	Forage - alfalfa			3, 11b, 12, 13	Focus on cation (Ca-Mg-K) balancing				
2006-02051	2	Apple			1, 3, 5, 14, 15c	grafting, org trans, cultivar evaluation	1			
2006-02052	2	blueberry, blackberry, raspberry			2, 3, 5, 20	20 - Season extension	1			
2006-02057	4a				1, 2, 5, 11b, 14	Focus: wheat breeding for organic	2			
2007-01380	1	Tomato			1, 2, 5, 11b, 11c, 15b, 20	15b - tomato grafting; 20 - season extension	1			
2007-01384	1, 2	All fruits and vegetables	9	All livestock	3, 5, 8, 9, 11b, 11c, 11d, 14, 15a	Wide range of issues addressed	1			
2007-01391	1	head brassicas and crucifer greens			3	crucifer flea beetle org management methods				
2007-01398	1	Tomato, pac choi			2, 3, 5, 11b	Effect of prod. sys. on phytochemicals				
2007-01405	1	Potato			5, 11a, 11b, 11c, 12, 13	potato disease management via soil food web	1		2, 3b	reduce pesticide use

Appendix A2. Research topics addressed

Project number	Crops (1-12)	Crops comments	Livestock (1-9)	Livestock comments	Production practices (1-20)	Production practices comments	Social/ economic (1-4)	Social/ economic comments	Environmental (1-3h)	Environmental comments
2007-01411	1	All vegetables	1		All	Info sys covering all production issues (1-20)	1, 2			
2007-01412	1	tomato, pepper, so. peas, sweet corn			3, 5, 11a, 11b, 11c, 12, 14		1			
2007-01417	12	all crops	9		10, 12, 13, 14	10 - grazing for weed management on cropland				
2007-01418	2	apple	3		3, 8, 10, 14	Hogs grazing orchards for pest & weed management				
2007-01437	4a				1, 2, 3, 5, 11b, 11c, 11d, 12, 14	Focus: breeding wheat varieties for organic				
2007-01441	1	Vegetables in general			18	ID and test NOP allowable sanitizers				
2007-03671	1	squash, pepper, broccoli, sweet corn			3, 5, 11b, 12, 13, 14	pest, weed, disease management w/o winter				
2008-01237	2	blueberry			11b, 14, 19	optimize N nutrition & weed management	1	enterprise budgets		
2008-01245	2	apple			3, 5, 11a, 11b	soil life, replant disease, pest nematodes.				
2008-01247	1	broc, lettuce., spinach, w. squash, snap bean	4, 7a	In rotational pasture w/ vegies	10, 11a, 11b, 11c, 11d, 12, 13, 14, 18	compare 12 sys - soil quality, N, weeds , yield	1, 2			
2008-01251	2	apple			3, 5, 11b, 11c, 14	focus: organic orchard nutrition	1			
2008-01265	4b, 5b, 6				3, 14	Field borders for pest/weed management			2, 3a	Birds, etc. for pest/ weed management
2008-01278	12		9		9, 11b, 11c	"production" of org crops & livestock	2			
2008-01281			1		7, 8, 16	comparative organic & conventional dairy - animal health	1, 3		3h	Farmers est. "environmental benefits"

Appendix A2. Research topics addressed

Project number	Crops (1-12)	Crops comments	Livestock (1-9)	Livestock comments	Production practices (1-20)	Production practices comments	Social/ economic (1-4)	Social/ economic comments	Environmental (1-3h)	Environmental comments
2008-01284	4a, 4b, 4d, 5a, 5b, 6	4c - oats, 5a - pinto bean, 6 - alfalfa			11a, 11b, 11c, 11d, 12, 13, 14	organic no-till & soil quality, weeds, yield	1		1a, 3c, 3e, 3f	Ecosystem services organic no till
2009-01311	1	Vegetables in general			11c, 12, 13, 14, 15a	focus: cover crops for weeds, soil qual.	1		3e	
2009-01322	1	Cucurbits - melon, cucumber, squash			3, 4, 5, 11a, 11b, 14	focus on pollinators, disease/pest management	1		1d, 3a,	1d - pollinator habitat (conservation),
2009-01325	2	apple			1, 3, 5, 11b, 11c, 19	cultivar evaluation, management strategies for organic	1			
2009-01327	1	Vegetables in general			3, 11c, 11d, 14	organic no-till	1		1a	
2009-01330	6		1		6, 7, 8, 9		1		1	"Conservation outcomes"
2009-01332	4a, 4d, 6	Perennial wheat for grain and forage			1, 9, 11a, 11b, 11c, 13, 19	Breeding program for perennial wheat in org	1		1a, 3b, 3e, 3f	Ecosystem services of perennial grain
2009-01333	4a, 4b, 5b, 8d				1, 5, 14	Breeding network - Southeast, field crops				
2009-01338	2	peach, cherry, apple			2, 3, 5, 11a, 11b, 11c, 11d, 12, 14, 19		1, 3		1c	
2009-01340	1, 4a, 4b, 4d, 5b	4c = spelt; 1 = potato, squash, other veg			2, 3, 5, 11a, 11b, 11c, 11d, 12, 13, 14	Comparison of low-high intensity rotations	1		3e, 3f	
2009-01343	12	Emphasis on vegetables			1, 15a					
2009-01346	12	Emphasis on horticultural crops	9	All livestock	3, 11a, 11b	conference, organic inspector training	2	certification	1	"conservation practices"
2009-01361	4b				11b, 12, 14		1		3b	
2009-01366	4a				1, 2, 5, 11b, 13, 14, 17	multi-site, multi-year variety evaluation org sys	1			
2009-01371	4a, 4b, 5b, 7	7- sunflower			1, 2, 11b, 11c, 11d, 12, 14,19, 20	variety evaluation, 20-on-farm research	3	Farmer network, build on-farm res capacity.	2, 3a, 3f	Emphasis: songbird habitat

Appendix A2. Research topics addressed

Project number	Crops (1-12)	Crops comments	Livestock (1-9)	Livestock comments	Production practices (1-20)	Production practices comments	Social/ economic (1-4)	Social/ economic comments	Environmental (1-3h)	Environmental comments
2009-01377	4a, 4b, 5b				3, 11b, 11c, 11d, 12, 14	Emphasis: organic no-till, weeds, soil cons.	1		1a, 1b , 1d, 3e	1d - conserve pollinators & other beneficials
2009-01383	11e	hops			1, 2, 3, 5, 11b, 11c, 12, 14				3b, 3e, 3f	3b - "reduce N loss"; 3f - C sequestration
2009-01389	12				1	Project reports mixed up, cannot evaluate				
2009-01402	1	Test crop tomato			5, 11a, 11c, 12	multi-species cover crops, soil life & crop dis	1, 3	economic and socioeconomic analyses		
2009-01405	1	lettuce, tomato, eggplant			2, 3, 11a, 15b	vermcompost based potting media	1			
2009-01415	1	Tomato test crop, wider applicability			1, 11a, 11b, 11c	Soil-plant N cycling, genetic mechanisms			3b, 3f	
2009-01416	4a, 4d, 6	Grains in generally, barley, wheat, alfalfa			1, 2, 11a, 11b, 11c, 11d, 12, 13, 14	Focus - weeds, N, erosion	1, 2		1a	
2009-01420	12				13, 14		3	Mental models & farmer weed management practices		
2009-01422	8d				2, 17, 18	Peanut butter processing & safety				
2009-01429	1	Potato			1, 2, 3, 5, 14, 15a	Variety evaluation and organic seed prod	1			
2009-01434	12		1		All		1, 2			
2009-01435			1		8, 9, 11b	Survey of organic, grazing, conventional dairy farmers	1		3b, 3f	
2009-01436	4a, 5a	5a - dry bean			11b, 11c, 14		1, 2, 3, 4	3 - social factors inhibit adoption of organic		
2009-05488	1 ?	title says "vegetables"; text "corn" (sweet?)			11b, 11c, 11d, 12	C, N, P retention in conventional / or, till / no till	4		3b	

Appendix A2. Research topics addressed

Project number	Crops (1-12)	Crops comments	Livestock (1-9)	Livestock comments	Production practices (1-20)	Production practices comments	Social/ economic (1-4)	Social/ economic comments	Environmental (1-3h)	Environmental comments
2009-05497			1, 2		9, 11b				3b, 3c	
2009-05499	4b, 4d, 5b, 6	Corn-soy-oats-alfalfa rotation			11b, 11c, 13, 19		1		3b, 3c	
2010-01869			1		8, 9, 11b, 11c, 16	Birdsfoot trefoil for tannin & milk prod	1		3b, 3d, 3e	3b - nutrient leaching; 3d - ammonia emissions
2010-01870	8a				1, 2, 3, 19	Breed cotton for thrips & droughts resist.	1	Mentioned in methods, no results yet		
2010-01884			7a, 7b		6, 7, 9	Integrated management of gastrointestinal nematodes	1			
2010-01899	12		9				2	Organic farmers' guide to contracts		
2010-01904	5a	dry bean (Phaseolus vulgaris)			1, 2, 3, 5, 11b, 12, 14	variety selection + cover crops for N, weeds				
2010-01905	2	cherry, apple, raspberry			1, 3, 5, 11b, 11c, 12, 14, 15c, 20	20 - season extension / high tunnels	1			
2010-01913	1	Tomato, applicable to vegetables in general			1, 2, 3, 5, 11a, 11b, 11c, 12, 13, 14		1, 2			
2010-01916			8c	Bison	6, 9		2			
2010-01927	12	Vegetable farmers attended	9	Livestock grazers attended			4		1b	
2010-01929	12				11b, 11c, 11d				1a, 3b, 3e	
2010-01932			1		7, 8, 9	additional topics TBD by needs assessment	2	Additional topics TBD by needs assessment		
2010-01940	2	Blackberry			1, 2, 5, 11b, 14, 17, 18, 19	in-depth anal. quality and shelf life assessment	1	Econ anal of food safety recall impacts	1c	

Appendix A2. Research topics addressed

Project number	Crops (1-12)	Crops comments	Livestock (1-9)	Livestock comments	Production practices (1-20)	Production practices comments	Social/ economic (1-4)	Social/ economic comments	Environmental (1-3h)	Environmental comments
2010-01943	1	Potato			1, 3	Variety evaluation for potato beetle resistance, yield	1	Enterprise budgets for varieties & traits		(pesticide reduction noted, not studied)
2010-01944	6		1		7, 8, 9, 11c, 16	Educational materials / outreach thru eOrganic				
2010-01945	1	leafy greens - lettuce, spinach			2, 11a, 17, 18	antimicrobials, org inputs soil / pathogens				
2010-01954	1	tomato, snap bean, broccoli			3, 5, 11a, 11c, 12, 13, 14				3e	Environmental context, lot of soil health assessment
2010-01965	12				11b, 11c	Nutrient flows and GHG in organic systems			1b, 3b, 3f	Focus: GHG / C sequestration in organic systems
2010-01970			7a, 7b		7, 8, 9		1			
2010-01975	4a, 4b, 4d, 5b, 6	4d - small grains, 6 - alfalfa	1				1, 2	Focus: econ analysis organic transition		
2010-01988	1, 2	Vegetables and fruits in general			17, 18	Nonthermal pasteurization for juices				
2010-01998	4b, 5b, 6				3, 11a, 11b	Test cation balancing hypothesis (gypsum)				
2010-02363	4b		9		1, 2, 3, 5, 8	Extensive breeding program / network				
2010-03392	1	pea, broccoli, sweet corn, carrot, w. squash			1, 2, 5, 15a	Extensive breeding network - org. vegies				
2010-03952	4a, 6, 7	7 - oilseed sunflower			10, 11b, 11c, 11d, 19	Soil c and N dynamics	1		1b, 1c, 3c, 3f	
2010-03954	4b, 5b				11a, 11b, 11c, 11d, 12, 13, 19	soil C dynamics in organic, min-till, conventional			1a, 1c, 3b, 3c,3e, 3f	
2010-03956	1	tomato, squash, bean, lettuce., onion, broc.			2, 3, 11a, 11b, 11c, 11d, 12, 13, 14	C dynamics of veg rotations w/ diff organic practices	1		1a, 3b, 3e, 3f	C seq. and other ecosystem services

Appendix A2. Research topics addressed

Project number	Crops (1-12)	Crops comments	Livestock (1-9)	Livestock comments	Production practices (1-20)	Production practices comments	Social/ economic (1-4)	Social/ economic comments	Environmental (1-3h)	Environmental comments
2010-03957			1		10, 11b, 11c				3b, 3e, 3f	
2010-03958	1	snap bean & broccoli; wider applicability			2, 3, 5, 11a, 11b, 11c, 11d, 12, 13, 14, 19	bahia sod & strip till in org trans	1		1c, 3b, 3c, 3e, 3f	Ecosystem services of sod / reduced till org
2010-03990	1, 2	onion, melon, grape, grapefruit, other			3, 4, 11a, 11b, 12, 14, 19	focus - pest, pollinator, beneficial arthropods.	1, 2	Exc. info marketing venues, CSA, farmers markets, etc.	1a, 1c, 3f	
2010-04008	12	Applies to crop production in general			11a, 11b, 11c, 11d, 12	Cover crop N fix, C sequestration, termination method			3f	Ecosystem services - narrow focus on C sequestration
2011-01942	5a, 5b	kidney, pinto, heirloom dry bean, soybean			1, 2, 5, 11a, 11b, 11d, 13, 14	Focus farmer participation breeding, N fix, weed management				
2011-01950	6, 7	ryegrass, clover, annual forages; flax seed	1		1, 2, 8, 9, 16	Manage cow nutrition to improve milk quality	1, 2		3f	Methane emissions from dairy cattle
2011-01955			4		6, 7, 8, 9, 16, 18					
2011-01959	4a, 4b, 5b, 6				3, 11a, 11b, 11c, 12, 13, 14	Focus: cover crop mixes for diff purposes	1		1a, 3b, 3e	3b - nutrient leaching / retention
2011-01962	1	Carrot			1, 2, 3, 5, 11a, 11b, 11c, 14	Focus: major carrot breeding program				
2011-01965	2	Apple, pear			5	Focus: fire blight management, NOP allowed materials				
2011-01969	1, 2	broccoli, lettuce, strawberry			3, 5, 11b, 11c, 12, 13, 14	anaerobic soil disinfection disease management	1		1b, 3b, 3e, 3f	3f - soil C sequestration, GHG mitigation (CO_2, CH_4, N_2O)
2011-01979	1	Cabbage and other crucifer vegetables			3, 5	Focus: leaf beetle, harlequin bug, black rot	1			
2011-01982	1, 2, 4, 5b, 7, 11	Wide range of crops, grain species not specified	1, 7a		1, 3, 5, 6, 7, 8, 9, 11a, 11b, 11d, 12, 14	Based on review of Proceedings	1, 2			
2011-01983	2	Fruits in general			2, 3, 5, 11a, 11c		1, 2		1b, 2, 3a, 3b, 3e	2, 3a - less pesticides protect habitat, diversity

Appendix A2. Research topics addressed

Project number	Crops (1-12)	Crops comments	Livestock (1-9)	Livestock comments	Production practices (1-20)	Production practices comments	Social/ economic (1-4)	Social/ economic comments	Environmental (1-3h)	Environmental comments
2011-01985	1, 2	Fruits and vegetables in general					1, 2, 4	Marketing barriers to organic		
2011-01987	12	Not specified / TBD	9	Not specified / TBD	TBD	Not specified; production scientists on team	2, 4	Marketing and policy constraints		
2011-01989	1, 2, 4b, 4d, 5b	4d - sorghum; many fruit and veg affected			3	focus: brown marmorated stink bug control				
2011-01990	8d				5, 11b, 14, 19		1, 2			
2011-01994	4a, 4d	ancestral wheat (spelt, einkorn, emmer)			1, 2, 5, 11b, 13, 14, 15a, 17, 18	Breeding wheat for quality, organic sys	1, 2, 3		1a	add grain to veg rotation for soil conservation
2011-02000	4	"grains" in general, likely wheat & other			11b, 11c, 14		2			
2011-02002	4d	naked oats	4	Broilers	1, 6, 8, 9, 10, 11b, 13	Grain-poultry integration., naked oats in feed				
2011-02005	12	Crops in general			3, 4	Biodiversity for pollination and pest management			3a	
2011-04944	1	pepper, eggplant, cucumber, lettuce			3, 11b, 11c, 11d, 12, 14, 19		1		3c, 3e, 3f	
2011-04948	12	no info on crops actually considered	9	no info on what livestock species	10, 11a, 11b, 11c, 11d, 12, 13	Focus: soil biology, C and N in diff systems			1a, 3f	Ecosystem service - C sequestration, 3 GHG (CO_2, CH_4, N_2O)
2011-04952	4a, 4b, 5b				11b, 11d, 12, 13, 14	Cover crops, tillage, and soil N dynamics	1		3b, 3f	GHG, especially N_2O
2011-04958	1, 4a, 4b, 5b	presentations included vegetable systems			11b, 11c, 11d, 12, 14	Soil C/N dynamics, cover crops & tillage			3b, 3d, 3e, 3f	GHG (CO_2, N_2O), other ecosystem services noted
2011-04960	4a, 4d, 5a, 7	4d -millet 5a -lentil, pea; 7 - flax, safflower	7a	sheep graze no-till cover crops	10, 11b, 11c, 11d, 12, 13, 14	Soil C/N dynamics, cover crops & tillage	1		1a, 3f	Ecosystem service - C sequestration, 3 GHG (CO_2, CH_4, N_2O)

Appendix A2. Research topics addressed

Project number	Crops (1-12)	Crops comments	Livestock (1-9)	Livestock comments	Production practices (1-20)	Production practices comments	Social/ economic (1-4)	Social/ economic comments	Environmental (1-3h)	Environmental comments
2012-02201	6	Sum annuals sorg-sudan, teff	1		7, 8, 9, 16					
2012-02222	1, 2, 4b, 4d, 5a, 5b, 7	Sorg., millet, sunflower., okra as trap crops			3	Integrated management of brown marmorated. stink bug				
2012-02236	4a, 4b, 5b, 8d				1, 5, 14	Regional breeding center for organic				
2012-02244	4a, 4d, 5a, 7	4d-millet; 5a-lentil, bean, pea; 7-safflower	7a	sheep grazing in lieu of tillage	2, 3, 4, 5, 7, 8, 9, 10, 11b, 11c, 11d, 12, 13, 14, 19		1		1a, 3a, 3c, 3e	
2012-02247	1, 2	Test crops tomato, spinach, lettuce, melon			2, 18	Essential oils as alt. to chlorine	1			
2012-02270	4d	Quinoa			1, 2, 3, 5, 11b, 13, 14, 19	Quinoa breeding & prod practices for organic	2			
2012-02290	6	Birdsfoot trefoil	7a, 7b		1, 7, 9	high tannin trefoil for GIN control	1			
2012-02292	1	Cucumber, melon, summer squash			1, 3, 5	Breeding &prod practices for pest/disease management	1			
2012-02965	4a		7a		2, 8, 9, 10, 11a, 11b, 11c, 14		1	enterprise budgets	1a, 3b, 3d, 3e, 3f	Emphasis: C footprint, GHG (CO_2, CH_4, N_2O)
2012-02977	4a, 4b, 4d	4d - rye			11b, 11c, 11d, 12, 13	Soil C & N cycles linked			3e, 3f	GHG all three (CO_2, CH_4, N_2O), C seq.
2012-02978	4b, 5b	"long rotation" - corn, soy, cover crops			11a, 11b, 11c, 11d, 12, 13, 14	Soil C & N cycles linked			3e, 3f	GHG all three (CO_2, CH_4, N_2O), C seq.
2012-02980	1, 4	Veg, grain -specific crops not mentioned			11a, 11b, 11c, 12, 14	Focus: cover crops mixes -opt agronomic benefit			3b, 3e, 3f	Focus on N_2O emissions / mitigation
2012-02981	4a, 4d, 5b	Corn-soy-spelt rotation			3, 11a, 11b, 11c, 11d, 12, 13, 14				1a, 3a, 3b, 3d, 3e, 3f	Functional biodiversity for GHG mitigation, nutrient cycle, etc.
2012-02983	4c				1, 2, 11b, 11c, 12	cover crops, org amend, cultivar & rice prod	1		3b, 3e, 3f	Net C balance, N leaching, soil quality

Appendix A2. Research topics addressed

Project number	Crops (1-12)	Crops comments	Livestock (1-9)	Livestock comments	Production practices (1-20)	Production practices comments	Social/ economic (1-4)	Social/ economic comments	Environmental (1-3h)	Environmental comments
2012-04472	1, 6	Experiments w/ veg and veg-pasture rotation	9		10, 11a, 11b, 11c, 11d, 12, 13	few details on system, in-depth soil anal.			1b, 3f	C and N dynamics, all three GHG
2013-03943	1, 2	Tomato variety trial; fruit & veg in general			1, 3, 5, 12, 14	student projects; participatory network	2	marketing & organic certification		
2013-03950	1	Vegetables in general			3, 11c				3a	role of biodiversity. & soil quality in reducing pest pops.
2013-03968	2	Apple			5	Specific focus on organic fire blight management				
2013-03971	3	Pecan			1, 3, 5		1, 3	1-profit, 3- strategy promote adoption	3a	
2013-03973	12	Groups on grains, forages, fruits, vegies			1, 3, 11b, 11c, 12, 13, 14		2		1a	Soil conservation noted as educational topic
2014-03354	1	Mixed vegetable farms			10, 11a, 11c, 18	food safety via soil bio-diversity & activity			2, 3a	Natural areas for pest control
2014-03365	1, 2	Summer and winter squash test crops			4	native bee habitat / pollination			1d, 2, 3a	1d - Native bee conservation; div & natural areas for bees
2014-03378	1, 11b, 11e	Crops TBD in course of project	1		4, 9, 11b, 11d, 12, 13, 14, 19	topics TBD based on needs assessment	1, 2	market analysis, bus planning, org cert.	1a, 3a, 3f	3f - C sequestration, N2O
2014-03379			4		8	methionine synthesis & poultry nutrition				
2014-03385	4b, 5b				4, 11b, 11c, 11d, 12, 13, 14	benefits of cover crops in organic transition	1		1d, 3e, 3f	1d - pollinator conservation, Eco-service of cover crops
2014-03386	2	Apple, pear			2, 5	focus: non-antibiotic control of fire blight				
2014-03389	1	Melon			1, 2, 3, 5, 11a, 12, 18	cover crops, soil microbes, & disease management			3a	Soil microbial diversity, impact of cover crops

Appendix A2. Research topics addressed

Project number	Crops (1-12)	Crops comments	Livestock (1-9)	Livestock comments	Production practices (1-20)	Production practices comments	Social/ economic (1-4)	Social/ economic comments	Environmental (1-3h)	Environmental comments
2014-05324	4a				1, 2, 11b, 11c, 12, 14, 19	org dryland wheat prod, covers, compost	1, 2	market anal, return on input costs	3b, 3e, 3f	"Environ. Sustainability" - water use, soil quality
2014-05325	12	Crop TBD in stakeholder mtgs, likely veg			1, 15a	Breeding goals TBD in stakeholder meetings				
2014-05326			1		7, 16, 18	Residues of organic mastitis in milk, meat				
2014-05340	4b				1, 2, 3, 5, 14, 15a	Breed for quality, disease/weed/ insect res				
2014-05341	4a, 4b, 5b				11c, 11d, 12, 13, 14	Integrated weed management, innovative tools	1			
2014-05348	12		9		All		All		All	
2014-05354	12		9		10	risk assessment crop-livestock diversified farms	1, 4	Crop insurance / risk anal divers org farms		
2014-05355	12				11c, 13, 15a, 18	workshop topics	2		1a	
2014-05376	1, 4	Vegies & grains in general			14	Focus: abrasive weed control technology	1			
2014-05377	4a, 4b, 5b, 6				3, 11b, 11c, 11d, 12, 13, 14	reduced till cover crop sys - decision tool	1		1a, 3b, 3e	
2014-05378	2	grapes, small fruits, stone fruits			3	Focus: spotted wing drosophila org management				
2014-05381	1	Vegetables in general			2, 3, 5, 11b, 11c, 11d, 12, 13, 14, 20	20 - resilience. to climate change / rainfall extremes	1, 3	cost/benefit anal, labor, quality of life	1a, 1b, 3b, 3e, 3f	3f - net C sequestration
2014-05388	12	Crops TBD by papers offered & accepted	9	TBD by papers offered/ accepted	All crop; livestock 7, 8, 9	TBD based on papers offered & accepted	All	TBD	All	TBD
2014-05396	12	TBD	9	TBD		TBD	3, 4	3 - food security; 4 - policy needs anal	3	Conference emphasis ecosystem services of organic sys

Appendix A2. Research topics addressed

Project number	Crops (1-12)	Crops comments	Livestock (1-9)	Livestock comments	Production practices (1-20)	Production practices comments	Social/ economic (1-4)	Social/ economic comments	Environmental (1-3h)	Environmental comments
2014-05402	1	tomato, pepper, squash, sweet corn, cabbage			1, 2, 5, 15a	Farmer participation breeding & variety evaluation				
2014-05405	1	tomato			1, 2, 5, 11a					
2014-05407	12	Any crops susceptible to powdery mildew			5	Focus: UVB light to control powdery mildew				
2014-05408	1, 4a, 4b, 5b	Focus: corn, soy; wheat, tomato mentioned			2, 3, 11a, 11b, 11c, 14	Test cation balancing hypothesis (gyp, lime)	1	cost/ benefit anal, enterprise budgets		
2014-05411	4,5b, 6	"Grains" general (incl. soy?), forages	2	"Cattle" not specified	2, 3, 8, 9, 10, 11b, 11c, 13, 16, 18	Focus: crop-livestock integrated systems	1, 3		3e, 3f	

APPENDIX A3. Producer involvement, outreach, and impact

Key to Appendix A3

Project Number: The Proposal number.

Producer/processors involvement (codes entered as follows):

1. Application team (includes identifying priorities and project planning)
2. Research team
3. On-farm research
4. Results dissemination
5. Project evaluation

Note: Any significant level of farmer involvement in each of these aspects of the project was noted, based on reports or (for 2014 projects, for which first annual report was not yet available at time of data collection) proposals. Thus:

- *"Application team" means farmers were consulted regarding priorities, objectives, methods, etc., but not necessarily that farmers were on the proposal writing team;*
- *"Research team" means farmers participated in data collection and/or other aspects of carrying out research, not necessarily that producers were among the project co-PIs;*
- *"On-farm research" means farmers either hosted trials conducted by scientists on the team and/or conducted trials themselves;*
- *"Dissemination" means hosting field days, sharing outcomes or teaching practices to other farmers, serving as co-presenters at workshops, or other extension activities; "Evaluation" includes workshop participant farmers filling out post-event surveys and/or 6-month follow-up surveys to assess adoption of practices and tools presented, as well as more in-depth engagement in evaluation of project outcomes and impacts.*

Producer/processor involvement comments – including a qualitative assessment of the apparent level of farmer involvement (L, M, H, VH = low, medium, high, very high) based on abstracts; sometimes includes quantitative information from abstract (e.g., numbers of farmers involved in a particular way).

Research results dissemination – to whom (target audiences, codes entered as follows):

1. Producers
2. Processors
3. Scientists/researchers
4. Service providers – Extension, NRCS, FSA, other gov't agencies, independent consultants, etc.
5. Teachers, professors, other educators
6. Students – public school, college, graduate, adult education
7. General public
8. Other (specifics in column E)

Dissemination to whom – comments

Research results dissemination, how/media (codes entered as follows):

1. Written materials – hard copy
2. Conference presentations, workshops, minicourses, training events
3. Farm tours, farm field days, university agriculture research station field days
4. eOrganic and eXension
5. Project web site
6. E-mail list serve and social media
7. Other electronic media (comment)
8. Radio, TV, other traditional news media
9. Other (comment)

Dissemination, how/media comments (including selected data from abstracts, such as numbers of individuals reached through presentations, trainings, or field days).

Project products (codes entered as follows):

1. Educational and extension materials for producers and other end users: information sheets, reports, bulletins, manuals, videos, etc.
2. User-ready decision tools for producers or processors
3. Producer-ready seeds (crop varieties) and livestock breeds
4. New input materials or production methods appropriate for organic systems
5. On-line courses or webinars (that users can take or view anytime)
6. Academic course curricula (any level from elementary school through university)
7. Interactive website for exchange of information and ideas, and/or technical assistance
8. Networks linking producers, processors, researchers, educators and/or extension personnel
9. Research articles and reports in refereed professional journals (mostly likely accessed by scientists and agriculture professionals rather than producers, processors, and the general public)
10. Other (including MS theses and PhD dissertations; details in column I)

Project products, comments (specifics on some of the most prominent products in terms of practical impacts or utility for producers and other stakeholders).

Impacts (codes entered as follows):

1. Improve/expand organic farming and processing operations
2. Enhance profitability
3. Improve conservation/environment
4. Evidence of use of practical outcomes (comment)

Impact Comments (including a qualitative assessment of potential practical impacts to farmers (L, M, H, VH, P = low, medium, high, very high, or potential), as well as details from abstracts on specific impacts).

Benefits of research to (codes entered as follow)::

1. Farmer
2. Processors
3. Agricultural professionals (research, extension, conservationist, independent consultant)
4. Rural community
5. Unban community
6. Other (comment)

Note: Categories 4 and 5 were used sparingly, as it was difficult to evaluate community level impacts without an in depth interview of stakeholders in a project's locale or region. Estimates of community level benefits based on project abstracts is thus conservative and likely lower than actual benefits.

Future research priorities (comment)
Research questions or topics suggested by project outcomes, including those surmised by consultant on OFRF analytical project (Mark Schonbeck) based on review of abstracts, as well as those specifically identified in project reports by the research team or its target audiences.

Additional comments
This column was used to flag projects of potential interest for the analytical team to explore in more depth (red type), or to note difficulties or concerns with the data collection for a given project because reporting on the CRIS database is sketchy or not up to date.

Appendix A3. Producer involvement, outreach, and impact

Project #	Producer/ processor involvement (1-5)	Overall producer involvement (L = low, M = moderate, H = high, actively engaged; VH = very high, integral role; ? = difficult to assess from abstract); Producer comments	Research results dissemination - to whom (1-8)	Dissemination to whom - comments	Research results dissemination - media (1-9)	Dissemination media - comments	Project products (1-10)	Project products - comments	Impacts (1-4)	Overall practical impacts for producers (L = low, M = moderate, H = high, VH = very high; P = significant potential impact); Impact comments	Benefits of research to (1-6)	Benefits comments	Future research priorities comments)	Additional comments. *= project recommended for further analysis
2002-3796	2, 3	M ?	1, 2, 3	Target audiences: organic crop and poultry farmers, poultry nutritionists	1, 2		9	Refereed journal articles only	(1, 2, 3)	P - Project outcomes not yet ready for on farm application, more research needed	(1, 2), 3	Primarily researchers at this point; farmers and processors in future	Need follow-through research to make project info farmer-ready; field testing of promising diets	
2002-3798	(1), 2, (3), 4	H ?	1, 3, 4, 5, 8	4 = consultants; 8 = economic development professionals	1, 2, 3, 6, 7, 9	9 = consultations	1, 9	Maybe more, hard to assess	1, 2, 3, 4	VH - 4 = used in market gardener training program with 100+ graduates, 30 market garden sites	1, 2, 3, 5, 6	6 = students		
2002-3799	(1), 2, 3, 4, (5)	VH - producers integral part of project; role in application and evaluation. unclear	1, 3, 8	8 = marketers	1, 2, 5	Project website active 2015	1,(7, 8)	7, 8 - strong network and website developed in OREI 2009-01429	1	H - great potential realized through ongoing work after this project finished	1, 6	6 = marketers	Production of disease-free seed potatoes; more breeding and variety evaluation for organic systems	* Great accomplishment on small budget; good follow-through
2002-3804	2	M ?	1, 3, 4, 7, 8	8 = nursery growers	1, 2, 3, 5		1, 7, 9, 10	10 = plant tags for marketing	1, 2, 3	L - small component of organic sector	1, 6	6 = consumers, home gardeners	Micro-irrigation for disease management, market research, consumer education	
2002-3805	3	M ?	1, 3, 4		3		8, 9	grower-researcher dialog "increasing"	1, (2, 3, 4)	P - Potential impacts of project appear substantial but speculative / in the future	1, 3			
2002-3806	3, 4	M - H ?	1, 3, 4, 5, 6, 8	8 = policy makers	1, 2, 3, (5)	Project website link broken or inactive	1, 7, 8, 10	10 = field school for agriculture professionals	2, 3	P - valuable crop rotation info; more research and outreach needed	1, 3		Farmer-researcher-educator groups meet to discuss ideas, identify new organic research topics	
2003-04559	(1), 2, 3, 4, (5)	VH - producers integral part of project; role in application and evaluation. unclear	1, 3, 4		1, 2	Whole farm planning workshops	1	Two organic production manuals	1, 3, 4	VH - project. helps farmers make sustainable decisions; N management for weed control in soy	1, 3		Continue research on N and other nutrients in weed management; more on giant ragweed management	
2003-04602	(1), 2, 3	H - major grower role in project; not clear if on application team	1, 4		1, 2, 3	136 growers total at field days	1, 9	3 Extension bulletins, ~5 journal articles	1, 2, 3, 4	VH - New NOP-allowed pesticides registered, ME blueberry acreage up 400-750	1		Continue trials; evaluate longer term environmental impacts	

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2003-04618	1, 2, 5	H - farmers identified 3 strategies to test; organic producer advisory board	1, 3, 4, 5, 6		1, 2, 3, 4, (5), 6	(5): web link broken or no longer active; 6 = e-newsletter	1, 9, 10	10 = two PhD dissertations and one MS thesis	1	H - Crop yield (soybean up 42%, tomato significant) and soil health advantages of low intensity (perennial ley) transition.	1, 3		Promising results with practical application - how well are these being disseminated to and used by organic farmers? (Posted on New Ag Network web site no longer active)	* Example of valuable practical info with inadequate dissemination?
2003-04619		L - No producer involvement mentioned	1, 3, 4, 5, 6		1, 2, 4, 5	5 + project website currently active and very informative	1, 6, 9		1, 2	P - project results "may help growers" improve income	1, 3			
2003-04625	2, 3, 4	H - five on-farm demo trials	1, 3, 4, 5, 6		1, 2, 3		1, 9, 10	16 info sheets; 10 = two MS theses	1, 2, 3	P - potential gradually realized through new equipment. development., additional studies, written materials.	1, 3		Continue research and development on organic conservation agriculture, including equipment for organic rotational no-till	
2004-05131	(1), 2, 3, 4, 5	H - not clear if farmers also in application team.	1, 2, 4, 7, 8	8 = lenders, policy makers	1, 2, 3, 7	7 = U. Maine and U. Vermont web sites	1, 2, 9	Manual for producers; decision tool for lenders	1, 2, 4	H - widely used new information aid for lenders.	1, 2, 3, 4, 6	6 = lenders		
2004-05136	1, 2, 3, 4, 5	VH - strengthened existing grower-researcher network	1, 2, 3, 4, 5, 6		1, 2, 3, 5		1, 6, 8, 9, 10	6 = taught to 400 Agroecology students, 10 = two PhD dissertations	1, 2, 3, 4	VH - outcomes widely used by growers, researchers, industry; network supports learning and practical application	1, 3, 6	6 = college students	More research on soil, nutrient, disease, and pest management in organic strawberry	
2004-05151	(1), 2, 4, (5)	H - integral farmer role in proposal, not documented in final report	1, 3, 5, 6		1, 2, 3	2 - includes keynote at international symposium on nematodes as bio-indicators	1, 9, 10	10 = mentor 7 students / researchers; 100-spp mite specimen collection	(1, 2, 3)	P - farm impacts stated in proposal, not documented in final reports	3	Basic research findings on soil food web, practical applications not clear	More research to identify "robust relationships" among soil foodweb components that can support practical application.	
2004-05153		L - none stated in proposal; 1-on-1 interactions with growers in final rept.	1, 3, 4, 5, 6, 8	3 = other labs studying crop disease; 8 = product dev. and agriculture supply firms	1, 2, 3, 6, 9	9 = conference calls	1, (4), 9	4: promising seed meal products for disease management, not farmer ready	1	P - seed meal and disease resistant rootstock show promise, need to be tested together	1, 3, 6	6 - product development and farm supply companies	Further RandD, testing integrated strategies needed to arrive at farmer-ready products and procedures	

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2004-05169	(1), 2, 3, 4, 5	VH - 4 farmers, 3 milk processors integrally involved throughout project	1, 2, 4, 8	8 = veterinarians	1, 2, 3, 5		1, 10	10 = PCR method to detect 6 major foodborne pathogens in milk	1, 4	VH -new PCR method widely used by farmers and processors in region	1, 2, 3, 6	6 = general public - public health		
2004-05187		L - No producer involvement mentioned	1, 3, 8	8 = National organic Standards Board, certifiers	1, 2, (7)	NCAT sustainable poultry web URL not functional; ATTRA bulletin available	1	Excellent ATTRA bulletin on poultry nutrition	4	M - Practical info on poultry nutrition for organic farmers; methionine problem not solved.	1, 3	"Negative" result (slow growing breeds have same methionine need)	Need to develop affordable, practical methionine supplements for organic poultry	
2004-05204	3, 5	H - trials on 6 farms; farmer survey in first year of project	1, 3		1, 2, 3		(1), 4, 9	1: fact sheets for farmers mentioned in proposal but not final report	1	P - Rye reduced soy aphid; Yr. 1 survey: farmers would use rye b4 soy if it works	1, 3	No end-of-project survey reported; thus actual farmer benefit unclear.	Delivery of outcomes to farmers appears weak or under-reported. Is more research needed b4 farmer application?	
2004-05205	1, 2, 3, 4, 5	VH - 217 farmers conduct variety trials; farmers engaged at all stages	1, 3, 4, 5, 7		1, 2, 3, 5	66 outreach events reach 4,500; web site 4,800 hits	1, 3, 8	7 varieties released, 19 more ready; farmer-breeder networks @ 5 hubs in NY, WV, NM, CA, MS	1, 2, 4	VH - Farmer survey, 111 respondents: 76% adopt varieties based on field evaluation; 50% increase capacity to evaluate/breed or save seed	1, 2, 3, 6	6 = public plant breeders, seed companies that carry organic seed	Ongoing vegetable breeding efforts to address additional organic producer needs - disease and pest resistance, market qualities, response to organic soil management, etc.	* Excellent grower engagement and high value for investment
2004-05207	(1), 2, 3, 4	H - intensive study of one farm; 27 other farmers surveyed	1, 3, 4, 5, 6, 7, 8	6=high school through grad school; 8 = government agencies and NGOs in conservation	1, 2, 3, 5	3: farmer hosted field trip for international symposium on agriculture ecosystem services	1, 9, 10	10 = white paper on climate change and agriculture to CA Energy Commission	3	P - Practical impacts not clear at this point; more research and outreach needed	1, 3, 6	6 = collaborators. work with state agencies on climate mitigation and adaptation	Need to investigate causes and mitigation strategies for an observed increase in N_2O emissions	
2004-05216	4	M - 2 day stakeholders' workshop to review findings and implications	1, 3, 4, 8	8 = National organic Standards Board, NOP personnel	1, 2		1, 9		1	P - goal is to make NOP livestock welfare standards clearer and more science based	1, 3, 6	6 = NOSB, NOP, certifiers	Need to follow through and complete this work so that NOP standards can be improved and clarified based on science.	

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2004-05218	2	H - Research and education informed by "best" organic vegetable and grain farmers	1, 4, 5, 6		1, 2, 3, 5	20 field days reach 930; workshops reach 630; active Cornell organic. website	1, 2, 5, 6, 8	2 = improved Cornell soil health evaluation tool; 6 = results used in 4 courses; 8 = grower-extension network	1, 2, (4)	H - 4: hard to evaluate use of practical outcomes (overall impact could be VH)	1, 3, 6	6 = students: 276 take courses, 39 participate in research	Longer term evaluation of the four grain and four vegetable cropping systems - work continued under OREI 2009-01340	
2005-04426	3	H - on farm trials, project team answered many farmer questions	1, 3, 4		1, 2, 3	Several sheep and goat field days and producer meetings	1, 9	~10 refereed journal articles	1, 2	H - project info on parasite management has "reduced need for deworming."	1, 3		Additional research needed (and likely ongoing) to improve integrated parasite management for organic sheep and goats	
2005-04461	2, 3, 5	H - growers' group Soil Health in Fruit Tree Systems met 3x during project	1, 3, 4, 6		1, 2, 3	Strong emphasis on workshops - 10 events reached > 500 people	1, 9	Findings reported in growers pubs and refereed journals (2+ articles)	1, 4	H - Orchard floor management for soil health, conservation practices for EQIP funding	1, 3		Additional research may be warranted to develop more robust recommendations	
2005-04473	1, 2, 3, 4, 5	VH - farmers on advisory group, biweekly forum; 29 farmers and 112 wholesalers ID priority issues	1, 3, 4, 5, 6, 8	8 = marketers, wholesalers	1, 2, 3, 5, 6, 7	11 field days 450 participants.; website 200K hits; 7 = biweekly teleconference forum (15 farmers regular participants)	1, 5, 6, 8, 9	6: organic curriculum through student farm; 8: robust farmer-researcher network and tele-forum; 9: Agron. Monogr. and other	1, 2, 4	VH - Field day and curriculum info widely used in organic prod, trans, cert; Gt Lakes Fruit and Veg Exp greatly expands organic program	1, 3, 6	1 and 3 - highly effective mutual farmer-researcher learning; 6 = buyers and marketers (sourcing local organic)	Need to get the wealth of excellent information generated out to the wider organic farming sector.	* Excellent grower engagement - see V. Morrone notes
2005-04474	1, 2, 3, 4, 5	VH - Farmers helped choose four cropping systems to evaluate	1, 2, 3, 4, 5, 6		1, 2, 3, 4		1, (2), 9	2: decision matrices "being developed"	1, 2, 3	H - Useful info on cropping systems; project "paved way" for other funded projects	1, 2, 3	Primary audience is organic dairy farmers	More research may be (weed management, etc.) needed before full on-farm application of outcomes.	
2005-04477		L - No producer involvement mentioned in abstract	1, 3, 4, 6	Several masters' students engaged in project	1, 2, 3		1, 4, 9	4 - successful roll-crimp no-till for winter pea cover	1, 2, 4	H? - final report cited increased # organic farmers, organic wheat, pea, lentil acres in MT - link to project not clear	1, 3	Some practical info on N, P, weed, and cover crop management	More research needed on cover crop, nutrient and weed management to develop successful organic grain systems for this region	

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2005-04484		L - farmer survey on crop rotation; no active role in project mentioned	1, 2, 3, 4		1, 2, 3, 7	2, 3 - events reach 1,200; 7 = existing university and other web sites	1, 4, 9, 10	4 - organic Asian Soybean Rust (ASR) mgmt. strategy (copper); 10 = ASR detection test for in-field use	1, 4	VH - Improved ASR detection and management skill for thousands of organic soybean growers; ASR management compatibility with rolled rye cover	1, 2, 3		More follow through on rotations, windbreaks, strip cropping and other strategies (not discussed in final report summaries)	
2005-04494		L - No producer involvement mentioned in abstract	1, 3, 4, 7, 8	7 = home gardeners, 8 = commercial nursery / greenhouse owners and managers	2, 3, 5, 6, 9	6 = e-newsletter to 200 growers and service providers; 9 = "advice provided upon request"	4, 9, 10	4 ="effective" organic no till method for tomato and pepper; 10 = four masters' theses	1	P - written materials for farmers lacking or unreported; need means to deliver info after project ends.	1, 3, 6	6 = home gardeners, commercial nursery/ greenhouse managers	May need more research to develop practical information and methods ready for wide dissemination to end users.	
2005-04497	1, 2, 3, 4, 5	VH	1, 2, 3, 4, 5, 6, 7	5, 6 - high school and college students and teachers, 4H programs	1, 2, 3, 5, 6		6, 8, 9	8 = Farmer-researcher networks in 4 eco-regions; written materials for farmers not mentioned	1, 3, 4	H, P - 3 = bird habitat; 4 = flame weeding method, organic wheat breeding priorities; field day participants apply info on their farms	1, 3, 6	6 = high school, college, and university agriculture students	Long term (post-project) info delivery (e.g. info sheets) unclear; Need to ensure adequate long term support for wheat breeding follow-through on organic priorities	* Lots of practical info, but is it available to farmers after life of grant?
2006-02010	5	M - farmer feedback via semiannual learning group meetings with researchers	1	organic growers; no mention of extension or other stakeholders	1, 2, 3, 5, 9	9 = learning groups - farmers share experiences with researchers; annual field day draws ~125	1	Risk Management Guide for organic Producers (300 people), available free at web site	1	H - Sunflower, cereal grains, millet, amaranth promising alternative crops; information on diversified rotations for weed management	1		Additional work on rotations, weed management, best alternative feed grains for methionine content, etc.	
2006-02014	1, 2, 3	H - strong role in project design; role in execution, outreach, evaluation less clear	1, 3, 4, 5, 7, 8	3 - field days "for growers, agriculture prof, public; 8 = urban garden youth and adult groups	1, 2, 3		9, 10	3 refereed journal articles, 1 PhD dissertation; no mention of info sheets or other outreach materials for farmers	1, 3	P - much info with practical implications, but not clear whether and how it was delivered to farmers	(1), 3	Data on transition strategy, cover crop, plant diversity and nutrient inputs on weeds, soil, crop yields	Need to follow through with additional research and effective outreach to realize the potential benefits of this work.	* Lots of potential - find out if needed research and outreach was done
2006-02018		M - five farmers listed as participants; report cited farmer stakeholder input but not on-farm trials	1, 4, 7		1, 2, 3		(1), 9	Publications in preparation for scientific community	1, 2	P - Project generated new info on fertility, mulching, pest and weed mgmt. for blueberry; but not widely disseminated	(1), 3		Need to get this info out to producers - not clear if info is currently available in written or other form to producers	* Explore whether practical info from project has reached farmers

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2006-02028	3	M - on farm demo and research	1, 3, 4, 6, 7	6 = undergrad through post doc	2, 3, 8	Newspaper story on organic shrimp farming demo	9		1	L - research procedures encountered difficulties; practical application unclear	1, 3		Need better protocol for regulating diet / biological environment in experimental traits.	
2006-02030	2, 3, 4	H - Farmers select cover crops to evaluate, host on farm trials and student field days	1, 3, 4, 5, 6		1, 2, 3		2, 6, 9	2: Cover crop mgmt. tool tested with 20 farmers in 2009, no mention in final report; 6 = Sustainable Ag Scholars Program	1, 2	P - Valuable research data, not clear whether ready for widespread extension or on farm application.	1, 3		Additional research on impacts of cover crop species/ mixes impact N fixation and weeds to fine-tune decision tool and help farmers select cover crops for their goals.	
2006-02047		L - no mention of farmer role in project	1, 2, 3, 5, 6, 8	8 = "administrators"	1, 2, 3	One workshop and one field day reached total of 200.	9	Abstracts only	1, 2	L? - Results "used for soil amendment recommendations," but no results or practical impacts elaborated in report	3	Initial data on which additional research and eventually outreach cd be based.	Good questions asked about crop diversification as tool to reduce pest and weed pressure; more research needed. Continued as organic-2007-03761	
2006-02048	1, 2, 3, 4, 5	VH - eight-farmer advisory board; 6 farms in replicated trial; farmer presenters / mentors	1, 3, 4, 5, 6	6 = undergraduates (course)	(1), 2, 3, 4	Only one publication listed, no written materials for producers or extension cited in final report	5, 6	5 = webinar on eXtension, 6 = three-credit course at UW	1, 4	H - 70% in post webinar survey would use info learned; practical IPM guidance disseminated	1, 3, 6	6 = students in course	Additional research needed to evaluate nutrient balance hypothesis over long term, and was conducted under OREI in 2010-15 (proposal 2010-01998)	
2006-02051	5	M? - "interactive community of growers and agriculture prof"; "collaborative partnership," but no specifics	1, 3, 4, 5, 6, 8	8 = government and industry personnel	1, 2, 3, 5, 7	5 is now part of UVM fruit web site; 7 - web log of observations	1, 5, 6, 8	1 = Practical Guide for organic Apple Production, 3 case studies (web site); 6 = undergrad course	1, 2	H, P - Guide is quite extensive and informative; additional research would increase impacts of project	1, 3		Need several years additional monitoring as two systems (replanted vs. top grafted) enter production; OREI grant awarded in 2009 (2009-01325) to continue work	

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2006-02052	2, 3, 4,	H - On farm trials at three organic farms	1, 3, 4, 6	6 - two Masters and several undergrad students involved	1, 2, 3, 5		1, 2, 9	2 - Excel spreadsheets for econ anal of HT blackberry / raspberry; blueberry qualitative (field planting failed)	1, 2, 4	H - Decision tool; important info on HT microclimate and temperature management	1, 3		More on HT versus field blueberry to quantify economics; more on practical mgmt. of freeze risk in HT	
2006-02057	3, 4	H - On farm variety trials, bakers provide input and evaluate varieties for flavor	1, 2, 3, 7, 8	growers, extension, breeders, consumers, bakers	1, 2, 3		1, (3), 9	20 new cultivars "being considered for release" at end of project	1, 2, 4	VH / P - Variety trial and baker evaluation info help farmers select variety; organic "ideotype" for breeding; were the 20 cultivars released?	1, 2, 3	3 - especially plant breeders	Must ensure adequate funding and logistical support for follow-through breeding work to ensure the 20 varieties, and further improvements, reach the farmer!	* great potential - were the 20 variety released? Suff. support for additional breeding?
2007-01380	1, 2, 3, 4, 5	H - especially on farm trials and evaluations	1, 8	8 = vegetable propagators, nurseries	1, 2, 3, 4, 5, 7, 9	2 - Presentations reach ~2,400; 5,7 - web page and webinars reach ~87,000; 9 = individual consultations	1, (3), 5, 8	3: work to develop new rootstocks, not yet released; 8 = use/ strengthen existing grower-scientist network	1, 2, 4	H - info to help growers learn to graft, assess pros and cons; propagators offer grafted starts to farmers and gardeners	1, 6	6 = vegetable seedling propagators, nurseries	Follow-through breeding efforts to develop rootstocks with high scion compatibility, yield, and quality; research to improve grafting procedures and outcomes	
2007-01384	1, 2, 4, 5	VH - farmer input to guide future research	1, 3, 4, 5, 6	Primary focus: Get research findings into farmers hands, farmer priorities to researchers.	1, 2, 7	2 - 500+ farmers and 55 researchers at symposium; 7 - MOSES web site	1	Symposium proceedings with written research summaries (66 people) widely distributed via hard copy and web site	1, 2, 4	H - Valuable farmer-researcher mutual learning; farmers try new practices, res ask new questions; Proceedings reach 2,000+	1, 3, 6	6 = graduate students	One year project - could not assess actual on-farm implementation and new research topics. Follow-up participant survey and additional symposia could clarify and enhance impact.	Check whether there was indeed another symposium for researchers

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2007-01391	1, 2, 3, 4, 5	H - farmers select and field test treatments, host field days	1, 4		1, 2, 3, 5	2 - presentation to 40 at conference; 3 - field days reach 93; 5 web site active but sketchy	1	Handout for field days	1, 4	M, P - Several farmers adopt new flea beetle mgmt. tactics; limited outreach = unrealized potential	1, 3		Repeat experiments for more robust data? Not clear if results were widely disseminated, e.g. as a succinct Extension bulletin on results and most effective tactics could multiply impacts.	* find out if these results are avail to farmers, or "stuck on the shelf"
2007-01398	3?	L - proposal mentions farm-based studies, but no on-farm trial cited in final report	1, 2, 3, 4, 5, 6, 7	Academic professionals, growers, extension, food industry, consumers	(1), 2, (5), (6)	Fact sheets, web site, and new course mentioned in proposal but not final report.	(6), 9	Could find no evidence in final report of info sheets, distance learning, etc. for growers	4	P - Consist. trend with practical implications (field, low N higher phytochemical but lower yields than high tunnel, high N)	3	Delivery of practical info or tech assistance to growers is either lacking or unreported.	Need to get this information out to growers. More studies to identify practices that give satisfactory yields and phytochemical content?	
2007-01405	3, 4	H - few details given, but working farm appears to be major study site.	1, 3, 4, 5	Primarily researchers and farmers, means of delivery to latter unclear	1, 2, 3	Some dissemination reported but not emphasized.	9	10+ journal articles. Primarily a research project; no mention of info sheets or other extension materials	1, 2, 3, (4)	P - Farms "expected" to use results to improve yield, profit, environment.; not clear whether/how this is happening in fact	1, 3	Lots of research data to guide future scientific inquiry	Success with mustard green manure and microbials (disease) and compost (yield); outreach to farmers lacking or unreported. Is more research needed before giving practical info to farmers?	*find out if outcomes avail to farmers, being studied more, or "stuck on shelf"
2007-01411	2, 4, 5	H - Project led by agriculture professionals, but farmers invited to contribute, use and evaluation content, featured in videos, etc.	1, 2, 3, 4, 5, 6, 7		1, 4, 5 , 6, 8	eOrganic founded to deliver organic content (veg, dairy) to eXtension; contact 18,000 individuals at 80 events	1, 2, 5, 7, 8, 10	Communities of Practice develop, evaluate, refine, and publish content; 180 articles, 200 videos, 25 webinars	1, 2, 3, 4	VH - Major new info resource; 270,000 visit organic on eXtension in 3rd year; 90% find info accurate, relevant, practical	1, 2, 3		Continue developing content and delivery infrastructure (ongoing - received 2nd OREI grant and other funding)	major new resource - used by many other OREI projects

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2007-01412		L - None stated	1, 3		1, 3		9	Two refereed journal articles	1	L - Some treatment effects documented, but no clear trends with practical application	3	Research data of interest, but not ready for delivery to producers	Good research questions, study too short and sketchy to address them well, need multi-year studies on cover crop impacts on the soil-microbe-vegetable crop system.	
2007-01417	1, 2, 3, 4, 5	VH - Farmer feedback guided development of weed mgmt. bulletin, incl. farmer case studies, 10 on farm trials.	1, 3, 4, 5		1, 2, 5	Symposium -50 agriculture professionals; 10 workshops reach 556 farmer	1	Fine Tuning supplement to earlier MSU integrated. weed mgmt. bulletin - addresses organic weed management needs	1, 2, 4	H - Bulletin widely distributed / available	1, 3			* review bulletin (I ordered copy)
2007-01418	3	H - Major study conducted on working transitional-organic orchard	1, 3, 4, 5, 7	1 = hog farmers and fruit growers; 7 = "consumers"	1, 2, 3, 7, 8	3 - three grower field days, total attendance ~250. 7 = web news 8 = NPR radio, TV, newspapers	1	2 extension and 4 grower bulletins mentioned, but publication titles not listed in abstract	1, 2, 3	P - Excellent preliminary results with hogs for apple pest control; outreach and on-farm application unclear	1, 3, 6	6 -consumers / general public	More research to confirm benefits and fine tune system; and more outreach/ application. A lot was accomplished with just $33K - let's not lose this momentum!	* did project team obtain more $ to continue RandD on this promising system?
2007-01437	1, 2, 3, 5	H? - Actual farmer engagement under-reported or less than planned in proposal	1, 2, 3		1, 2, 3, 6, 7	7 - on line Sustainability journal article comparing organic and conventional breeding data	9	One refereed journal article		H, P - Project laid groundwork for additional breeding and res; identified N fertility and quality issues; 2 farms do seed increase on 3 var.	(1), (2), 3	Potential future benefits to farmers, millers, bakers substantial	Need ongoing support for farmer participatory breeding and variety evaluation until satisfactory varieties are developed; also continue to explore N fertility management options.	* considerable potential; find out if work is ongoing or if momentum lost

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2007-01441	2	M? - "active contribution of farmers" in proposal, no mention in reports	1, 2, 3, 8	8 = food safety scientists	1, 2		(4), 9, 10	4 -neutral electrochemically. active (NECA) water, bacteriophage against Listeria, not farmer-ready; 10 = PhD dissertation	(1, 4)	P - Outcomes and products in development, apparently not yet ready for extension to producers and processors.	1, 2, 3		Continue research until reliable farmer-ready practical materials or procedures are attained.	
2007-03671	4	M - farmer group reps in Virgin Is workshop, helped train additional farmers	1, 4, 6	Emphasis on extension personnel	1, 2	Intensive interactive workshops train 30 agriculture prof in FL and 25 in VI	9, 10	Several journal articles; three PhD, one MS complete; no mention of Extension bulletins / fact sheets	1, 4	H - Cover crops help with pest management; several VI farmers adopt new varieties, cover crop, pest mgmt.; workshop participants train others	1, 3, 6	6 - University students - several undergrads trained	: "Negative" results on weeds, nematodes, soil OM and avail NPK; more research on these issues; written extension materials would enhance impact	
2008-01237	1, 2, 4, 5	H - Farmer surveys and farmers on advisory group help set priorities and guide project	1, 2, 3, 4		1, 2, 3, 4		1, 2, 5, 7, 9	2 - cost of crop established spreadsheet; 5 - three webinars reach 158; 7 - growers and processors engaged via eOrganic	1, 2, 4	VH - Practical info for optimizing compost and N for blueberry; raised beds increased yields 48%	1, 2, 3		Additional research to optimize production systems for nutrient, water, and weed management; more extension to reach wider audience?	* Good info; explore how widely disseminated to and used by farmers
2008-01245	2, 3	H - Commercial organic orchard hosted major multi-year trial and field days	1, 2, 3, 4, 5, 6, 7	Emphasis on national and international scientific community; field days for farmers and industry reps.	1, 2, 3		4, 9	4 - Novel brassica seed meal formula. gives disease control ~ conventional fumigation, with better soil biology and higher yield	1, 2, 4	P - effective farmer-ready product and protocol; but no info sheets, videos, eOrganic, or product vendor cited	1, 2, 3, 6	6 = students	More Extension!! Excellent results shared with scientists internationally, but unclear whether it has been shared widely with farmers / orchard industry.	* Is this seed meal product and info widely available, or is it "stuck on the shelf"?
2008-01247	2, 3, 4, 5	VH - farmers host field trials (6+), plan and host 39 farm walks, co-present with researchers, serve on advisory committee	1, 3, 4, 5, 6	1 - including immigrant Hmong, Latino, east African farmers; 6 - students high school through PhD	1, 2, 3, 5	3 - farm walks ~900 total participants.; 5 - two websites on soil and small farms	1, 6, 8, 9	1 - five Extn bulletins, video on GAPs (485 viewers), 6 - Cultivating Success courses offered in four languages	1, 2, 3, 4	VH - Farm walk participants (228 survey respondents): improved soil management (>75%), pasture (30%), increased income (52%) transition to organic (8%)	1, 3, 6	6 = high school through grad school students; 5 interns	GAPs food safety training: project leveraged additional funds to address this need; 149 farmers complete basic and advanced GAPs training.	*excellent farmer engagement, outreach and practical application of outcomes

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2008-01251	1, 2, 3, 4, 5	H - preliminary survey to ID priority issues; project led by scientists but farmers involved at all stages.	1, 3, 4, 5 ,6, 7, 8	6 = grad students, three undergrads in apprentice program; 8 = garden and food writers	1, 2, 3, 5	5 - apprentice maintained pest scouting website and farm work journal	1, 2, 9, 10	2 - Economic decision support tool; 9 - many articles and abstracts; 10 = case study on University organic orchard	1, 2, 4	H - Apprentices acquire skills, continue work with farmers and researchers; growers change weed, pest and nutrient mgmt.	1, 3			
2008-01265	1, 4, 5	M - farmers on advisory group at proposal stage, minor role in outreach and evaluation	1, 3, 4, 5, 6, 7, 8	6 - over 100 interns at CEFS received project-related training; 8 = landowners, gov't employees	1, 2, 7	7 = "web based materials"	1, 6, 9	6 - Project findings used in several agriculture courses at NCSU	1, 4	H - Farmers change field border management to enhance beneficial habitat and biodiversity; teach other farmers.	1, 3, 6	6 = students and interns		
2008-01278	5	M - Advisory panel includes farmers, conducts annual evaluation of progress	1, 2, 4, 5, 6, 7, 8	8 = land conservation professionals, re-trained unemployed workers	2	organic Agriculture Practices Certificate course, Extension professional development. workshops	5, 6	5 = course available on line; 6 = high school agriculture teachers use project materials in lesson plans	1, 4	H - 267 enroll in organic Ag Certificate courses, 38 landowners complete on-farm course, 3 new TSPs for NRCS	1, (3), 6	3 - Professional development. workshops canceled due to low enrollment and agency travel restrictions; 6 = educators, students	Address barriers to agency and other agriculture professionals using this resource.	
2008-01281	2, 5	H - 200 dairy farmers provide input data throughout project	1, 2, 3, 4, 7, 8	8 = veterinarians, nutritionists, organic certifiers	1, 2, 5, 7	1 - You-tube videos viewed by ~14,000; 5 - website with 5 fact sheets is still active	1, 2, 7, 9, 10	2,7 - interactive tool to assess herd performance, 9 - nine journal articles; 10 - one PhD and 2 MS complete	1, 2, 3	H? - evaluate impact on farmer practices and environmental, econ, social benefits planned, but not reported; increased herd health awareness	1, 2, 3, 6	6 - consumers, veterinarians, nutritionists, organic certifiers	Need to document project-based improvements in herd health practices by the 300 participating farmers and others, and perceived benefits	
2008-01284	3	M - six trials conducted on farm, but no other mention of farmer role in project	1, 3, 4		1, 2,4	12 articles published, 61 talks to total of 4,667 producers and agriculture professionals	1, 9	Extension and refereed articles; Guidebook on organic Soil management cited in proposal, but not reported	3	M - Outreach on organic methods to improve soil quality, but impact of experimental system limited by poor yield and weeds	1, 3		Continuous organic no-till with 1-spec cover crops improved soil health but slashed yields, encouraged weeds. Research needed on reduced till, integrated weed mgmt., cover crop mixes	

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2009-01311	1, 2, (3), 5	H - "intense engagement" in proposal; on farm trials canceled due to "negative" results in experimental station trials.	1, 3, 4, 5		1, 2, 5	Web sites host decision tools and other info, still active	2	Project findings update and fine tune cover crop decision tools for Cornell and Midwest Cover Crop Council	2, 3, 4	H - ID best planting and tillage dates for 3 cover crops in North, 7 NY seed growers market organic buckwheat locally	1, 3	Vegetable farmers, seed growers	Explore further cover crop strategies for late summer weed management, e.g., multispecies covers (e.g., buckwheat-mustard or buckwheat-grass-mustard-legume)	
2009-01322	1, 2, 3, 4, 5	H - no details on survey or farmer role in dissemination in final report	1, 3, 4	Farmers primary audience	1, 2, 3, 5	Conf talks and website reach 2500; 25+ field days, organic cucurbit web site with project outcomes avail, last update 2012.	1, 2, 7, 8, 9 10	2 - model to predict cucumber beetle arrival; 7, 8 - strong web linked grower-scientist network; 10 = four PhDs	1, 2, 4	VH - practical info on row cover for cucumber beetle mgmt., pollination; cucumber beetle emergence model for large region (IA-PA-KY)	1, 3		Link organic cucurbit web site with other, current projects to facilitate updating	
2009-01325	1, 4	M-H? - "stakeholders involved in goal development"; "orchard tours"; extent of farmer involvement unclear	1, 2, 3, 4, 5, 6, 7		1, 2, 3,4, 5, 6, 8, 9	Project. website 67K visits; organic Orchard Observations e-news; TV news report; 9 - respond to individual questions	1, 9, 10	1 - Practical Guide for organic Apple Production; many info sheets online, 9 - many journal articles, 10 - two PhDs	1, 2, 4	H? - research based practical info widely disseminated; degree and success of farmer implementation unclear	1, 2, 3		This project was a continuation of OREI 2006-02051; additional money acquired to continue research based on grower priorities; need to document farmer implementation and outcomes	
2009-01327	1, 2, 3	H - Growers engaged in symposium and focus groups, not clear if on committee to develop OREI full proposals.	1, 3, 4		2, 3	Symposium, project committee team to develop full proposal; three focus groups	8, 10	Two OREI full proposals not funded; informal network carries on idea exchange, outreach, implementation	1, 2, 3, 4	H - Farmers at symposium changed fertility, cover crop, or weed mgmt., continue discussion, outreach	1, 3		Adapt roll-crimp cover crop organic NT practices and equipment to wet climate and soils, pests and weeds of Pacific NW; research and develop other reduced till approaches to protect soil quality.	Missed opportunity - this proposal merits OREI funding

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2009-01330	(1), 3	H? - 40 producers in focus groups; not clear if any farmers on planning team	1, 3, 7	Five organic dairy seminars for planning team and general public, reached 190 total	2, 3, 9	9 - Visits to other organic dairy research programs	8	No proposal as of final report, but ongoing grower-researcher network and focus groups established	(1, 2, 3)	P - No OREI proposal as of final report; focus groups identified needs (see Future)	(1, 3)		Focus group prior: animal health, mastitis, pasture / forage quality and quantity, economics. Focus groups, grower-scientist dialog, planning team to continue practices, develop proposals	
2009-01332	1, 2, 3, 4, 5	VH - farmers interest and engagement remain high despite problems with perennial wheat varieties tested	1, 2, 3, 4, 5, 6, 8	8 = policy makers (GHG / environmental benefits)	1, 2, 4	Regional, national, and international meetings; new ASA professional group on perennial grains; eOrganic webinar reaches 100	1, 2, 5, 9, 10	1 - MOSES news article (10K readers); 2 = participatory plant breeding toolkit with OSA; 10 = 2 MS, 1 PhD	(1, 2), 3	H, P - production and econ hurdles remain, great potential to breed improved perennial grains	(1, 2), 3	Benefits to soil and water quality well established; more work required to realize benefits to farmers, processors	Continue and expand farmer participatory breeding and agronomic research into perennial wheat to address challenges and realize full production, economic, and environmental potential.	* long term support needed to follow through and realize potential
2009-01333	1, 2, 3, 4, 5	H? - farmer-breeder network proposed; farmer input via RAFI in 1st yr. report; no mention in final report	1, 3	organic field crop producers, public plant breeders	1, 2, 3, 5, 7, 9	5 - web site still active; 7 = webinar for farmers and breeders; 9 = mailed organic seed survey to farmers	1, 8, 9	1 - NC organic Grain Production Guide (2000 copies), 8 -core group of 65 organic grain farmers in 11 states (1st yr.)	1	P - Developed accessible peanut breeding and soy variety evaluation methods, but farmer engagement after 1st yr. unclear	(1), 3	3 - public plant breeders	Continue work to breed GMO-excluding corn, weed-competitive wheat and soy, disease-resistant peanut; build/ maintain farmer participatory breeding network.	* long term support needed to follow through and realize potential
2009-01338	2, 3, 4, 5	H - Grower advisory group, grower gave two talks	1, 3, 4, 6		2, 3		5, 9	5 - ISHS organic Fruit Symposium talk available on line	1, 4	H - One grower harvested cert organic cherries; several others plan organic apple production as of 2012	1, 3		More on orchard floor management, impacts of legumes vs. grasses on top and root growth, insect pest management, etc.; additional years data to develop robust practical info for farmers.	Accuracy of data limited by lack of up to date reports

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2009-01340	1, 2, 3, 4, 5	VH - based on OREI 2004-05218 cropping systems study, continues and expands farmer involvement	1, 3,4, 6		1, 2, 3, (4), 5	2 - talks reached 1,700; 4 - eOrganic in proposal, not in 2012 report; 5 - website avail, last update 2013	(2), 6, 8, 9	2 - tools in proposal, not in report; 6 - project results in several course curricula; 8 - network active in 2012	1, 2, 3	Cannot evaluate	1, 3		Hard to assess - summary of outcomes sketchy, more research on 4 veg and 4 grain cropping systems desirable; not clear if the work is ongoing or if momentum has been lost	Accuracy of data limited by lack of up to date reports
2009-01343	1, 2, 4, 5	VH - farmers on organic Seed Working Group developing State of organic Seed Report and Action Plan	1, 2, 3, 4, 5, 8	8 = seed industry, organic certification agencies, policy makers	1, 2, 5, 6	Report/Plan developed and refined through input via Symposium, project web site and e-mail list serves.	1	State of organic Seed Report available free on organic Seed Alliance web site, to be updated every 5 years	1, 4	VH - Report/Plan and ongoing review strengthens organic Seed Alliance as leader in organic seeds and breeding	1, 2, 3, 6	6 = organic seed industry	Progress on the State of organic Seed Report and Action Plan to be reviewed annually beyond life of grant; major plan revision every 5 years.	* - a lot accomplished for $46K; verify / evaluation of long term impacts
2009-01346		L - no direct involvement other than as workshop participants	1, 3, 4, 7	Primarily agricultural professionals who want to become organic inspectors; workshops open to public	1, 2, 8	Study guide / info sheets, public workshops on 12 topics, one-week inspector training conference	1, 10	10 - eleven agriculture professionals completed inspector training; Guam Dept. Ag established organic demo site	1	H - increased public and farmer interest in organic; 11 organic inspectors in Guam, (previously none); organic agriculture demo site	1, 3		Follow up to determine whether organic certification is proceeding and helping Guam farmers, and address any problems or issues.	
2009-01361	2, 3, 4, 5	H (VH?) - not quite as high as proposed, but latest reports missing, weather delayed project 1 yr.	1, 3, 4, 8	8 - policy makers, NGOs, business (organic fertilizer manufacturers)	1, 2, 3, 4, 8		1, 4	4 - integrated legume + reduced manure rate strategy to balanced N and P nutrition	1, 2, 3, 4	H (VH?) - farmers utilize info from field day on farm, not clear how widely available project outcome is now	1, 3, 6	6 - manu-facturers of poultry litter based organic fertil-izer	Need to see final report - fine tuning cover crop species and management	Final report missing - im-pacts possibly underestimated
2009-01366	2, 3, 4, 5	H	1, 2, 3, 4, 5, 6, 7, 8	Incl. certified crop advisors, NGO reps, millers, bakers, chefs, distributors; hi school student project interns	1, 2, 3, 4, 5, 8, 9	8 - featured on radio, TV, newspapers; 9 = peer learning trips (including abroad)	1, 3, 8, 9	3 - existing varieties evaluation for organic and bread wheat quality - 8 "vibrant network of farmers, millers, bakers."	1, 2, 4	VH - Farmers adopt new varieties (72%), practices (>50%); increased wheat acreage (80%), yield (47%), quality (75%)	1, 2, 3, 4, 6	1 (average income increase $7K), 2 (bakers average income increase $5K), 4 - new local bread industry, 6 - consumers	More on crop rotations to optimize wheat quality, profits. Summer legume covers before wheat?	* impressive community level outcome - is farmer-miller-baker network ongoing?

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2009-01371	1, 2, 3, 4	VH - 12 farms actively engaged in research	1, 2, 3, 4, 5, 6, 8	8 = government agencies, NGO representatives	1, 2, 3, 6	6 - organic farmer research listserv share outcomes in real time	1, 2, 4, 6, 8	1 = organic farming guides; 2 = Healthy Farm Index; 4 = flame + cultivation weed mgmt.; 6 = two UNL courses	1, 3, 4	H - three farmer-researcher groups, new network among Nebraska organic farmers	1, 3, 6	6 = students	Continuation grant, but no follow-through on organic wheat breeding priorities ID in OREI 2005-04497 (dropped, or under other funding not reported here?)	
2009-01377	2, 3, 4	H - on farm research to complement research station trials	1, 3, 4, 8	8 = agricultural support industry	1, 2, 5		1, (2), 5, 9	2 - decision support tools mentioned in proposal, not documented in reports	1, 2, 3	M - some promising results, some challenges; not clear how much practical info delivered to farmers	1, 3		More work on effective high residue planters, providing N to corn in no-till organic, increasing soil organic C.	
2009-01383	2, 3	H - extensive on farm trials	1, 2, 4, 7	7 = home gardeners	1, 2, 4, 5	5 = U. Vermont web site	1, 9, 10	10 - two MS theses	1, 4	P - Hop cultivars suited to organic, effective cover crops for weed control and fertility identified; degree of dissemination not clear	1, 3		Continue breeding hops for organic systems	
2009-01389	2	L - Planned, but not reflected in project reports	1, 3, 4		2	Symposium and working groups develop a plan for additional work		None related to the proposed public seed initiative		Cannot evaluate	1, 3			Project reports seem to relate to different project from proposal
2009-01402	1, 2,	M - farmer input on cover crops and inoculants to try, but no on farm trials or field days mentioned.	1, 3, 4, 5, 6		1, 2, 4		1, 5, 9		1, 2	M - Farmer education on crop disease and bipoesticides; outcomes inconsistent, not ready for dissemination.	1, 3, 6	6 - students, K-12-grad school	Additional research on cover crop-inoculant-soil biota-crop pathogen interactions needed before practical guidelines for farmer implementation can be developed.	
2009-01405	(2, 3, 4), 5	M? - trials on two farms proposed, not cited in final report; actual farmer engagement unclear	1, 3, 4, 5, 6	6 - high school, college, and university students	1, 2, 3	presentations and field days reach 400 producers and agriculture professionals	1, 4, 9, 10	4 - higher-performing, lower-cost NOP compliant potting media from local materials; 10 - MS thesis	1, 2, 3, 4	H - positive farmer evaluation suggests likely use of locally-based media for organic vegetable starts	1, 3, 6	6 - makers / vendors of organic potting media		

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2009-01415	2, 3, 4, 5	H - eight farms in landscape survey, one hosts on farm trial	1, 3, 4, 5, 6, 8	8 - science policy professionals, stakeholders in agriculture responsible to climate change	1, 2, 3, 4, 5, 9	9 - one on one discussions with landscape survey farmer	5, 9, 10	5 - eXtension webinar; 10 - one MS and one PhD	1, 2, 3, 4	H, P - high organic tomato yield with low N leaching and N_2O; project team developing new tools for organic N management	1, 3	Farmers implement improved soil C/N mgmt. based on project; new tools and methods for researchers.	Excellent progress toward practical organic C-N-P mgmt. practices based on soil biology; need more research to fully develop and deliver farmer-ready tools.	*cutting edge research and practical outcomes, need additional support to realize full potential
2009-01416	1, 2, 3, 4, 5	VH - advisory council of 6 farmers, farmer interviews, on-farm trials and case studies	1, 3, 4, 6	Ag professionals include FSA and NRCS; six grad students play major role in project	1, 2, 3, 5		(7, 8), 9, 10	7, 8 - Interactive web site and network mentioned in proposal, not in reports; MS and PhD theses	1, 2, 3, 4	H, P - Practical info, method, tools (rotation, nutrient and weed mgmt.) adopted by a few farmers	1, 3		More outreach to deliver outcomes reported here and through end of project; more research might develop more robust practical outcomes.	Final report missing from CRIS - hard to fully assess impacts
2009-01420	2, 4, 5	H - 92 farmers in mental models interviews; farmers in eOrganic COP	1, 3		1, 2, 4		8, 9	Farmers and researchers network via eOrganic and interviews	1, 2, 3	P - Potential to overcome econ and "mental model" barriers to effective organic weed management; hard to assess impact	1, 3		Without final reports, difficult to assess whether outcomes elucidate best education / outreach strategies, or if more research is needed	Accuracy of data limited by lack of up to date reports
2009-01422	2	M - no farmer involvement; two processors provided nut butter, input on treatment protocols	2, 3, 8	8 - Processors, ingredient suppliers, scientists, government agencies	1, 2		9		4?	L, P - process ineffective on nut butter, but killed pathogens and extended shelf life of sauces <20% peanut butter.	2		Determine reliability and economic benefits of this process for sauces containing nut butters	
2009-01429	1, 2, 3, 4, 5	VH - farmers play integral role in potato breeding, variety evaluation, disease-free seed production	1, 3, 6	Undergrad students engaged in project	1, 2, 3, 5		1,3, 7, 8, 9	3 - varieties suited to organic identified; 7, 8 - interactive website supports ongoing farmer-scientist network	1, 2, 3, 4	VH - ongoing; farmers adopt new varieties, produce organic potato seed, evaluate and breed varieties	1, 2, 3, 4, 6	6 - students in project enter sustainable agriculture careers	Verify extent of impacts, especially on rural community through expanded employment and economic opportunities	*Continues work of organic 2002-3799; excellent follow-up realizes potential

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2009-01434	1,2, 4, 5	VH - farmers actively engaged in content development, dissemination, evaluation	1, 2, 3, 4, 5, 6, 7, 8	8 - organic certifiers and inspectors, government agency personnel	1, 2, 4, 6	You Tube channel 880,000 views, 1,100 subscribers; ~2,000+ contacted via social media	1, 2, 5, 7, 8	20 articles, 7 videos, 24 webinars, 7 live conference broadcasts in one year (2011-12)	1, 2, 3, 4	VH - 69% of in 691 post-webinar survey changed practices (farmers) or utilized info with farmers (agriculture prof).	1, 3, 4, 5, 6	4, 5 - community level benefits of widespread use of eOrganic are likely; 6 - students	Ensure adequate support for ongoing functioning of eOrganic; expand eOrganic beyond vegetables and dairy to include CoPs on field crops, orchard, beef, poultry, etc.	* Continues work of OREI 2007-01411 - do we want to "drill down" into eOrganic itself?
2009-01435	2, 3, 4, 5	VH - 100 working organic and non-organic grazing dairies form basis of the study	1, 3, 4, 5, 8	includes consultants, veterinarians, lenders, NRCS, FSA	1, 2, 5, 7	2 - reached 400 farmers; 5 - UW dairy web site current, has project products; 7 - Extension websites	1, 2, 5, 9, 10	2 - Several on-line decision tools on line; 10 - two PhDs, one MS	1, 2, 3	H, P - actual farmer implementation of project outcomes not reported in depth; some GHG assessments.	1, 2, 3			
2009-01436	3, 5	M - farmer survey, on farm trials mentioned but field days held at agriculture experiment station	1, 3, 4, 5, 6, 7	6 - students at all levels elementary through post-doc engaged or reached by project.	1, 2, 3		1, 9, 10	10 - Project launched annual WY-NE organic Farming Conference; 1 PhD and 1 MS completed	1, 2, 4	H - Effective organic strategy for providing P on alkaline soils	1, 3, 6	6 - strong emphasis on professional development for students	Can mycorrhizal inoculants and/or biochar enhance P availability and P use efficiency from these sources in semiarid, alkaline-soil environments?	
2009-05488		L - no farmer engagement in design or conduct of project	1, 3, 4, 5, 6, 8	8 = policy makers	1, 2, 3, 4		1, 5		3	L - outcomes likely to discourage adoption of "organic" and encourage no-till with conventional inputs	3	Experimental design not aligned with basic organic principles; outcomes validates no-till, but of little use to organic	Evaluate soil C and N dynamics and water quality in truly sustainable production systems for NC (including adequate crop rotation), with organic vs. conventional inputs, and conventional vs. min till.	* IMHO, this project was not the best use of $659K - do we want to "drill down" a poor example?

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2009-05497	3	M - some of studies conducted on farms, farmers kept informed of outcomes	1, 2, 3, 6		1, 2, 3		1	1 - handbook on dairy water quality mgmt. distributed to 500 farmers; also fact sheets	3	M - water quality mgmt. info for all farmers developed and distributed; limited outcomes specific to organic	1, 2, 3, 6	6 - students - intern program offer professional development opportunity	No significant difference organic vs. conventional or continuous vs. rotational grazed; may take a longer term study for different soil C-N-P dynamics and water quality impacts of diff systems to develop.	
2009-05499	3	M? - on-farm trials mentioned in proposal, but not in reports	1, 3, 4, 5		2, 3	Conference presentations and field days reach 328; no written pubs other than conference abstracts listed	(2, 5)	Class curriculum, validation of water quality model for organic mentioned in proposal but not in reports	1, 3	P - consistent water quality benefit of organic crop rotations with sod; not clear if and how info is available to farmers	1, 3		Follow-up needed! - study showed water quality benefit of organic diverse rotation vs. conventional corn/soy, but written or on-line means to deliver information to farmers are lacking or unreported.	
2010-01869	2, 3, 4	H? - Extensive farmer role stated in proposal, not documented in reports available (through 2013)	1, 3, 4, 5, 6, 7, 8	8 - local, state, and federal policy makers, lenders, organic certification personnel	1, 2, (3), 4	Field days pasture walks, eOrganic dairy CoP planned, not stated in latest report	1, 4, 9	4 - Birdsfoot trefoil as dairy forage crop in Mountain west	1, 2, 3	H, P - promising prelim results (forage and milk production, milk quality), need final report to assess full impacts	1, 2, 3, 6	6 - students professional develop-ment, gain range of skills; public health (high-er omega-3 milk)		Accuracy of data limited by lack of up to date reports (latest report 2013)
2010-01870	3, (4, 5)	H? - farmer role in outreach and evaluation in proposal, not in report.	1, 2, 3, 6, 8	3, 6, 8 - Plant breeders and plant breeding students, NGO representatives	1, 2, 3, 5		1, 3	1 - Extensive research report to growers, available on line; 3 - one variety and 3 breeding lines released.	1, 2	H, P - one thrips resistant variety; Entrust (NOP allowed) effective on thrips; team addresses lack of GMO-free cotton seed	1, 2, 3	3 - especially plant breeders	Continue breeding for thrips resistance and other organic needs / objectives; follow-up to evaluate grower adoption and on farm outcomes.	5-year project (2010-15), last report 2014

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2010-01884	3	M? - on farm trial mentioned, but farmer involvement not emphasized.	1, 3, 4, 6, 8	8 - veterinarians	1, 2, 5	Reached 500 at National Goat Conference; other presentations reached 100s of growers and professionals	1, 2, 4	2 - decision tree on line, but assumes use of synthetics; 4 - effective integrated methods for organic parasite management	1, 2, 4	H - practical info on integrated parasite management, efficacy of organic strategies similar to conventional meds	1, 3			
2010-01899	1, 2, 5	H - One farmer on advisory panel of 3; 10 farmers/ handlers interviewed; 50 share contract content with project	1, 2, 8	8 - distributors, retailers	1, 2, 4, 5, 6		1, 2	Farmers' Guide to organic Contracts w toolkit to review with negotiate contracts; info on 100+ contract provisions	2	VH - important new resource; downloaded 506 times in "short time" after publication	1, 2, 6	6 - distributors and retailers of organic products		2-year project, final report submitted
2010-01904	2, 3	H? on farm trials (one variety trial, six cover crop) in proposal, not mentioned in reports.	1, 2, 3, 4		1, 2, 3, 4	4 field days in 2013 reached 70 producers	5, 9	Webinar on eOrganic with 105 participants	1	P - significant progress breeding for increased N fixation and identifying highest yielding varieties for organic	1, 3		Need ongoing funding to further develop breeding lines into farmer-ready dry bean varieties with high N fixation efficiency and good performance in organic systems	5-year project (2010-15), last report 2014
2010-01905	2, 3	H - farm hosts demo trial of apple nursery stock production in compost beds in high tunnel	1, 3, 4, 5, 6, 7	6 - MSU student organic farm hosts workshops, 3 grad students trained	2, 3, 9	9 - farm visits by project personnel	1	Several project videos on HT fruit production in prep (2013)	1, 2, 3	P - successes with apple nursery stock; berry disease, weed, and water mgmt.; nutrient and pest mgmt. challenges identified	1, 3, 6	6 = consumers	Spotted wing drosophila mgmt. (SWD invaded high tunnels during project); effective, affordable organic nutrient management for hi tunnel raspberries (heavy feeders)	4 year project 2010-14; last report on CRIS 8/2013 - need final report to fully evaluate impacts

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2010-01913	2	M - national survey, input on tomato varieties and production, video 8 farmer interviews; on-farm variety trial not done	1, 3, 4, 5, 6		1, 2, 3, 5	51 presentations reach 1500 participants; national survey on organic cert decisions, 1559 respondents	1, 6, 9, 10	1 - farm videos, extension bulletins; 6 - organic agriculture undergrad course; 10 - successful 5-ac student farm	1, 2, (4)	H, P - Prelim findings on tomato varieties, cover crop / weed mgmt.; follow-through needed; excellent outreach	1, 3, 6	6 - students (curriculum, farm)	Breeding (promising germplasm identified, not yet farmer-ready cultivars); more work on cover crop-weed-soil-nutrient dynamics to yield farmer-ready info or decision tools.	5-year project (2010-15), last report 2014
2010-01916	1	H - team approach to planning proposal engaged university scientists and "stakeholders"	1, 3, 4, 7	Actively engaged tribal leaders	2, (3, 4, 9)	Dissemination clearly took place, but means / media not stated; 9 - one-on-one communica-tions?	8, 10	OREI prop; SDSU researchers network with Flandreu Santee-Sioux Tribe (FSST) to undertake organic transition	1, 3, 4	VH - full proposal not funded, yet FSST restored pasture, selected bison breeding stock for organic, initiated transition	1, 4, 6	4, 6 - public health (improved diet) in tribal communities		Unusual success in that planning process itself resulted in substantive and lasting impacts
2010-01927	1	H - organic crop and livestock farmers in 1-day colloquium and 3-day workshop	1, 2, 3, 4, 5, 8	8 - organic suppliers, government agencies, nonprofit reps,	2		10	Two OREI proposals, one AFRI proposal	3	L - proposals not funded	(1, 2, 3)	Likely benefits had full project been funded	Energy use in agriculture, including organic systems, needs to be researched. Seek funding program better matched to proposal.	
2010-01929	1	H - several farmers included in group of 20+ developing proposal	1, 3		2, 3	Planning meeting and site visits	10	OREI proposal	3	L - proposal not funded	(1, 3)	Likely benefits had full project been funded		
2010-01932	1, 2, 3, 4	VH - 5 farmers on advisory panel, 35 in focus groups, 159 in survey, 20 serve as collaborators	1, 2, 3, 4, 5, 6		1, 2, 3, 4		5, 8, 10	8 - network of organic dairy farmers and researchers; 10 = full OREI prop, database of participant priorities	1, 2	VH - $2.9 million OREI proposal awarded; strong grower-researcher network ready to carry out project	1, 2, 3		Addressed in full OREI project	Highly successful planning grant, built strong network and laid groundwork for full project
2010-01940	1, 3	H? - input on systems trial; on farm trials planned, not mentioned in reports	1, 2, 8	8 - input (fertilizer) vendors	1, 2, 3, 4		9		1, 2	H? - hard to evaluate with up to date reports; weed mgmt. improves yield; low food safety risk documented.	1, 2, 3			Accuracy of data limited by lack of up to date reports (5-yr project through 2015, last report 2013)

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2010-01943	1, 2, 3	M? - proposal including stakeholder meetings, farmer input on pesticides, enterprise budget; not in reports.	1, 2, 3		(1), 2, 3, (4, 5)	Written and on line dissemination in proposal but final report mentioned only field day and 2 conferences	(1, 9)	Refereed journal articles and Extension bulletins proposed, not listed in final report	1, 2, 3	M? - varietal pest resistant inconsistent for potato beetle, significant for wireworm; info products for farmers lacking or unreported	(1, 3)	Very difficult to assess benefits from sketchy reports.	Additional research on varietal differences in yield, yield impact of beetle defoliation, and varietal resistance to wireworm	
2010-01944	2, 4, 5	H - farmers participate in content development via eOrganic dairy CoP.	1, 4, 5, 6	Emphasis on service providers	1, 2, 4, 6, 7	Conference broadcast	1, 5, 6	5 - webinars 550 participants; 7 videos, online course Intro organic Dairy Prod; 62K viewings of project. products	1, 2, 4	VH - 72% of webinar participants (farmers, agriculture prof) change practices/advice; 56 of 57 online course students plan to use info	1, 3		Project proposal identified severe economic challenges to organic dairy; outreach products reach tens of thousands. Explore how well project improved prod and econ viability of organic dairies.	5 yr. project through 2015, last report 2013. Explore full impact of project at completion.
2010-01945	2	M? - Input from growers in proposal, reports mainly documented lab research and extensive outreach	1, 2, 3, 4, 5, 6, 7, 8	8 - manufacturers of natural antimicrobials, food safety professionals	1, 2, 5, 6, 8	5 - several web sites; 8 - informed pubic through various media	1, 5	1 - bilingual videos (2100 views), training DVDs, modules; 5 - Fresh Produce Safety website 2700 visits	1, 4	VH - extensive produce safety education; promising initial results with plant based antimicrobials	1, 2, 3, 6	6 - hi school, undergrad and grad students, postdocs, techni-cians - prof development training in food safety	More research or meta-analysis of project findings to develop practical, user-ready protocols; evaluate impact of treating produce with "edible antimicrobial films" on human health.	4-year project (2010-14), last report 2013; need final report to evaluate accurately
2010-01954	(1), 2, 3, (4), 5	H - four on-farm trials; farmer role in planning. Presentations and farm tours proposed, not in latest (2012) report.	1, 3, 4, 6, 7	Farmers are main target audience; several graduate and post doc students in project	1, 2, 3, (5)	5 - project web site (at U MD) proposed but not in report	1, (10)	10 - organic farming internships mentioned in proposal, not in latest report	1, 2, 3	H, P - 19 of 45 farmers at field day implement changes; cover cropping adopted on "100s of acres"	1, 6	6 - entire Chesapeake watershed stands to benefit from increased use of cover crops.	Await final project report to identify additional research needs	5-yr project through 2015, last report 2012; cannot appreciate full impact with up-to-date report
2010-01965	2, 3, 5	H - 5 farmer case studies, one completed LCA analysis; 15 farmers use pilot of GHG footprint tool.	1, 3, 4, 6		1, 2, 4, 5		1, 2, (5), 10	2 - OFoot LCA tool to est. farm GHG footprint; 5 - eOrganic webinar planned; 10 - two MS theses	1, 2, 3	H, P - 15 growers use first OFoot version; 5 case study farms inventories; one completes LCA analysis	1, 3		Awaiting final project outcome; more research to refine and ground-truth OFoot tool.	5 yr. project through 2015, last report 2013; hard to estimate full impact

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2010-01970	1, 2, 3, 4, 5	VH - growers play integral role in proposal development and all stages of planned project	1, 3,4, 8	8 - organic certifiers, veterinarians	2, 3, (4)		8, 10	8 - process developed strong grower-scientist network; 10 - successful OREI proposal submitted	1, 2	VH - effective process to identify grower priorities; proposal for 4-year project funded	1, 3		Contained in full project plans	
2010-01975	2, 4, 5	H - farmers provide input, several do full business plan, several farm profiles, farmer presentations	1, 4, 5, 8	8 = lenders, crop insurance agents, policy makers, organic certifiers	1, 2, 4, 5		2	Transition Business Planner in review; updated existing computer models for farm business planning	2, 4	H - 47 farmers enroll in Farm Business management program, work with 22 bus mgmt. instructors	1, 3			
2010-01988	1	H - especially juice processors	1, 2, 3		2	Conference talk and short course on non-thermal pasteurization of fruit juices to 50 industry reps	10	Two full proposals to OREI (2011, 2012) neither funded	1	M - expanded industry awareness of concept and its potential	2		Identify funding source that will support this work	Potentially valuable food safety tool for organic; worth pursuing
2010-01998	1, 2, 3, 4,	H - proposal "involve farmers in shaping" project; somewhat less emphasis in reports	1, 3, 4, 5, 6		1, 2, 3, 4		6, 9	6 - three-credit course at 2-yr colleges: Social and Scientific Aspects of organic Agriculture	1, 4	H? - practical benefits of organic practices and mycorrhizae; none from gypsum treatment; need more outreach	1, 3, 6	6 - students - new course and undergrad research opportunities	Need to see final project outcomes; more research may or may not be needed; clear need for "durable" project products to deliver practical info to farmers beyond life of grant.	5 yr. project through 2015, last report 2013; hard to estimate full impact
2010-02363	1, 2, 3, 4, 5	VH - farmers play integral role in corn variety evaluation, and organic seed production	1, 3, 4, 6, 8	3 - especially plant breeders; 8 - seed companies	1, 2, 5, 6		1, 3, 5, 8, 9	5 - webinar on organic winter nursery on YouTube; 8 - grower-breeder networks in several regions	1, 4	VH - A few new varieties grown by farmers more coming, project PIs expect full impact in 5 more years	1, 2, 3, 6	2 - improved feed nutritional quality; 3 - especially public breeders; 6 - seed companies serving organic	Ensure ongoing support to realize full potential for new varieties with improved nutritional profile, ability to thrive on low nutrient inputs, and withstand weeds, insects, cool soil.	Excellent farmer engagement and impacts to date; is team funded for needed 5 yr. follow-through?

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2010-03392	1, 2, 3, 4, 5	VH - farmers integral role in variety evaluation, breeding, organic seed production in 4 regions.	1, 3, 6		1, 2, 3, 4, 5, 8	2000 farmers attend workshops, 300+ learn breeding skills	1, 3, 5, 7, 8, 9, 10	1 - book organic Seed Grower, 5 - five webinars; 8 - robust farmer-researcher networks; 10 - variety trial database	1, 2, 4	VH - project participants change varieties, save seed or do on-farm breeding; 2 new varieties; ID and promote many other varieties for organic	1, 2, 3, 6	3 - especially breeders; 6 - students, chefs, public	Database http://varietytrials.eOrganic.info/ out of date (2012). More pea, sweet corn, broccoli, winter squash, and other varieties near release; continued funding OREI 2014-05402.	Exemplary farmer engagement and impacts to date, follow-up OREI funding secured
2010-03952	2, 3, 5	H? - Farmers on steering committee; on-farm studies of "long term" systems proposed, not in final report	1, 3, 4, 5, 6, 7, 8	8 - policy makers	1, 2, 3		1, 6, 9, 10	6 - freshman, senior, grad courses; 10 - two MS and three PhDs	2, 3	P - Huge amount of data collected, practical application unclear; more research needed	(1), 3, 6	1 - farmer benefits not yet realized; 6 - students from elementary through grad school	Report states: "Research past the transition period is needed to fully embrace accrual of benefits ... New OREI grant .. funded based on hypotheses [from] this project."	What happened to the on-farm long term systems studies?
2010-03954	2, 3, 5	VH - data from 72 farmers' fields with extensive farmer interviews; farmer focus groups, survey	1, 3, 4, 5, 7		1, 2, 3, 4, 5		1, 5, 9		1, 2, 3, 4	H - C sequestration benefits of both reduced tillage and organic verified; soil C measurement tools and methods refined	1, 3, 6	6 - environmental policy makers, carbon traders	Use improved / validated soil C sequestration measurement methods to explore and optimize systems that are both organic / long rotation and reduced-till.	It may be worth exploring one GHG / C sequestration study further - recommend this one
2010-03956	1, (3)	H? - Farmers key role in proposal and experimental methods; advisory panel; on farm trials proposed but not in reports	1, 3, 4, 6, 8	8 - policy makers	(1), 2, 3, (4)	1 and 4 - Written materials, eOrganic in proposal, not in reports to date; talks and field days reach 700 in 2012-13.	(1, 9)	Publications planned by end of project; need informational products for farmers	3	P - soil quality, nutrient, GHG benefits of no till, compost, cover crops documented, practical impact pending final report	(1), 3	Lots of good data to support additional research; await final report to assess practical benefit to farmers	Continue refining organic systems (rotation, cover crop, inputs, reducing tillage as practical) for optimum soil quality, C and N dynamics, GHG footprint, and crop yield.	

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2010-03957	3	M - decision tool to be developed at UNH research sites, then tested on farms and by farmers	1, 3, 5, 6	5 and 6 - Grad student to work with middle and high school teachers and students	1	Workshop to train stakeholders in use of decision tool; trainees evaluate tool	2	Decision tool to quantify GHG and other ecosystem services of organic dairy, apply to specific farm	3	P - valuable decision tool proposed - but what was the outcome?	1, 3, 4, 6	4 - potential region wide benefit; 6 - High school and middle school students and teachers	Proposed tool combines validated C and N biogeochemical model with GIS soil and climate data and farm specifics for site-specific evaluate. Additional research / outreach based on outcome.	No report on CRIS - proposal only. Potentially valuable tool, but what was outcome?
2010-03958		L - none mentioned in proposal; "grower presentations" in final report (by or to growers??)	1, 3, 4		1, 2, 5		1, 4, 9	4 -organic veg rotation with Bahia grass sod phase increased SOM, soil life, soil water; reduced pest nematodes	1, 2, 3, 4	H? - vegetable rotation with 2-3 yr. Bahia sod ecological benefits, econ, viable; degree of farmer implementation unclear.	1, 3	Excellent environmental outcome: soil organic C increases 0.1% per year in Bahia	Explore benefits of increasing species diversity of annual cover crops, and/ or sod phase; try system on other vegetable crops. Document farmer implementation and any barriers thereto.	
2010-03990	1, 2, 3, 4, 5	VH - farmers work with students to conduct research on their farms; host field days	1, 3, 4, 5, 6	6 - college students conduct research on farm / with farmers; presentations to schoolchildren	1, 2, 3, 5, 8		1, 4, 6, 9	4 - effective organic pest mgmt. strategies; 6 - competitive student research program on organic farms	1, 2, 3, 4	VH - farmers adopt mulching, irrigation, organic pest mgmt. practices from project; farmers start or expand organic ops	1, 3, 6	1 - organic horticulture in south TX proves econ viable at small to large scale; 6 - college and public school students	Explore the GHG / C sequestration footprint of successful organic systems from this project (GHG analysis in proposal but not done).	Innovative model for farmer-student collaborators with far-reaching practical benefits to farmers
2010-04008		L - little farmer involvement in planning and execution of project (based on proposal and report abstracts)	1, 3, 4, 6, 7, (8)	8 - Learning modules on C sequestration for urban gardeners in proposal, not in report.	1, 2, 4		1, 5, 9	5 - series of eOrganic webinars for Extension on working with organic farmers	3	H - mainly for Extension and students; direct farmer impact not clear	3, 6	3 - Extension webinars reach 300, 80% will use info; 6 - minority youth, grad students	What is take-home message for farmers regarding cover crops and soil carbon? May need more research before developing info or tools for farmers. Await final report.	5 yr. project through 2015, last report 2013; hard to estimate full impact

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2011-01942	2, 3, 4	H - on farm trials of varieties and breeding lines and production practices, farmers host field days	1, 3, 4, 6	6 - Three MS students in plant breeding	1, 2, 3, 4, 9	4 - organic farm field day reaches ~100/ yr.; 9 - learning groups, round table discussions	1, 5, (9), 10	1 - farm videos; 5 - eOrganic Webinars; 9 - journal articles planned at end of project; 10 - three MS theses	1, 2	P - variety evaluate, breeding progress but no new farmer-ready varieties; production practice outcomes unclear	1, 3		Continue breeding to obtain farmer ready varieties with enhanced root system, N fixation, or other traits. Need to see final project results on tillage, rotation, weed management.	Note: from 2011-2014, many projects still in progress; impact assessment pending final outcomes
2011-01950	1, 2, 3, 4, 5	H - considerable farmer throughout project; farmer-to-farmer mentoring in proposal, not 2014 report	1, 2, 3, 4, 6, 8	6 - undergrad and grad students; 8 - nutritionists	1, 2, 3, 4	field days, pasture walks, workshops, presentations reach 2,000	1, 5		1, 2 ,4	H - annual forages reduce reliance on purchased grain; flaxseed supply improves winter milk (omega-3)	1, 2, 3, 6	2 and 6 - improved nutritional quality (omega-3) of milk benefits processor and consumer / public health		
2011-01955		L - none specified in proposal or latest reports	1, 3, 4		1, 2,3, 4, 9	2 - workshops reach 250; 4 - organic Poultry forum on eOrganic; 9 - individual meetings with producers	1, 5, 9	Numerous articles on eOrganic; webinars on eXtension	1	P - few practical outcomes in 2014 report; probiotics to reduce foodborne pathogens show some promise	(1, 2,3, 6)	6 - public health; actual benefits unclear because no results or data on farmer implementation in report	Need to see final report with actual outcomes; work included free choice feeding studies, outdoor access studies, and individual feed ingredients - but what were results?	
2011-01959	1, 2, 3, 4, 5	H - farmer participatory research and learning networks; farmer input on cover crop traits, dissemination	1, 3, 4, 5, 6, 7, 8	6 - undergrad to post doc; 8 - nonprofit organizations, government agencies, industry	1, 2, 3, 4, 5	4, 5 - Posting on multiple web sites, preparing materials for eOrganic / eXtension (as of 8/2014)	1, 5, 6, 8, 9	6 - learning modules and other materials used in several undergrad courses; 8 - "study circles", networks ongoing	1, 3, 4	H, P - Half of 170 study circle and field day participants implement new practices; full project impact pending	1, 3		Extensive and detailed experiments and sophisticated analysis still in process; rye in cover before corn ties up N; few other results given in reports.	
2011-01962	1, 2, 3, 4, 5	VH - integral role in setting priorities, trials, plant breeding, outreach, training others, and evaluation	1, 3, 7, 8	8 = marketers, seed companies	1, 2, 3, 4	250 farmers trained in variety trials, breeding, seed production	1, (3), 8	3 - new carrot varieties ready for seed increase, more on the way; 8 - Strong farmer-breeder networks	1, 2, 4	VH, P - Farmer-researcher breeding model; 250 trained; large-top carrot varieties outcompete weeds	1, 3		Great genetic potential to breed carrots for organic priorities - disease, nematode and weed resistant; flavor, color, nutrition; may need more $ beyond this grant (2015) to fully realize potential	Excellent farmer engagement, excellent progress toward important goals

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2011-01965	1, (3)	H? - producers requested work on fire blight; close engagement with farmers proposed, not in 1st yr. report	1, 3, 4, 7	4 - crop consultants	1, 2, (3, 4)		1, 5, 9		1, 2	P - cannot ascertain actual impacts based on one-year report only	1, 3, 6	6 - consumers who want antibiotic-free fruit	Need additional work to establish farmer-ready protocols for managing fire blight in apple and pear without antibiotics; continuation funding received through organic 2014-03386.	Only first-year annual report (2012) on CRIS
2011-01969	1, 2, 3, 4	VH - farmers select traits for on-farm trials (7+ farms), co-present webinar, workshops; on "consortium" with extension	1, 3, 4, 6	20 undergrad and 2 high school students in project	1, 2, 3, 4, 5		1, 5, 9	One webinar on eOrganic, more planned	1, 2, 3	H, P - Cover crops, 4-yr rotation increase soil C; N mgmt. for broccoli; full impact pending 4th yr. trials and analysis	1, 3, 6	1 - Spanish speaking farmers engaged in research and workshops; 6 - students		
2011-01979	2, 3, 4, 5	H - multiple on farm trials; grower surveys to guide project mentioned in proposal, not in reports	1, 3, 4	Major audience = farmers	1, 2, 3, (4), 5, 6, 8	8 - magazine and newspaper articles	1, 5, 9		1, 2, 3, 4	H - 43% of survey respondents have changed IPM practices in response to Alabama IPM newsletter	1		May need additional years research to identify best integrated strategies (2014 research was hampered by very low levels of target pests)	
2011-01982	1, 2, 4, 5	VH - farmers engaged throughout process; project led by farmer organization.	1, 3, 4, 6	Primary focus on farmers and researchers	1, 2, 5, 6, 9	1 - posters; 2, 9 - talks, roundtable discussions; 5 - NOFA-NY web site with Proceedings, session videos	1, 8	1 Symposium Proceedings (2-pp research summaries); videos of all sessions; 8 - farmer-researcher network	1, 4	VH - 153 symposium participants (62 farmers); 57% reported making changes in 6-month post-survey	1, 3	Valuable farmer-researcher dialogue set this event apart from most conferences for many participants.	MOSES hosting organic research symposia in upper Midwest; NOFA hosting them in Northeast - we need a similar symposium in the South!	Conference grant: excellent impact for small ($50K) investment
2011-01983	2, 4	M - 10 growers @ symposium (total 120, mostly scientists and agriculture professionals); all day tour of organic fruit farms	1, 3, 4, 6, 7	Mainly a scientific info exchange; videos of sessions available to public via eOrganic	1, 2, 3, 4, 5	57 presentations given at symposium, of which 55 are available on line	1, 5, 9	1 - booklet of abstracts; 5 - 33 webinars on eOrganic; 9 - 50 manuscripts submitted for Acta Horticulture	1, 2	H, P - scientific exchange, next symposium planned for 2015; not clear how much info delivered to farmers	(1), 3	Primary immediate benefit is to scientific and agriculture professional community	Explore how effectively the info shared at symposium is delivered to and used by farmers. Meta-analysis of findings to identify practical applications and additional research needs.	

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2011-01985	1, 2, 5	H - farmer interviews and survey provide data for the project	1, 3, 4, 5, 8	8 = policy makers, farmers' market organizers, nonprofit organizations	1, 2		1	Project report widely dissemination; no full proposal - OREI funding hiatus in 2013, low potential for cert organic in WV	2	M - project ID barriers to cert organic: small farm size, small market potential	1, 3	Project linked farmers with one another; informed NGO and other stakeholders re barriers to cert organic	Explore alternative ways to strengthen sustainable agriculture production and marketing in WV and the rest of Appalachia.	
2011-01987	1, 4	H - farmers involved in workshop and ongoing efforts to address constraints identified	1, 2, 3, 7, 8	8 - retailers, chefs, state and federal agency reps, school board, hospital and nursing home reps	2		8, 10	Stakeholders working together to address marketing and policy constraints; OREI full proposal	2	? - outcome of full OREI proposal not stated in report	1, 2, 3		Difficult to evaluate with very limited info in project report. What was outcome (what were the constraints on growth of organic in AL?), and what are next steps?	Final report very sketchy
2011-01989	1, 2, 3	VH - farmers guided full proposal development, shared observations on project web site, did prelim trials	1, 3, 4, 7		2, 5		7, 10	7 - farmers and scientists share results on project website accessible to public; 10 - full OREI proposal	1, 4	VH - successful $2.5M multi-region proposal; info sharing and organic BMSB mgmt. strategies via website	1, 3, 6	6 - general public - access to the latest development in organic BMSB management	Addressed in full proposal - integrated organic brown marmorated stink bug (BMSB) management - trap cropping, habitat manipulation, NOP-allowed pesticides, natural enemies.	
2011-01990	1, 2, 3	H - focus gr 7 farmers, 2 processors, 11 researchers/ extension, ID priorities, survey and recruit farmers; research/ extension team wrote proposal	1, 2, 3, 4		1, 2, 3, 4	Focus group notes, survey outcome posted on eOrganic	1	Focus group developed farmer survey questionnaire	1	M - ID'd constraints on organic peanut prod, recruited farmers; no full proposal due to 2013 OREI funding hiatus	1, 2, 3		Top five constraints: weeds, water availability, diseases, land access, soil fertility - team seeking other funding sources to address these and conduct on farm trials.	

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2011-01994	1, 2, 3 ,4, 5	H -farmers host trials and field days, six farm case studies; millers and bakers engaged throughout project.	1, 2, 4, 7		1, 2, 3, 4, 5, 6, 8	Several project websites; extensive and multi-faceted outreach efforts.	1, 5, 9		1, 2, 4	H - dissemination existing info ' increased grain prod and integration into vegetable rotations and market for ancient grains	1, 2, 3, 4	Increased awareness and interest among producers, processors, consumers - benefits to rural community.	Progress in breeding, prod, meeting; some setbacks; project applied for 1 yr. extension. Most of impact to date = disseminating existing info on organic grains; additional research needed.	
2011-02000	1, 4, 5	H - farmers identified priority topics for symposium; role in outreach and evaluation	1, 2, 3, 4, 5, 6		2, 4, 5	84 participants in symposium, most farmers and students; project provided outreach for OREI 2009-01416	5, 8	5 - conference session webinars on eOrganic; 8 - farmer-processor-agriculture professional network	1, 2, 4	H - >50% of survey respondents adopt new production or business practices after symposium	1, 2, 3, 6	6 - students	Research into priorities identified - marketing strategies, organic transition, managing weeds and soil fertility in organic dryland grain (may be underway in OREI 2009-01416).	
2011-02002	3	M - trials of naked oats as broiler feed on 3 organic farms; no other farmer involvement specified.	1, 3		3, 4		5		1, 2, 3	P - integrate naked oats and poultry into rotation to improve soil and profits; verify with final outcome	1	1 - crop and poultry farmers	Suitability of naked oats as major (70%) component in broiler diet verified; need research on impacts of oats and poultry in crop rotations on soil quality, crop nutrition, and net profits	Accuracy of data limited by lack of up to date reports (latest report 2013)
2011-02005	1, 2, 3, 4, 5	VH - builds on existing programs in functional agriculture biodiversity (FAB) in OR, CA, ID, farmers in leadership roles.	1, 2, 3, 4, 8	4 - especially conservation-ists (NRCS, SWCDs); 8 - organic certifiers, policymakers	1, 2, 4, 8	Meetings announced through extension, farmer newsletters, popular press	8, 10	8 - strengthened farmer FAB networks; 10 - OREI full proposal (not funded)	3, 4	VH - review of FAB work in CA, OR, ID; project partner (Wild Farm Alliance) works with NOP to update FAB guidance	1, 3, 4, 6	4, 6 - biodiversity enhanced at regional community / ecosystem level	OREI grant not funded; need other support for research into: economic analysis; bird, bat, winter beneficial insect habitat; cover crops and intercropping; on-farm conservation planning, etc.	Missed opportunity - this proposal merits OREI funding - did it find other funding?

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2011-04944	3, 4	M? - team worked with two MD growers to adopt practices; replicated on farm trial in HI proposed, not in reports	1, 3, 4, 5, 6	5 - three public school teachers, 6 - six undergrad and two grad students trained	1, 2, 3		1		1, 2, 3, 4	M, P - two growers adopt cover crops or reduced till; full impact awaits project completion and data analysis	1, 3		Evaluate more diversified crop rotations, which are more likely to succeed agronomically and to provide ecosystem services.	Accuracy of data limited by lack of up to date reports (latest report 2013)
2011-04948	2, 4, 5	M? - actual level of farmer engagement unclear from final report	1, 3, 4, 7		3, 4, 6	4 - soil microbe assessment protocols on eOrganic; 6 - listserv with 160 subscribers	(1, 9), 10	1, 9 - written materials in proposal, not in report; 10 = Protocols to evaluate nitrifier / denitrifier soil microbes	1, 3, (4)	? - "facilitate and evaluate" farmer adoption of BMPs related to GHG, but not clear whether and how it was done	1, 3		Actual outcomes not indicated in final report; suggests that some aspects of project are ongoing (with other funding?)	
2011-04952		L - experiments at research station; no direct farmer involvement in project planning and execution	1, 3, 4, 5, 6		1, 2, 3, 5		1. (2)	2 - decision tools in proposal, not in latest report	1, 2, 3, 4	H, P - risk of high N2O in organic sys identified; cover crops offer substantial economic benefit in organic transition	1, 3		Clarify N2O sources in organic systems (conflicting conclusions in 2013 and 2014 reports); and how to reduce N2O emissions and maintain yields. Were poultry litter rates excessive (too much sol. N)?	
2011-04958	3, 4	H? - 4 replicated on-farm trials and farmer-hosted field days in proposal, not in latest report	1, 3, 4		1, 2, 3, 5, (8)	8 - traditional media mentioned in proposal, not in 2014 report	5, (9)	5 - webinars archived and available; 9 - journal articles to be submitted at end of project.	1, 2, 3, 4	H - practical outcomes - cover crops, compost rates, no-till methods, GHG/C sequestration; unclear how widely used	1, 3		Need to assess degree of farmer implementation and ensure that practical outcomes are widely disseminated; one more year to go on project	
2011-04960		L - main field trial at research stations, no farmer involvement in planning / execution of project mentioned	1, 3, 4, 5, 6	5 - ecological principles of project communicated to K-12 educational community	1, 2		9		1, 2, 3	? - difficult to evaluate from very sketchy reports; at least one more year of field trials to complete	1, 3, 6	6 - students and K-12 educators	Either more research is needed, or experiments procedures and results need to be clearly communicated	Sketchy and confusing experimental trt descriptions, no report of results -hard to evaluate outcomes

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2012-02201	1, 2, 3, 4, 5	H? - farmers ID'd project goals; lead role in on-farm research and field days proposed, not in 2013-14reports.	1, 2, 4, 5, 6		1, 2, 3, (4), 8	2, 3, - reaching ~1,200; 4 -interactive use of eOrganic in proposal; 8 - newspapers	1, 9		1, 2	H, P - developing info on summer annual pasture, wintering practices, fly mgmt., animal health, on-farm application pending	1, 3		TBD	2012-2014: projects in progress - future research priorities mostly "TBBD" based on final outcomes
2012-02222	1, 2, 3, 4, 5	VH - farmers on planning grant team, host field trials and field days, interact via web site, participate in evaluation.	1, 3, 4, 5, 6, 7, 8	7 - engaged 300+ people in BMSB overwintering observations; 8 - master gardeners (240 trained)	1, 2, 3, 4, 5, 6, 8		1, 5, 7, 8, 9	7, 8 - interactive web site linked farmers, researchers, general public	1, 2, 3, 4	H, P - IPM strategy of trap crop, pheromone trap, winter trap, beneficial habitat; 9 farmers adopt practices	1, 3, 6	6 – general public – engaged in study and provided with practical mgmt. info. (BMSB also a house pest!)	Continue to refine IPM system; optimize beneficial habitat, predation, trap cropping, overwinter aggregation trapping, and other BMSB habitat manipulation	Innovative public role (300+ volunteers record BMSB fall aggregation on their houses)
2012-02236	1, 2, 3, 4	VH - develop farmer-led crop improvement model for organic seed production (based on proposal only)	1, 3		2, 3, 9	9 - videoconferencing	3, 8	8 - develop existing farmer-researcher network into organic plant breeding center (in proposal)	1, 2, 4	P - potential to release GMO-resistant corn, weed-resistant wheat and soy, disease-resistant peanut, cannot assess with reports	1, 3		TBD	No report on CRIS - proposal only; thus, hard to assess
2012-02244	3, 4	? - on farm trials mentioned in proposal, not in reports.	1, 4, 5, 6	5, 6 - Trained several undergrad, MS, and PhD students; and elementary and high school teachers	1, 2, 3, 5, 8		1, 6, 9	6 - project outputs delivered to ~400 students through several undergraduate courses	(1, 2), 3	H - extensive student and public school teacher training; study outcome = lower yields in integrated grazing system	1, 3, 6		Explore why sheep grazing reduced till integrated into diverse crop rotation gave such low crop yields	
2012-02247	3, 4, 5	M? - Six farmers on Bd of Advisors; on farm testing and role in outreach proposed, not in reports to date	1, 3		1, 2		9		1, (4)	P - promising results with alternatives to chlorine wash solutions likely to lead to changes in practices	1, 2, 3, 6	6 - public health	TBD - progress toward effective alternatives to chlorine for sanitizing produce (lettuce, tomato); await final project outcome.	
2012-02270	1, 2, 3, 5	H - Farmers participate in shaping project; 7 on-farm variety trials	1, 2, 3, 6, 7, 8	8 - distributors	1, 2, 3,4, 5		1, 5, 6, 9	1 - book in press; 5 - webinars on quinoa breeding, prod and meeting; 6 - project material in four courses	1, 2, (3, 4)	? - goal = integrate quinoa into rotation for diversity and resilience; cannot assess impact with no results summary in reports	1, 2, 3, 6	6 - consumers of quinoa	TBD	Extensive experiments, several journal articles, but no results summary in CRIS reports

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2012-02290	2, 3, 5	H - 11 farmers in field testing; farmers actively linked with researchers and extension in project and evaluation	1, 3, 4		1, 2, 4, 5, 6	2 - workshops reach ~400; 5 - four case studies posted on project web site	1, 5, 9		1, 2	P - info on parasite mgmt. and high-tannin birdsfoot trefoil widely dissemination; research trials just starting	1, 3		TBD	
2012-02292	2, 3, 4, 5	VH - farmer-breeder-researcher network links Northeast and Southeast; on farm variety and IPM trials	1, 3, 4		2, 3, 4, 5, 6	5 - organic Seed Alliance variety trial database; 6 - Facebook, twitter	3, 7, 8	3 - pest/ disease resistant varieties; 7, 8 - Network of growers, researchers, extension via interactive website	(1, 2, 4)	? - cannot assess without project reports	1, 3		TBD	No reports on CRIS; v. promising project based on conversation with PI - explore further
2012-02965	2, 3, 4	VH - replicated on farm trial appears to be the main project experiment.	1, 3, 5, 6, 7		2, 3, 4, 5	3 - farm hosts field day; 4 - webinar on eOrganic	5, 6		1, 2, 3	P - first year of in depth experiments completed, no outcome summary given, await final report to assess impact	1, 3, 6	6 - students	TBD	Accuracy of data limited by lack of up to date reports (latest report 2013)
2012-02977	2, 3, 4	H? - in depth on farm experiments; difficult to assess actual engagement without progress reports	1, 3, 4, 6		1, 2, 3, 4		2, 5	2 - test, validate, refine existing GHG and C sequestration models	3	? - Hard to assess without reports; focus on net GHG and C footprint of long rotations.	1, 3		TBD	No report on CRIS - proposal only; thus, hard to assess
2012-02978		L - No farmer involvement stated; evaluation by academic community of CEFS (Center for Environmental Farming Systems)	1, 3, 4, 6, 7	4 - Extension and NRCS; 7 - "public interested in organic"	1, 2, 3	Joint CEFS-NRCS field day (attended by 500); CEFS organic grain field day (150)	1, 2, 6, 9	2 - fine-tuning NRCS tools (RUSLE2, GHG); 9 one journal article published, more coming	1, 2, 3	? - prelim data for 3 organic and 3 conventional; organic sys used high chicken litter rate; practical impacts pending final data analysis	(1), 3, 6	Benefits thus far primarily for researchers and university students engaged in the project	Evaluate mycorrhizal activity, C sequestration and N_2O mitigation in conventional and organic systems with equivalent P inputs. Report outcomes for long term rotations.	
2012-02980	1, 2, 3, 4, 5	H - farmers on advisory committee., host trials and field days, help select treatments	1, 3, 4, 6, 8	8 - policy makers	1, 2, 3		1	Instructional modules - from brief presentation to 1-week course	1, 3	P - testing hypothesis that higher crop diversity enhances GHG mitigation and other ecosystem services	1, 3, 6	6 - students	TBD	Accuracy of data limited by lack of up to date reports (latest report 2013)

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2012-02981		L - none stated	1, 3, 6		2, 3		2	In field assessment tools for soil health, soil nutrients, and net GHG and NH_3 emissions or removal.	1, 3	? - project appears to have been abandoned after PD left the University	1, 3		Project design includes multispecies cover crops to deliver multiple ecosystem services. Need to get this project going again to evaluate this hypothesis and cropping system design.	2013 report, then terse "8/2015" report stating that PD left university - what happened??
2012-02983	1, 5	M - Farmer survey to ID priorities, farmers on advisory committee; no farmer role in research or outreach stated	1, 3, 4, 8	4 - Extension and industry consultants; 8 - media reporters	2, 3			No info sheets, videos, webinars, course curricula, decision / assessment tools, or other products cited.	1, 2, 3	? - difficult to assess; practical implications of results unclear from abstract	3	Project appears to be at a "research" level at this time	TBD	From this point on, codes for farmer roles, products, etc. are based on proposal, not reports
2012-04472	2	L? - 200 participants to be "surveyed"	1, 3		1, 2, 4		1, 5, 9, 10	eOrganic webinar, PhD and MS theses	3	P? - difficult to assess, very few details	1	Intent is to help farmers reduce GHG		
2013-03943	1, 2, 3, 4, 5	VH - Farmers work with students to plan research topic and treatments, host field trials.	1, 2, 3, 4, 5, 6, 7, 8	6 - ten undergrad students to be engaged in farmer-driven research; 8 - certifiers, vendors	1, 2, 5		1, 5, 6, 8	8 - student researcher - farmer network	1, 2, 3, 4	H - team provides technical assistance to producers; unique research partnership of students and farmers	1, 2, 3, 6	6 - students	TBD	Unique approach - explore efficacy of farmer-student collaboration, esp. for farmers
2013-03950	1, 2, 3, 4, 5	VH -all research conducted on farm; farmer advisory board with evaluation and oversight role.	1, 3, 4, 6	6 - three undergrad, on grad, one post doc in project	1, 2, 3, 4, 5	eOrganic webinar and several info sheets planned for 2015 (2nd year of project)	1, 5, 8	8 - Expert and transitioning organic farmers on advisory board network with wider organic farming community	1, 2	P - large numbers of plant and insect samples collected from 53 farms	1, 3, 6	6 = students	TBD	
2013-03968	3, 4,	M - three organic farmers will test optimized protocols in large scale on farm plots, host field days	1, 3, 4		1, 2, 3, 7	7 = video - not clear whether via eOrganic or project web site	1, 4	4 - project goal is protocol(s) for non-antibiotic management of fire blight	1, 2, 3	P - promising initial results using Oxidate to enhance establishment of yeast fire blight antagonist (Blossom Protect)	1, 3		TBD	

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2013-03971	1, 2, 3, 4, 5	H - farmer co-PI; 3 on-farm trials, non-organic cooperator network (40) in TX collects and shares data	1, 2, 3, 4, 7		2, 4, 5		4, 7, 9	4 - whole farm organic pecan production and pest mgmt. sys; 7, 8 - cooperator network / pecan IPM website	1, 2, 3, 4	P - Initial data on IPM tactics and biodiversity posted on IPM website with 4,000 users; research still in progress	1, 3		TBD	Excellent and innovative farmer engagement; promising initial results after 1 year
2013-03973	1, 2, 4, 5	VH - expert and trans organic farmers in learning groups with researchers and educators; engaged throughout project.	1, 3,4, 5, 6, 8	8 - sustainable agriculture NGO personnel	1, 2, 3, 4, 5, 6		1, 4, 5, 6, 8	14 learning modules with decision case studies to teach critical thinking about common organic farming dilemmas	1, 2, 4	VH - existing grower-professional network strengthened; module topics chosen, 3 case studies completed during 1st year.	1, 3, 4, 5, 6	6 - students, sustainable agriculture NGOs; 4, 5 - unique educational model can yield community-wide benefits	TBD	Unique learning model, substantial results in 1st year, merits further exploration.
2014-03354	3, 4	H - multiple farms surveyed for beneficial organism / human pathogen interaction, host field days	1	Farmers appear to be primary audience	3, 4		1	Videos of field days posted on eOrganic	1	P - goal = identify conditions and practices that suppress foodborne pathogen through biodiversity on crop-livestock farms	1, 2, 3, 6	2, 6 - processors and general public benefit from safer food	TBD	
2014-03365	3, 4	H - data collected from farms; farmers host field days, linked with project team via web site	1, 7		2, 3, 4, 5		1, 5		1, 2, 3	P - goal is to provide farmers with tools to maintain health populations of native pollinators	1, 3		TBD	
2014-03378	1, 2, 5	H - farmers engaged from planning through implementation	1, 2, 4, 5, 6, 8	8 - "food system stakeholders", school districts, health care institutions	2, 3,		1, 2, 6, 8	2 - tool kit for meeting NOP rules; 8 - peer learning network	1, 2, 3	P - aims to disseminate existing and new practical information more widely through organic farming community	1, 2, 3, 4, 6	4, 6 - many sectors of the community, including health care institutions, school districts	TBD	
2014-03379	3	M - two on-farm trials to be conducted, based on outcomes of research	1, 6, 8	6 - high school, undergrad, and grad students; 8 - policy makers	2, 4, 7	7 - podcasts, Wimba Horizon	5		1	M? - poultry feed ingredient analysis useful; scientific basis of "de novo synthesis" of methionine unclear	1, 6	6 - students	TBD	
2014-03385	1, 3, 4, 5	H - main trials at research stations; farmers interviewed, select cover crops, provide samples, evaluation.	1, 3, 4, 5, 6		1, 2, 3	3 - cover crop interseeding and soil weed seed bank characterization demo	1, 6	1 - newsletter, bulletins; 6 - undergraduate organic cropping systems course with hands on learning	1, 2, 3	P - goal = overcome tradeoff short term profit vs. long term sustainable - soil health, GHG, beneficial organisms	1, 3, 6	6 - students	TBD	

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2014-03386	1, 2, 3, 5	H - work closely with growers in planning, research, evaluation; on farm trials; case studies, grower surveys	1		2, 7	7 - webinars, venue not stated	1, 4, 5	4 - yeast based biocontrol for fire blight	1, 2, 3, 4	P - strong potential for effective non-antibiotic fire blight management system	1		TBD - integrated strategy including component strategies that complement or enhance the yeast-based fire blight antagonist may be warranted	
2014-03389	2, 3, 4, 5	H - close collaborators with farmers, on farm trials, farmer evaluation of cultivars and practices.	1, 4		1, 2, 3, 4		1	Articles, videos distributed locally and via eOrganic	1, 4	P - Disseminate crop disease mgmt. and best food safety practices for organic melon	1, 2, 3, 6	6 - public health (food safety)	TBD	
2014-05324	3, 4	H - long term trials on working farms	1, 2, 3, 4, 8	8 - marketers	1, 2, 3, 5		1, (3), 5	3 - evaluating advanced breeding lines with disease resistance and excellent end-use quality	1, 2, 3	P - legume covers, compost have potential to improve wheat yield and soil quality in wheat/fallow system	1, 2, 3		Proposal: seed hairy vetch, winter pea at 100 lb./ac; cover crops tilled in. Suggest try "normal" rates for vetch (25-40 - reduced cost), and roll-crimp cover crops (soil conservation).	
2014-05325	1, 2	VH - farmers on team, in 6 stakeholder forums, one regional meeting to outline proposal; farmer survey	1, 3, 4, 8	8 - NGO representatives	1, 6	In-person meetings, e-mailed survey	10	full OREI proposal for a Southern organic Seed Network	1, 2, 3	P - So. organic Seed Network would enhance availability of organic seeds and regionally adapted crop varieties	1, 3, 4	4 - anticipate benefits to local economies	TBD in survey and planning process	
2014-05326		M? - proposal: "work with farmers" but no specifics; not clear whether advisory panel includes farmers.	1, 3, 4, 6, 8	6, 8 - veterinarians and veterinary students	1, 2, (4, 5, or 7)	webinars planned; not clear if eOrganic, project website, or other venue	1, 5, 6, 9	6 - short course	2	M? -document residues from NOP-allowed mastitis treatments in meat and milk - address market concerns?	1, 3, 6	3 - veterinary science, food quality pro-fessionals; 6 - consumers	Is there a way to do this with less than $1.4 million and without sacrificing (euthanizing) cows to trace metabolites of garlic and herbs?	Possible example of a "poor" investment of OREI funds?
2014-05340	1, 2, 3, 4, 5	H - builds on farmer network of OREI 2010-02363, but with increased emphasis on high-tech lab methods	1, 3, 8	8 - organic / non-GMO seed industry	1, 3, 5, 9	5, 9 - Data and seed from new varieties disseminated through web and networks of organic farmers.	1, 3, 8	1 - videos on corn varieties, etc.; 3 - new varieties licensed to seed companies; 8 - OPV network; US Testing Network	1, 2, 4	VH - new corn varieties to meet organic needs; more land in organic seed production; strengthened network	1, 2, 3, 6	Benefits to corn and poultry farmers and feed processors (hi methionine corn), plant breeders, consumers (hi nutrition variety)	TBD - project continues and builds on OREI 2010-02363	Evaluate balance between "hi tech" research and practical outcomes for farmers

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2014-05341		L? - "collaborators effort" including farmers, but farmer roles in project planning, execution, and evaluation not stated.	1, 3, 4, 5		1, 2, 3		1, 4	4 - soil-conserving weed mgmt. strategies for organic grains with crop rotation and cover crops	1, 2, 3, 4	P - testing integrated, cutting-edge weed mgmt. strategies, with in-depth economic analysis.	1, 3		TBD	
2014-05348	1, 2, 4, 5	H - at least 1 farmer on advisory team, farmer input solicited via interviews and workshops	1, 2, 3, 4, 7, 8	8 - decision makers, administrators of OREI and other NIFA programs related to organic	1, 2, 4, 5		1, 10	10 - increase farmer access and use of products and tools from other OREI and organic projects, policy recs.	1, 2, 3, 4	H, P - make existing OREI/organic project outcomes more available, inform and fine-tune priorities for future RFAs	1, 2, 3, 6	6 - policy makers, administrators of NIFA programs, general public	TBD based on gaps and needs identified during course of project	
2014-05354	2, 5	H - farmers provide essentially all the research data (~90 organic and 90 conventional farmers in study)	1, 8	8 - policy makers	1, 2, 5		1, 10	10 - policy recommendations for federal crop insurance programs for diversified organic farming systems	2	H, P -accurate data on risk of organic vs. conventional farming will support equitable access to crop insurance	1, 6	6 - policy makers, insurers	TBD	
2014-05355	5	M? -conf. participant evaluation will shape future conferences and research topics; other farmer roles not stated	1, 3		2, 4	Poster sessions, day-long intensives (marketing, food safety, organic. seed), workshops (rotations, soil health)	1, 5	5 - webinars on eOrganic (seed, rotations, soil)	1, 2, 3	P - enhance markets for organic (address gaps, food safety, adapt rotations); organic seed production	1, 3, 6	6 - markets, consumers	TBD	
2014-05376	2, 3, 4, 5	VH - farmers advise project, host trials and field days; input in post-field-day surveys to assess implementation	1, 3, 4		1, 2, 3, 4		1, 5		1, 2, 3, 4	P - potential of air-propelled abrasive grits for organic weed control, pending outcome of trials.	1, 3		TBD	
2014-05377	1, 2, 3, 4, 5	VH - 3 farmers host trials and field days, design/ select treatments; farmers utilize and evaluate decision tool	1, 3, 4		1, 2, 3, 5		1, 2, 5, 8	2 - beta version of decision support tool for cover crop mgmt., etc.;	1, 2, 3, 4	P - project takes next step toward reduced till organic systems that benefit soil, environment, yield, net profits.	1, 3		TBD	"Second generation" organic reduced till project - worth exploring
2014-05378	1, 2, 3, 4	VH - producers comprise half of planning grant team, establish priorities, help develop protocols	1, 3, 4		1, 4, 6, 9	9 - conference calls	7, 10	7 - interactive web page on eOrganic; 10 - OREI full proposal - funded in 2015	1, 2	P - goal is to develop integrated organic management for serious invasive pest, spotted wing drosophila (SWD)	1, 3		TBD in full proposal	

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2014-05381	2, 3, 4	VH - farmers develop decision making tool, help design experiments, conduct on farm research	1, 3		1, 2, 3		2, 5, 8	8 - learning network of aspiring organic reduced-tillage farmers	1, 2, 3, 4	P - goal to address barriers to organic reduced till - weeds, nutrient mgmt., cover crop mgmt., equipment	1, 3		TBD	Second generation organic reduced till project - worth exploring
2014-05388	(1, 2, 4), 5	? - farmer participants evaluate symposium; other roles (Program Committee, review submissions, give talks) unclear	1, 2, 3, 4, 5, 6	Main focus - bring organic researchers and producers together	1, 2, 4		1, 5, 8	1 - Symposium Proceedings, videos; 5 - webinars of some sessions; 8 - ongoing farmer-researcher network	1, 2	P - goal to create "lasting relationships and ongoing dialogue" regarding research priorities	1, 3, 6	6 - students	TBD	
2014-05396		L - no farmer role in planning; goal - "facilitate exchange among researchers and practitioners."	1, 3, 8	8 - policy makers	1, 2		1	Proceedings of Innovations in organic Food Systems Conference	1, 2, 3	? - Hard to assess impacts from sketchy abstract	(1), 3	Primarily a scientists' conference; Proceedings intended for "practitio-ners and policy mak-ers."	TBD	
2014-05402	1, 2, 3, 4, 5	VH - continue and build upon integral engagement of farmers under NOVIC I (OREI 2010-03392)	1, 3, 6, 8	6 - grad student training and internships; 8 - regulators, seed companies	1, 2, 3, 4, 5		3, 8	3 - tomato, cabbage, pepper, sweet corn, winter squash varieties; 8 - expand farmer trialing network established in NOVIC-I	1, 2, 4	VH - likely to deliver new farmer-ready varieties, info on existing varieties, and increased organic seed production	1, 3, 6	6 - vendors of vegetable seeds for organic producers	TBD	Explore NOVIC-II to assess level of farmer engagement and farmer satisfaction
2014-05405		L? - "participatory breeding" in title, but no farmer role mentioned in proposal	1, 3	Inferred - no mention of dissemination, extension, or outreach activities in proposal abstract		Dissemination media not mentioned	3	Disease resistant tomato varieties	1, 2, 3	P - new tomato varieties for organic; reduced Cu loads to soil and water through disease IPM and resistant varieties	(1), 3	Primarily a research project - benefits to farmers pending outcomes and effective dissemina-tion thereof.	TBD	"Participatory breeding" - yet little evidence of farmer participation - explore further?
2014-05407	1	M? - reps of 5 organic farming NGOs at first two meetings, but not at 3rd where actual proposal is developed	(1), 3, 8	1, 8 - NGO representa-tives, who may or may not be farmers	2		10	Full OREI proposal - funded in 2015	1, 2, 3	P - if successful, a very low environmental-impact tool for managing powdery mildews will become available	1, 3		TBD	

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2014-05408	1, 2, 3, 4, 5	VH - learning community with 60+ farmers, consult on soil quality, do on farm research, host twilight meetings	1, 3, 4, 6	6 - undergrad summer assistants	1, 2, 3, 5		1, 7, 9	1 - case studies, print and audiovisual info; 7 - Soil quality blog for farmers to share observations	1, 2, 3	P - scientific evaluation of soil nutrient balancing will either validate the practice or save farmers unneeded input costs.	1, 3		TBD	Testing of highly controversial hypothesis with high farmer engagement - explore further
2014-05411	2, 5	H? - main experiments at university research farms and Rodale; many farmer collaborators, farmers help evaluate by survey	1, 3, 4		1, 2, 3, 4, 5, 6		1, 9		1, 2, 3, 4	P - goal is increased adoption of crop-livestock integrated systems	1, 3		TBD	

APPENDIX A4. Projects Funded by OREI in 2015

Title	Grant Yr	Prop No	Investigator	Institution	Award amount $
Organic agriculture research symposium	2015	2015-07418	Dahlberg, J.	University of California, Davis	48509
An experiential learning-based public plant breeding pipeline for organic cultivar development	2015	2015-07458	Brummer, E.	University of California, Davis	999955
Needs assessment to characterize the use of soil amendments and microbial food safety best practices in organic and sustainable agriculture	2015	2015-07395	De Andrade, E. Pires, A.	University of California, Davis	50000
Sustainable organic strawberry (SOS) cropping systems for the Southeast	2015	2015-07389	Chase, C. A.	University of Florida	1994559
Development and implementation of systems-based organic management strategies for spotted wing drosophila	2015	2015-07403	Ahmad, A.	University of Georgia	2000000
A systems-based management practices for enhancing quality and safety of organic produce: planning grant	2015	2015-07419	Panigrahi, S.	Purdue University	50000
Organic tomato breeding for arthropod resistance with a focus on protected cultivation: a planning proposal	2015	2015-07394	Snyder, J.	University of Kentucky	50000
Innovative sowing, cultivation, and rotation strategies to address weed, fertility, and disease challenges in organic food and feed grains	2015	2015-07453	Mallory, E. B.	University of Maine	999120
Leveraging long-term agroecological research to improve agronomic, economic, and environmental performance of organic grain production	2015	2015-07400	Cavigelli, M.	Agricultural Research Service	902804
Creating the cover crops that organic farmers need: delivering regionally adapted varieties across America	2015	2015-07406	Mirsky, S. B.	Agricultural Research Service	1998686
Assessing and addressing the needs of a growing United States organic sweet potato industry	2015	2015-07432	Meyers, S. L.	Mississippi State University	49273
A planning network of organic farmers, researchers, and dairy processors to optimize productivity and resiliency of forage production	2015	2015-07416	Brito, A. F.	University System of New Hampshire	47018
The novel use of light to suppress a broad group of plant pathogens affecting sustainable production of organically grown crops	2015	2015-07450	Gadoury, D. M.	NY Agricultural EXPT Station	1765854
Making diversity functional: farm-tuning cover crop mixtures to meet grower needs	2015	2015-07433	Kaye, J. P.	Pennsylvania State University	999972
Develop science-based recommendations to efficiently manage forages, herd health and productivity on organic dairies in the southeastern US	2015	2015-07388	Pighetti, G.	University of Tennessee	1807044
Sustainable and profitable strategies for integrated pest management in southern organic rice	2015	2015-07384	Zhou, X.	Texas A&M University	555805
Fine-tuning supplementation strategies on organic dairies during the pasture season to improve productivity	2015	2015-07409	Greenwood, S. L.	University of Vermont	974720
Avian biodiversity: impacts, risks and descriptive survey (A-birds)	2015	2015-07405	Snyder, W.	Washington State University	1994090
The student organic seed symposium: supporting and educating future leaders in organic seed and plant breeding	2015	2015-07457	Dawson, J. C.	University of Wisconsin	49992
A modular curriculum to teach critical concepts in organic agriculture across regions	2015	2015-07411	Jabbour, R.	University of Wyoming	242908

APPENDIX A5. Projects Funded by ORG in 2015

Title	Grant Yr	Prop No	Investigator	Institution	Award amount $
Fishing for a novel source of methionine in organic poultry feed: exploring the potential of invasive Asian carp as sustainable fish meal	2015	2015-06280	Donoghue, D. J.	University of Arkansas	499984
Organic decision tools to manage N for production and climate	2015	2015-06289	Wander, M. M.	University of Illinois	492596
Reinventing sustainable protection systems for cucurbit production	2015	2015-06288	Gleason, M. L.	Iowa State University	499974
Assessing the resiliency of integrated crop-livestock organic systems under current and predicted climate	2015	2015-06281	Menalled, F.	Montana State University	499990
Tradeoffs between soil carbon sequestration and greenhouse gas emissions in organic pastures under management intensive grazing	2015	2015-06273	Contosta, A.	University System of New Hampshire	498384
Quantifying and predicting the effects of ecological weed management strategies on organic agroecosystems to inform farmer decision making	2015	2015-06287	Wilson, R. S.	Ohio State University	498658
Unraveling the interactive effects of tillage, residue, and manure additions on nitrous oxide emissions on grain and silage systems	2015	2015-06276	Kemanian, A. R.	Pennsylvania State University	375243

APPENDIX B:

Questions Used in Interviews with OREI and ORG Project Participants

Principal Investigator and collaborators questions:

- How would you evaluate the application and review process; administrative details of disbursement and management of project funds?
- How would you evaluate the research process, i.e., the conduct of the project, including outreach/extension and/or education components?
- What problems/challenges did you encounter in your ability to conduct the research?
- Did farmers participate in the project?
- What roles did producers and/or processors play in the project: Identification of priorities and project objectives, development of proposal, planning the work, conducting research, education, and/or outreach activities, hosting on-farm trials or field days, evaluating project outcomes?
- How was your experience working with farmers as part of the research team?
- What recommendations would you make to your project team that would allow your project to be done better?
- Did project outcomes include recommended practices, tools, or products that could be adopted or utilized by producers? Have these practices been adopted by farmers?
- Did you conduct case studies? How could that activity be strengthened?
- What do you perceive as the impacts (current and future) from your project?
- Do you believe that there may be cultural/topical differences of what gets funded by USDA; for example, beef vs. vegetable research?
- Overall, do you feel that the projects funded were relevant to farmer needs? If not, how can that be improved?
- Do you feel that OREI/ORG projects are as scientifically rigorous as other funded grants by USDA NIFA?

Farmer participants' questions:

What was your role(s) in the research project?

- Planning, identifying priorities, developing experimental procedures or treatments, proposal development.
- Advisory role during project execution.
- Research – including conducting, maintaining, or hosting on-farm trials.
- Outreach, including hosting farm tours and field days, serving as co-presenter or trainer in workshops, short courses, and other project outreach events.
- Evaluation of project outcomes.
- Other

What were your goals for participation in the project? Were your goals met?

What did you gain from the project collaboration? Has the project outcome, information, product, or tool(s) benefited your operation, and how?

- New skills, new knowledge, insights into the scientific process.
- New tools and practices to implement on your farm.
- New connections or networks with other farmers, scientists, service providers, processors, and/or vendors. Have these new connections helped your farm operation, and if so, how?
- Other

Have you shared information and results from the project with your farmer peers?

What were the challenges of collaborating on research (for you, for your work crew)?

Did you feel engaged as an equal partner in the project?

Did you feel that your questions, ideas, suggestions, or concerns were heard and understood by others on the team?

How well do you think project outcomes, products, or tools are reaching a wider range of producers and/or other stakeholders who might benefit? How might such dissemination be improved, either during the project itself or after the lifetime of the grant?

How can OREI/ORG research, education, and/or extension activities more closely match the needs of organic producers?

What do you think are the top priority research topics for future OREI and/or ORG funding?

Do you have any other comments or recommendations that you would like to communicate to OREI/ORG/NIFA?

APPENDIX C:

Further Analysis of OREI and ORG Grants by Region, State, and Funded Entity

CONTENTS

USDA Organic Research Funding and Organic Industry Statistics in Four USDA Regions

The 2014 Organic Production Survey (USDA, 2015) was reviewed to determine numbers of USDA certified and exempt organic farms and total farm sales by state and region. Tables 1-4 show these data in relation to numbers of OREI and ORG projects and total funding. Generally, NIFA invested the most OREI and ORG funding in states and regions with the strongest organic farming sectors, though some exceptions were noted.

Northeastern Region

In the Northeastern region (Table 1), New York and Pennsylvania led the region in numbers of organic farms and organic sales in 2014, and in OREI and ORG funding. Vermont ranked third in the region in size of the organic industry, but only sixth in USDA organic research funding.

Table 1.
Comparison of OREI and ORG funding, numbers of organic farms, and total organic farm product sales by state in the Northeast region

State	Number of Grants	Total funding, $M	Number of Organic Farms1	Total Organic Sales, $ M/yr1
Connecticut	0		122	3.7
Delaware	0		10	0.3
Maine	5	2.64	517	54.2
Maryland	5	3.25	120	19.0
Massachusetts	1	0.20	179	24.8
New Hampshire	3	3.59	150	20.8
New Jersey	1	2.67	87	7.8

Continued on pg. 126

Table 1, cont.

New York	13	12.28	917	164.2
Pennsylvania	4	7.34	679	313.4
Rhode Island	0		24	0.9
Vermont	4	2.68	542	92.1
West Virginia	3	1.93	24	-2
Region total	39	36.58	3,371	701.2
% of national total	20.6	25.7	23.9	12.9

1 USDA National Agricultural Statistics Service (NASS) 2014 Organic Survey (USDA, 2015)

2 Total sales data withheld by NASS to avoid disclosing data for individual farms.

Of the five states with the smallest organic sectors, Connecticut, Delaware, and Rhode Island received no OREI or ORG awards, while West Virginia received two planning grants and one full award (parasite control in small ruminants), and New Jersey received one large award, funding Rutgers University to coordinate a nationwide effort to manage the invasive exotic Brown Marmorated Stink Bug.

While the Northeast region hosts nearly one-quarter of the nation's organic farms, it accounts for only 13% of organic sales, with average annual proceeds of $208 K per farm. Northeast region organic and sustainable producers are supported by strong NGOs such as Pennsylvania Association for Sustainable Agriculture, Northeast Organic Farming Association (CT, MA, NH, NJ, NY, RI, and VT), and Maine Organic Farmers and Gardeners Association. In addition, public plant breeders at Cornell University, dairy scientists at the University of Vermont, and crop/soil scientists and others at the University of Maine, Pennsylvania State University, and other LGUs have collaborated closely with producers and NGOs on OREI, ORG, and other research endeavors.

North Central Region

In the North Central region, the five states with the largest organic sectors—Iowa, Michigan, Minnesota, Ohio, and Wisconsin—also garnered the greatest number of OREI and ORG awards (Table 2). In addition to well-established sustainable agriculture programs at LGUs, several vigorous NGOs serve these states, providing vital support for organic production, research and educational endeavors. These include Midwest Organic and Sustainable Education Service (MOSES) in WI and neighboring states, Ohio Ecological Food and Farming Association (OEFFA), and Practical Farmers of Iowa (PFI).

Interestingly, Wisconsin led the region in number of organic farms and organic sales, but not in total OREI and ORG funding. The nine grants awarded to Wisconsin applicants included several lower-budget yet highly effective endeavors, including two symposia held in 2008 and 2015 (co-sponsored by MOSES and the University of Wisconsin), two projects that launched an ongoing organic potato growers network, and an innovative extension project led by Northeast Wisconsin Technical College.

Table 2.
Comparison of OREI and ORG funding, numbers of organic farms, and total organic farm product sales by state in the North Central region.

State	Number of Grants	Total funding, $M	Number of Organic Farms1	Total Organic Sales, $ M/yr1
Illinois	4	3.98	249	52.7
Indiana	2	3.28	282	59.8
Iowa	8	9.79	612	102.6
Kansas	1	0.50	83	17.2
Michigan	9	4.78	332	124.6

Minnesota	11	7.96	512	92.2
Missouri	2	1.66	216	43.3
Nebraska	4	3.01	170	75.9
North Dakota	1	0.74	94	27.3
Ohio	11	9.96	541	88.8
South Dakota	1	0.04	80	16.0
Wisconsin	9	3.81	1,228	200.8
Region total	63	49.51	4,399	901.2
% of national total	33.3	34.8	31.2	16.5

1 NASS 2014 Organic Survey (USDA, 2015)

The three North-Central states with the fewest organic farms and lowest organic sales—North and South Dakota and Kansas—received just two full project awards (KS, ND) and one planning grant (SD).

Western Region

The Western region includes a tremendous diversity of climates, soils, production systems, market conditions, and challenges facing organic farmers and ranchers. The Western region has the most organic farms and by far highest total organic sales (Table 3), with average income for organic farms at $681K. California dominates the region and accounts for 40% of the nation's total organic sales, yet it came in a distant third in OREI and ORG funding during 2002-2014. Washington and Oregon, second and third in farm numbers and sales, ranked first and second in OREI and ORG awards. Strong organic research and outreach programs in LGUs (Washington State, Oregon State) and NGOs (Oregon Tilth, Tilth Producers of Washington, and Organic Seed Alliance) provided capacity for applying for and conducting organic research. In addition, Oregon State hosted the OREI-funded eOrganic community of practice, through which many other OREI and ORG projects communicate with their networks and disseminate outcomes.

Semi-arid climates of the interior parts of the West present unique challenges to dryland organic grain, livestock, and forage producers, which were addressed by 12 OREI and ORG projects based in Washington, Montana, Utah, and Wyoming. Colorado ranked fourth in the region in organic sales, yet received no OREI or ORG awards. Idaho (sixth in organic sales) received only one small award (to evaluate potato varietal resistance to pests), but several of the dryland organic production projects included partners or study sites in Idaho. Alaska and Nevada, with small organic farming sectors, did not host or play major roles in any OREI or ORG projects.

Table 3.
Comparison of OREI and ORG funding, numbers of organic farms, and total organic farm product sales by state in the Western region.

State / territory	Number of Grants	Total funding, $M	Number of Organic Farms	Total Organic Sales, $ M/yr
Alaska	0		17	0.9
Arizona	1	2.91	61	93.5
California	6	4.13	2,805	2,231.2
Colorado	0		157	146.8
Guam	1	0.04	-2	-2
Hawaii	2	0.40	166	13.4
Idaho	1	0.11	161	65.7

Continued on pg. 128

Table 3, cont.

Montana	4	3.46	147	43.7
Nevada	0		49	20.4
New Mexico	2	0.54	116	21.9
Oregon	13	9.73	525	237.1
Utah	3	3.22	60	18.5
Washington	18	10.10	716	514.9
Wyoming	2	1.27	49	16.7
Region total	53	35.91	5,029	3,424.7
% of national total	28.0	25.3	35.7	62.8

1 NASS 2014 Organic Survey (USDA, 2015)

2 Total sales data withheld by NASS to avoid disclosing data for individual farms.

The disparity between California's huge share in the organic market (41% of national total) and smaller share of USDA organic research funding (3%) raises an interesting question: are California's organic producers under-served by the organic research community? Have other (non-federal) funding sources, such as OFRF, supported sufficient research for the state's organic producers? Or, does the existing body of knowledge regarding organic production in California's bioregions, together with existing Extension other services adequately meet the needs of the state's organic producers?

Southern Region

The Southern region clearly has the smallest share of the nation's organic producers and organic sales, as well as the lowest total number of projects and funding from OREI and ORG (Table 4). An exact figure for total sales was not available, because NASS withheld data for three states in the South, as well as West Virginia (Northeast) and Guam (West). However, the total sales for these four states and Guam came to only about $26M, less than 0.5 percent of the nation's total; thus omission of this data from totals does not have a substantial impact on trends or conclusions.

North Carolina led the region in numbers of organic farms, and was second for total organic sales. North Carolina State University conducts organic and sustainable agricultural research and education at a large research facility, the Center for Environmental Farming Systems (CEFS), and received the most OREI and ORG support of all LGUs in the region (Table 4). In addition, the State's organic farmers and researchers are supported by several leading NGOs, including Carolina Farm Stewardship Association, Rural Advancement Foundation International USA, Georgia Organic Growers, and American Livestock Breeds Conservancy.

Table 4.
Comparison of OREI and ORG funding, numbers of organic farms, and total organic farm product sales by state in the Southern region.

State	Number of Grants	Total funding, $M	Number of Organic Farms	Total Organic Sales, $ M/yr
Alabama	4	1.64	28	1.4
Arkansas	5	3.57	34	-2
Florida	6	2.17	166	57.2
Georgia	4	0.91	117	12.5
Kentucky	0		107	7.8
Louisiana	0		23	5.5
Mississippi	0		8	6.0

North Carolina	7	6.25	264	66.9
Oklahoma	0		45	-2
South Carolina	1	0.43	47	-2
Tennessee	2	2.04	54	4.0
Texas	4	2.84	234	199.1
Virginia	1	0.35	167	41.3
Region total	34	20.20	1,294	401.7
% of national total	18.0	14.2	9.2	7.8

1 NASS 2014 Organic Survey (USDA, 2015)

2 Total sales data withheld by NASS to avoid disclosing data for individual farms.

Texas leads the region in organic sales and is second in number of organic farms, indicating a larger average farm size in TX ($850K/farm in sales) compared to the region as a whole ($310K/farm). The state received four awards, including two to Texas A&M University and University of Texas Pan Am for innovative projects that brought students onto working organic farms in southern Texas to conduct research projects focused on farmers' priorities.

Florida and Virginia were third and fourth in size of their organic sectors. The University of Florida received six OREI and ORG awards to address the soil, weed, and pest challenges in organic agriculture, and Virginia Tech received one ORG grant to evaluate cover crop based organic minimum till.

The low figures for both organic industry and research funding in the South raises an important question. Is research funding lower because there is a smaller audience for OREI and ORG project outcomes and therefore less perceived need? Or, is the organic industry in this region lagging because there is a great need for additional research and outreach to develop and deliver new tools and techniques to help organic producers make a living in this area? The hot, humid climates and ancient, highly-weathered soils (order Ultisols) prevalent across most of the South present organic and sustainable producers with particularly intense challenges related to soil fertility, soil quality, soil conservation, weeds, pests, and crop and livestock diseases. The farmer-student research projects in south Texas have brought OREI and ORG funds into a region that had not previously received organic research funding, and appear to have had significant positive impacts on viability of organic farming in this area.

Recent RFAs for the OREI program have specifically invited proposals from the Southern region related to organic pest, weed, and disease management, and the 2015 OREI awards included six to applicants from the South totaling $6.46 M, comprising 37% of the $17.58M awarded nationwide. This suggests that increasing institutional capacity for organic agricultural research, and/ or increasing awareness of research needs and funding opportunities have led to a recent increase in high quality proposals from the South. In addition, while Alabama and Arkansas had small organic sectors as of the 2014 NASS Organic Farming Survey, they received several awards during 2004-14 to tackle organic crop production challenges in the Deep South (Alabama) and poultry and small ruminant parasite management challenges throughout the region (USDA-ARS in Arkansas).

Lead Institutions (Funded Entity) in Each of Four USDA Regions

OREI and ORG grant awards by funded entity are shown for each of the four regions in Tables 5-8. Land-grant universities with strong sustainable and organic research and extension programs generally received the most awards and highest funding totals. In some cases, USDA funded research activity correlated with the presence of strong sustainable agriculture NGOs with large memberships and major annual conferences that attract producers, researchers, educators, and other service providers.

In the Northeast region, Cornell University led the region in number of awards (Table 5), and led the entire nation in total funding. Two other universities received small numbers of awards but relatively large sums: Pennsylvania State University (four multidisciplinary projects focused on organic reduced till, crop rotation, and cover crops to manage weeds and build soil quality), and Rutgers University (one award for a nationwide endeavor to develop organic strategies against Brown Marmorated Stink Bug).

Table 5.
Project Funding Summary by Primary Funded Entity: Northeast Region

Entity Type	Entity	No. Projects	$ (million)
Land Grant 1862:	Cornell University	12	12.23
	University of Maine	5	2.64
	Pennsylvania State University	4	7.34
	University of Vermont	4	2.68
	University of Maryland	4	2.49
	University of New Hampshire	3	3.59
	West Virginia University	2	1.88
	Rutgers University	1	2.67
Total Land Grant 1862:		35	35.52
Other University:	Tufts University	1	0.20
Total other university:		1	0.20
USDA agency:	USDA Agricultural Research Service	1	0.76
Total USDA Agency:		1	0.76
Non-profit NGO:	Northeast Organic Farming Assoc. NY	1	0.05
Total Non-profit NGO:		1	0.05
For-profit organization:	Downstream Strategies	1	0.05
Total For-profit organizations:		1	0.05
Total for Northeast		39	36.58
% of national total		20.6	25.7

In the North Central region, Ohio State and University of Minnesota led the field in number of projects (10) and total funding, but seven other 1862 LGUs received substantial funding for two to nine projects (Table 6).

Northeast Wisconsin Technical College is one of the few non-LGUs to receive USDA organic funding, and used it to launch an innovative educational program for organic and transitioning growers in that part of the state. Farmers' Legal Action Group (FLAG, based in MN) received $109K to develop a Farmers Guide to Organic Contracts, and MOSES received funding for an organic research symposium held in 2008.

USDA ARS received substantial grants for public breeding and cultivar development of corn (Ames, IA), and carrot (Peoria, IL) for organic systems, as well as a planning grant (Coshocton, OH).

Table 6.
Project Funding Summar y by Primary Funded Entity: North Central Region

Entity Type	Entity	No. Projects	$ (million)
Land Grant 1862:	Ohio State University	10	9.91
	University of Minnesota	10	7.85
	Michigan State University	9	4.78
	University of Wisconsin	7	3.33
	Iowa State University	6	4.96
	University of Nebraska	4	3.01
	University of Illinois	3	1.88
	Purdue University	2	3.28
	University of Missouri	2	1.66
	North Dakota State University	1	0.74
	Kansas State University	1	0.50
	South Dakota State University	1	0.04
Total Land Grant 1862:		56	41.94
Other University:	Northeast Wisconsin Technical College	1	0.43
Total other university:		1	0.43
USDA agency:	Agricultural Research Service	4	6.98
Total USDA agency:		4	6.98
Non-profit NGO:	Midwest Organic & Sustainable Educ. Serv.	1	0.05
	Farmers Legal Action Group (St. Paul, MN)	1	0.11
Total Non-profit NGO:		2	0.16
Total for North Central:		63	49.51
% of national total		33.3	34.8

In the Western Region, Washington State University led the nation in number of projects awarded, though its funding total was fourth behind Cornell, Ohio State, and Oregon State. The Pacific Northwest LGUs (WA and OR) received nearly half the projects and funding for the region. The challenges of organic agriculture in semiarid environments was a strong theme throughout the region, including Washington State and Oregon State as well as other funded entities from interior states in the West.

The Western region included the largest award to a NGO, $750,000 to the National Center for Appropriate Technology for a study of risk management and crop insurance for organic. Organic Seed Alliance received OREI funding to hold a symposium in 2010 (which developed a State of Organic Seed Report and Action Plan, to be updated every five years), and a planning grant in 2014 to develop a full proposal for a plant breeding and organic seed production network in the Southeast. Other NGO-led OREI projects in the Western region include a 2014 conference grant to Oregon Tilth, and the Analytical Grant to Organic Farming Research Foundation to conduct this analysis.

Table 7.
Project Funding Summary by Primary Funded Entity: Western Region

Entity Type	Entity	No. Projects	$ (million)
Land Grant 1862:	**Washington State University**	**16**	**9.28**
	Oregon State University	10	9.59
	University of California	5	4.03
	Utah State University	3	3.22
	Montana State University	3	2.71
	University of Wyoming	2	1.27
	New Mexico State University	2	0.54
	University of Arizona	1	2.91
	University of Hawai'i	1	0.35
	University of Idaho	1	0.11
	University of Guam	1	0.04
Total Land Grant 1862		45	34.05
USDA Agency:	**Agricultural Research Service**	**2**	**0.82**
Total USDA Agency:		2	0.82
Non-profit NGO:	**National Center for Appropriate Technology**	**1**	**0.75**
	Organic Seed Alliance	2	0.09
	Kohala Center (Hawai'i)	1	0.05
	Organic Farming Research Foundation[1]	1	0.10
	Oregon Tilth	1	0.05
Total Non-profit NGO:		6	1.04
Total for Western:		53	35.91
% of national total		28.0	25.3

1 Analytical and conference grant, of which this report is a product.

In the Southern region, North Carolina State University received the most awards and accounted for nearly one-third of all OREI and ORG funding in the region (Table 8). Alabama's two 1890 LGUs received small awards, a planning grant to Tuskegee University, and a integrated project by Alabama A & M University that demonstrated successful cover crop based reduced till organic production of tomato and other vegetables. As noted earlier, one award went to a non-land grant university (University of Texas Pan-Am) to support farmer-student collaborative research.

No awards went to NGOs as primary funded entities in the Southern region; however, at least several NGOs in the region have been partners in OREI and ORG funded work. Examples include Virginia Association for Biological Farming and Georgia Organics in an ORG funded Virginia Tech project on organic minimum till vegetable production; and RAFI participation in OREI-funded breeding of field crops (funded entity North Carolina State University).

Table 8.
Project Funding Summary by Primary Funded Entity: Southern Region

Entity Type	Entity	No. Projects	$ (million)
Land Grant 1862:	North Carolina State University	7	6.25
	University of Florida	6	2.17
	University of Georgia	4	0.91
	Texas A&M University	3	2.09
	University of Tennessee	2	2.04
	Auburn University	2	1.44
	University of Arkansas	2	1.07
	Virginia Tech	1	0.35
Total Land Grant 1862:		27	16.32
Land Grant 1890:	Alabama A&M University	1	0.15
	Tuskegee University	1	0.05
Total Land Grant 1890:		2	0.20
Other University:	University of Texas Pan Am	1	0.75
Total Other University:		1	0.75
USDA Agency:	Agricultural Research Service	3	2.50
Total USDA Agency:		3	2.50
State Gov't Agency:	South Carolina Dept. Natural Resources	1	0.43
Total State Government Agencies		1	0.43
Total for Southern:		34	20.20
% of national total:		18.0	14.2

Project Types and Funded Entities

Most OREI and all ORG awards funded "full" proposals, consisting of multi-year research, education, and/or extension endeavors. Beginning in 2009, OREI has offered small grants (maximum $50K) for project planning and proposal development, and for conferences and symposia in organic agriculture. Table 9 shows the distribution of full project, planning, and conference grant awards to LGUs, USDA ARS, NGOs, and other applicants.

The USDA Agricultural Research Service (ARS) received 10 awards, many of them with substantial budgets (funding almost 8% of national total). USDA projects included corn and carrot plant breeding (North Central), organic management of livestock and poultry parasites (South), nutrient management (Northeast), and soil biology management to suppress orchard replant disease (Western).

Non-profit NGOs received nine grants, yet only 1% of total OREI and ORG funding because only two of the awards funded full proposals (Farmers' Legal Action Group, and National Center for Appropriate Technology). Several other

NGOs received small (≤$50K) grants for five conferences and one planning project, and $100,000 for the Organic Farming Research Foundation's analytical project with conference presentations. Thus, there may exist an opportunity and need for greater participation and leadership by sustainable agriculture NGOs in full integrated projects as well as conferences, symposia, and analyses.

Table 9.
Project Type and Funding Summary by Primary Funded Entity: All Regions

Entity Type	Planning projects	Conference projects	Research and/or Ed.	Total No. projects (%)1	Total Funding, $million (%)1
Land Grant 1862	12	5	146	163 (86.2%)	127.83 (89.9%)
Land Grant 1890	1		1	2 (1.1%)	0.20 (0.1%)
Other Universities			3	3 (1.6%)	1.38 (1.0%)
USDA ARS	1		9	10 (5.3%)	11.06 (7.8%)
Non-profit NGO	1	6	2	9 (4.8%)	1.25 (0.9%)
State Gov't Agency			1	1 (0.5%)	0.43 (0.3%)
For-profit organization	1			1 (0.5%)	0.05 (<0.1%)
National Total	16	11	161	189 (100%)	142.20 (100%)

1 Percent of national total.

Reference

USDA National Agriculture Statistics Service, 2015. NASS 2014 Organic Production Survey.

http://www.agcensus.usda.gov/Publications/2012/Online_Resources/Organics/

APPENDIX D.

Further Analysis of Commodities, Research Issues and Priorities

CONTENTS

Commodities: OREI and ORG Emphasis Relative to 2014 NASS Organic Survey Results

Have OREI- and ORG-funded research, education, and extension endeavors addressed those organic commodities for which the need is greatest? One criterion for research priorities among organic commodities is the economic importance of each commodity to the organic farming sector. Table 1 (page136) compares numbers of OREI and ORG projects with total organic sales and numbers of farms producing each commodity in 2014, as reported in the 2014 Organic Production Survey conducted by USDA National Agricultural Statistics Service (NASS) (USDA, 2015).

The number of farms and total sales were higher for organic vegetables than for any other crop category, with fruits second in sales and third in number of farms. With high consumer demand for organic produce and many production challenges in meeting this demand, organic producers need research and outreach efforts to meet those challenges, and NIFA has clearly responded to this need (Table 1). Other specialty crops represented small fractions (≤2%) of total organic sales, and received correspondingly less OREI and ORG emphasis. It is interesting to note that four projects addressed organic peanut breeding and/or production, while only one project focused on tree nuts and none on organic mushroom production, whose sales exceeded that of organic peanut six- to seven-fold.

Among field crops, OREI and ORG projects addressed production of corn, soybean, wheat, other grains, and forages. While substantial numbers of organic farms produced each of these crop categories, together they accounted for just over 10% of organic sales proceeds (Table 1). However, sales figures likely underestimate the importance of these commodities because many organic livestock producers feed farm-grown grains and forages to their own herds or flocks. For example, while NASS reported $138.6M in sales of organic hay, this represented only 56% of total organic hay production, and, only 2,191 of the 3,733 organic farms producing hay, sold some or all of their hay crop. Similarly, the $25.4M in haylage sales represents about 30% of the crop, with similarly low percentages for corn and sorghum silages. Organic sales of grain corn, dry soybeans, grain sorghum, proso millet, and oats ranged between 73-86% of total production.

Despite their importance in US commerce, cotton, rice, and peanut are grown by very few organic producers, and together represent just over 1% of organic sales (Table 1). This suggests that significant barriers to organic production of these commodities exist, and that additional research into improved cultivars, cultural practices, and pest management for organic systems may be required before the US organic cotton, peanut, and rice sectors can grow to meet demand.

Table 1.
Numbers and percentages of OREI and ORG projects addressing different commodities, compared to national total organic sales and number of farms producing each commodity, as reported in USDA National Agriculture Statistic Service 2014 Organic Survey.

	Number and (%)[1] of OREI & ORG projects	$M and (%)[2] of organic sales in 2014	Number and (%)[3] of farms producing commodity
Crops:			
Vegetables (including potato)	65 (34)	1,326 (24.3)	3,981 (28.2)
Fruits (tree fruit, berries, grapes)	31(16)	938(17.2)	>3,120 (22.1)10
Peanut	4 (2)	16 (0.3)	21 (0.1)
Tree nuts	1 (<1)	94 (1.7)	>205 (1.5)10
Floriculture and bedding plants	0	27 (0.5)	427 (3.0)
Nursery and propagation materials	1 (<1)	45 (0.8)	197 (1.4)
Mushrooms	0	109 (2.0)	110 (0.8)
Other specialty crops[4]	2 (1)	48 (0.9)	>300 (2.1)10
Corn (grain, including popcorn)	34(18)	162(3.2)	2735 19.4)
Wheat	33 (17)	102 (1.9)	1093 (7.8)
Rice	1 <1)	35 0.6)	85 0.6)
Other grains and pseudo-grains[5]	18 10)	37 0.7)	>995 7.1) 10
Soybean (dry)	36 (19)	72 (1.3)	1432 (10.2)
Other dry legumes[6]	11 (6)	32 (0.6)	>179 (1.3) 10
Oil seeds[7]	8 (4)	9 (0.2)	>62 (0.4)10
Forages[8]	21 (11)	173 (3.2)	>3733 (26.5)10
Cotton	1 (<1)	11 (0.2)	38 (0.3)
Other field crops[9]	0	54 (1.0)	408 (2.9)
Livestock:			
Dairy cattle	19 (10)	1,082 (19.8)[12]	2262 (16.1)
Beef	2 (1)	- [13]	>520 (3.7)[13]
Pork	2 (1)	5 (0.1)	205 (1.5)
Poultry (broilers, layers, eggs)	6 (3)	795 (14.6)[14]	936 (6.6)[10]
Turkeys	0	50 (0.9)	144 (1.0)
Sheep	9 (5)	1 (<0.1)	181 (1.3)
Goats and goat dairy	4 (2)	1 (<0.1)	88 (0.6)
Other[11]	2 (1)	14 (0.3)	83 (0.6)[10]

1 Percentage calculated by dividing number of projects by 189 and rounding to the nearest percentage point. Totals exceed 100% because many projects addressed more than one commodity.

2 Percentage calculated by dividing by total organic sales in 2014 ($5,455M).

Continued on pg. 70

Table 1, cont.

3 Percentage calculated by dividing number of farms producing the commodity divided by total number of certified and exempt organic farms in the 2014 NASS Organic Survey (14,093).

4 Medicinal herbs and hops for OREI and ORG (one project each); maple syrup ($34M), dried herbs ($9M), and hops ($5M) reported in NASS survey.

5 Oats, barley, rye, spelt and other ancestral wheat, perennial wheat, sorghum, millet, buckwheat, amaranth, and quinoa (OREI and ORG); oats, barley, rye, millet, wild rice (NASS).

6 Lentils, dry peas, chick peas, dry common beans (pinto, black, navy, etc.), dry lima beans.

7 Sunflower, safflower, flax (OREI and ORG); flax (NASS).

8 Various grass and legume forages for pasture or hay (OREI and ORG); hay and haylage (NASS).

9 "Other field crops category in NASS report; not specified.

10 Dollar amount for sales represents a sum of several commodities in NASS report; the minimum figure for number of farms is based on the most widely grown commodity; would give an inflated number because some farms may produce two or more of the commodities.

11 Bison, aquaculture (OREI, one project each); mostly "other poultry" not specified (NASS).

12 Milk sales.

13 NASS report shows "milk cows" ($69M, 2184 farms), "beef cows" ($16M, 520 farms), and "other organic cattle including bulls, beef calves, and replacement milk heifers: (131M, 2557 farms).

14 Broilers $372M, eggs $420M, laying hens $3M.

Although OREI and ORG funding for corn, soybean, wheat, and other grains seems high relative to their share of organic sales, the investment may pay off by helping organic producers overcome barriers to profitable grain production. In addition, grains can play important roles in diversifying crop rotations and protecting soil quality. For example, OREI and ORG have funded research on alternative grain crops (millets, sorghum, oats, rye, spelt, emmer, einkorn, buckwheat, quinoa, amaranth), dry legumes (peas, beans, lentils), and oilseeds (sunflower, safflower, flax), often in the context of diversifying crop rotations and improving soil quality in semiarid regions, where one-sided wheat-fallow cropping systems have led to soil degradation and inefficient utilization of water and land resources.

Organic livestock and animal products comprised just over one-third of all organic sales in 2014. Organic milk was the second largest commodity after vegetables in sales, and eggs and broilers were fourth after fruit. Organic livestock enterprises received proportionally less OREI and ORG funding than organic crops, but the programs appropriately emphasized dairy, and a few projects addressed poultry health and nutrition. Small ruminants (sheep and goats) yielded only a tiny fraction of organic sales proceeds (Table 1), yet nine OREI and ORG projects focused on integrated approaches to parasites, a major barrier to successful organic production of small ruminants.

The sales value of organic beef and pork could not be estimated because the NASS categories conflated dairy and beef animals, and did not distinguish sales of animals to another farm from animals for slaughter. Given the importance of beef and pork in the US food system, and strong demand for organic meat, these commodities merit more OREI and ORG-funded research to identify and remove barriers to organic production.

The sales figures in Table 1 do not add up to the $5,455M nationwide total because NASS reported a separate production category for "value added products," which include cheese, bottled milk, processed meat, specialty grain products, jams, sauces, etc. made from farm products. Total sales in this category came to $730M in 2014; thus gross proceeds for dairy, meat, vegetables, fruits, and grains are higher than those shown in Table 1 for the raw commodities.

Table 2 (pages 4 and 5) show the breakdown of vegetables, fruits, and tree nuts into individual commodities in the NASS survey. OREI and ORG emphasis on different vegetable crops reflected the numbers of organic farms growing each crop more than total sales. For example, lettuce had by far the highest sales, but was addressed in only seven projects, while tomato ranked sixth in proceeds but first in number of farms, and played a substantial role in 24 projects. This differential research emphasis may reflect the relative challenges of organic production: tomato is susceptible to multiple serious diseases, lettuce is not as disease prone though sensitive to heat, and sweet potato (no projects) is fairly easy to produce, especially in hotter climates. Other widely grown vegetables that received significant research focus include broccoli, squash, pepper, and potato; all have significant pest and disease challenges in organic production. Only two projects addressed carrot, but one of these is a large nationwide farmer-participatory breeding network focused exclusively on this crop. The "other" vegetable category in the NASS survey includes cucumber, eggplant, kale, and other greens.

Table 2.
Breakdown of organic vegetable, fruit, and tree nut sales by individual commodity, and numbers of OREI and ORG projects addressing each.

Commodity	$M sales	Number of farms	Number of OREI & ORG projects
Vegetables grown outdoors	**1,249.6**		
Lettuce	263.9	1,063	7
Spinach	117.1	411	3
Broccoli	78.7	716	10
Carrot	69.1	1,062	2
Sweet potato	68.0	302	
Tomato, total	67.7		24
fresh	*52.8*	*1,847*	
processing	*14.9*	*88*	
Potato	61.8	953	6
Celery	49.2	190	
Onion, total	43.1		2
fresh yellow	*15.6*	*463*	
fresh red	*1.4*	*281*	
fresh white	*0.8*	*300*	
yellow processing	*2.7*	*26*	
dry	*22.6*	*417*	
Fresh herbs	35.6	574	
Squash, summer and winter	40.3	1,347	10
Pepper, bell	26.1	881	10
Cauliflower	17.0	316	1
Sweet corn	25.2	432	6
Cabbage, all	24.2		3
Green	*12.1*	*671*	
Red	*1.5*	*237*	
Other	*10.6*	*191*	
Melons, all	16.0		5
cantaloupe/ muskmelon	*10.5*	*375*	
honeydew	*0.8*	*84*	
watermelon	*4.7*	*341*	
Snap bean, all	15.5		4
fresh	*9.6*	*843*	
processing	*5.9*	*65*	
Green pea	11.2	385	1
Garlic	6.8	972	

Artichoke	1.0	61	
Other vegetables	211.5	2,056	12
Vegetables, protected[1]	76.1		
Tomato	18.1	995	1
Fresh herbs	6.0	195	
Lettuce	5.4	379	
Pepper	1.0	319	
Spinach	0.6	237	
Other vegetables	44.0	669	
Berries & other small fruit	385.6		
Grape	195.4	834	2
Strawberry	89.2	618	3
Blueberry, all	70.3		4
fresh	*60.9*	*648*	
processing	*8.6*	*51*	
Wild	*0.9*	*57*	
Raspberry	14.1	465	2
Blackberry	12.4	280	3
Cranberry	3.1	30	
Other berries	1.0	116	
Tree fruit	552.3		
Apple	249.6	868	11
Orange, all	56.7		
navel	*28.8*	*169*	
Valencia	*12.4*	*168*	
tangerine	*6.9*	*134*	
other	*8.7*	*94*	
Cherry, all	38.5		3
sweet	*29.8*	*160*	
tart	*8.7*	*35*	
Pear	30.5	344	2
Avocado	28.3	371	
Peach	27.9	295	2
Lemon	26.9	211	
Plum	19.4	240	
Date	8.6	26	

Continued on pg. 140

Table 2, cont.

Fig	6.4	119	
Grapefruit	4.8	135	1
Coffee	1.1	43	
Other tree fruit	52.8	673	
Tree nuts	94.2		
Almond	32.3	99	
Pistachio	26.3	18	
Walnut	23.3	205	
Pecan	11.2	62	1
Hazelnut	0.4	15	
Other tree nuts	0.7	90	

1 Grown in greenhouse, high tunnel, or other structure or cover.

Several projects used tomato, broccoli, or lettuce as test crops to evaluate minimum till systems, new weed management strategies, soil biology management for suppression of crop disease or human foodborne pathogens, and other experimental techniques with a broader application. Several others tackled pest and disease issues in tomato, cucumber, melon, and squash through plant breeding.

Tree fruit, strawberry, and grape are notoriously difficult to produce organically, and the need for research in organic fruit production is especially acute. Apple is the most economically important organic fruit crop, and has also received the greatest research emphasis (Table 2). Grape and strawberry rank second and third in sales, but were addressed in only a few OREI and ORG projects. Several others focused on blueberry and bramble crops, which have historically been less difficult for organic producers than other fruit, but are now threatened by the invasive exotic Spotted Wing Drosophila.

Although tree nuts collectively account for less than $100M in annual organic sales, more research focus on these economically important crops could remove barriers to expansion in their organic production.

Commodities: Trends in Funding for Crops and Livestock

Nearly three out of four projects addressed crops only, about one in ten focused on livestock only, and the rest included both crops and livestock. In response to livestock priorities in RFAs, the number of funded projects on organic livestock production showed an upward trend during the 2010-14 period, compared to 2002-09 (Table 3). Part of this trend is related to the increased funding of conferences, symposia, and planning teams since 2009; many of these projects had a broad scope including both crop and animal agriculture. In addition, investment in crop-livestock integrated systems increased substantially. The 11 crop-livestock integration integrated projects during 2010-14 received a total of $9M in funding, compared to just $1.6M for the four projects in the earlier period.

Table 3.
Numbers of OREI and ORG projects funded during 2002-2009 and 2010-2014 that addressed crops only, livestock only, both crops and livestock, and crop-livestock integrated systems.

	Crops only	Livestock only	Crops & livestock	Crops-livestock integrated[2]
Integrated projects[1]				
2002-2009	66	10	8	4
2010-2014	54	6	18	11
Total	120	16	26	15

% of Integrated[2]	74	10	16	9
Conference & Planning Projects				
2002-2009	3	0	3	0
2010-2014	12	3	6	1
Total	15	3	9	1
% of Conference/Plan[3]	56	11	33	2
All Projects	135	19	35	16
%	71	10	19	8

1 Full projects that include research, education, and/or extension components.

2 Number of "crops and livestock" projects that specifically address crop-livestock integrated systems.

3 Percentages calculated as (number of projects ÷ 162) × 100%.

4 Percentages calculated as (number of projects ÷ 27) × 100%.

Research Issues

Table 4 (pages 142-143) provides the full breakdown of research issue categories used in the data collection phase of our analysis. Nearly all projects addressed more than one research issue within one or more of the broad categories of production, socio-economic, and environmental concerns. Some projects addressed ten or more issues, reflecting the need for holistic and multidisciplinary approaches to research and extension in organic and sustainable systems.

Several "environmental" issues, notably soil and water conservation; and water quality, soil improvement, and carbon sequestration/greenhouse gas mitigation as ecosystem services, overlap with production issues such as nutrient management, soil quality, reduced tillage to protect soil, and moisture management. Soil, nutrient, and water management were tallied under production whenever these issues were addressed within the context of crop production (e.g., quality of soil within crop fields), and were also tallied under environmental when the project summary, objectives, approach, and impacts included an assessment of farm impacts beyond production areas or on the wider environment (e.g., prevention of streambank erosion, protection of ground or surface water quality, or greenhouse gas mitigation). Often, projects addressed both production and environmental aspects of soil and other resources.

While the majority of projects addressed the 2007 NORA priorities (Sooby et al, 2007), several projects addressed more recently-emerging needs, such as pollinator conservation, food safety, and making organically produced, GMO-free crop seed more available.

OREI and ORG research, education, and extension have emphasized the widely accepted organic priorities of nutrient management, soil life and soil quality, and weed, pest, and disease management, as noted above under NORA priorities. The large numbers of projects on cover crops and crop rotations reflect the central role that these two practices play in meeting soil quality, nutrient management, and crop protection challenges in organic systems, and in complying with NOP Rules for crop production. Several projects focused on the multiple benefits of higher-diversity cover crop mixtures, and have developed practical information and decision tools to help farmers identify the best cover cropping and crop rotation strategy for their needs, goals, climates, soils, and production systems.

Within the larger category of soil quality and soil health, 48 projects (25% of the total) included direct assessments of soil microbial or total biological activity, food web function, and/or microbiological diversity. Many of these used sophisticated measurements (direct microscopy, genetic fingerprinting) to document the many soil organisms that do not grow in lab culture media. Others monitored soil metabolism, and C and N sequestration, cycling, and release by soil microbes. While these methods entail substantial investment and may not yield practical farmer-ready outcomes during the lifetime of a single grant award, they may make significant long term contributions to understanding soil dynamics in organic systems, leading to practical applications in the future.

A substantial number of projects directly tackled one of the greatest challenges faced by organic producers: how to maintain adequate weed control in annual cropping systems without degrading soil quality or risking increased erosion from repeated tillage and cultivation. Thus far, 43 OREI and ORG projects (23% of the total) specifically addressed reduced-till and/or no-till practices for organic systems, evaluating them in comparison to current standard ("conventional till") practices on organic farms. Thirty-six projects (19%) addressed weed management, soil quality, and nutrient management, and at least one other soil sub-topic (usually reduced-till, sometimes soil biology), and compared different cover cropping and/or crop rotation treatments in relation to soil conservation and quality, weed control, and crop production.

Six of the 36 "weed/soil" projects took a holistic approach to the full gamut of organic annual crop production challenges, addressing crop disease, pest, and weed management, cover crops and/or crop rotation, soil biology, soil quality, nutrient management, and reduced/no till in organic systems.

Twenty projects (11%) addressed the important issue of water management for crop production, from effective use of irrigation technology to selection of drought tolerant crop varieties. Thirteen projects addressed the particular challenges faced by organic producers in semiarid regions such as the high plains (Dakotas to Texas) and interior parts of the Pacific Northwest. Several of these took a holistic approach, looking at crop diversification and crop rotation (adding leguminous cover or production crops, and "minor" grain crops to dryland wheat production systems), moisture management, soil conservation and/or soil health enhancement, and sometimes varietal evaluation for performance under semiarid conditions.

In addition to crop yield and financial return, over one-quarter of the 189 OREI and ORG projects included assessments of the quality of crops and crop-based farm products, including flavor, shelf life, market acceptance, and nutritional value (including content of antioxidants and other "nutriceuticals"). Quality evaluations on organic wheat and other grains include milling and baking quality as well as nutritional value for organically produced livestock and poultry.

Table 4.
Research topics addressed by 188 OREI and ORG projects between 2002 and 2014.

Research Topic	Number of projects	%[1]
PRODUCTION ISSUES	182	96
Soil management in organic systems	123	65
Soil biology and soil food web	54	29
Fertility, nutrient cycling, and nutrient management	107	57
Soil quality and soil health	83	44
Organic reduced till and no-till systems to protect soil	45	24
Cover crops	71	38
Crop rotations and crop diversification	60	32
Moisture management, irrigation, and crop drought tolerance	20	11
Weed management	91	48
Integrated, multi-component strategies	80	42
Breeding for weed competitiveness or allelopathic activity	7	4
Crop variety evaluation for weed competitiveness	1	<1
Testing of a single tactic compatible with systems approaches	3	2

Continued on pg. 76

Crop pest management (insects, nematodes)	75	40
Integrated, multi-component strategies	67	35
Breeding for pest resistance	4	2
Crop variety evaluation for pest resistance	2	1
Testing of a single tactic compatible with systems approaches	2	1
Crop disease management	75	40
Integrated, multi-component strategies	56	30
Breeding for disease resistance	12	6
Crop variety evaluation for disease resistance	2	1
Testing of a single tactic compatible with systems approaches	5	3
Crop breeding and genetics	52	28
Farmer-participatory breeding and public cultivar development	12	6
University-based breeding and public cultivar development	8	4
Crop variety evaluation for disease resistance and other traits	24	13
Conferences, symposia, planning grants, eOrganic	8	4
Seed and seedling management	19	10
Production of organic crop seed	14	7
Transplant production, including grafted vegetable starts	2	1
Perennial planting stock, including grafting and nursery stock	3	2
Crop pollination and pollinators	7	4
Quality of crops and plant-based products	51	27
Livestock nutrition, health, living conditions, and wellbeing	34	18
Pasture and grazing management	28	15
Animal breeding and genetics	8	4
Livestock and poultry breeding	0	0
Evaluation of breeds for parasite resistance or other traits	8	4
Crop-livestock integrated systems	16	8
Quality of milk, meat, and other animal products	11	6
Post-harvest handling	6	3
Food safety	16	8
High tunnels and season extension	3	2
Resilience to climate change	2	1
Building farmer capacity to do on-farm production research	1	<1
ECONOMIC AND SOCIAL ISSUES	112	59
Economic analysis (enterprise budgets, cost-benefit analysis, etc.)	91	48
Marketing and organic Certification	30	16
Socio-economic analysis	13	7
Policy analysis	7	4

Continued on pg. 144

Table 4, cont.		
ENVIRONMENTAL ISSUES		
Resource conservation	38	20
Soil (preventing erosion)	26	14
Energy	8	4
Water (reduced irrigation water use)	6	3
Other (pollinators and pollinator habitat conservation)	4	2
Preservation of natural areas, endangered species, etc.	8	4
Ecosystem services	67	35
Biodiversity	15	8
Water quality (nutrients, sediment, etc.)	34	18
Water storage and water availability	10	5
Air quality (ammonia, particulates, odors, etc.)	4	2
Soil improvement	33	17
Carbon sequestration and greenhouse gas mitigation	40	21

1 (Number of projects ÷ 189) × 100, rounded to nearest whole percentage point.

The 48 projects that focus on livestock show a balanced distribution among the topics of livestock disease and parasite management, animal health and nutrition, and pasture management, with some projects addressing all three. Ten of these projects included quality evaluations of organic milk, meat, and other animal-derived products. As mentioned before, animal breeding and genetics remains a weak point, receiving limited attention in just eight projects, with no actual animal breeding for organic systems.

Organic seed and seedling production is another area that merits greater research attention than it has received to date. While ten projects (5%) included significant emphasis on organic seed production (usually within the context of crop breeding and variety evaluation), only two projects addressed production of organic transplants for annual crops, and three projects addressed production of organic perennial planting stock.

The emerging issues of food safety, especially in relation to produce, milk, and other animal products have begun to receive research attention through OREI and ORG (16 projects, most of them in recent years).

In addition to production issues, 91 projects (48%) included an analysis of the economic performance of the production systems being studied. Economic assessments included enterprise budgets, cost/benefit analyses for specific production practices or pest management strategies, or overall assessments of short or long term profitability of the production system(s) researched. Thirty projects (16%) included either market analysis, and/or outreach efforts aimed at helping producers meet marketing objectives, including those related to USDA organic certification. A few projects addressed social, socio-economic, and/or policy issues.

Finally, with regard to environmental issues, a substantial cluster of ORG projects, funded between 2010-2013, focused specifically on the "carbon footprint" and net greenhouse gas/climate change mitigation impacts of organic systems. The greenhouse gases considered included methane (mainly from livestock flatus and/or decomposing manure) and nitrous oxide (from denitrification of soluble N in the soil, decomposing manure, or composting operations) as well as carbon dioxide (from fossil fuel use, soil respiration, and organic matter decomposition). Net soil carbon sequestration (or carbon loss) was evaluated as well, so that the total carbon-equivalent "footprint" of a given farm or farming system could be evaluated. Most of these studies compared organic with conventional farming systems, many compared tilled versus no-till or reduced till, and some evaluated livestock and crop-livestock integrated systems as well as crop farms.

Outcomes of these large GHG/C sequestration studies have been hard to discern from CRIS abstracts (an in-depth evaluation of referred journal articles and any extension bulletins from these projects is needed, but was beyond the scope of this project). Based on abstracts, results to date have been variable and difficult to interpret. One interesting result was a huge burst of nitrous oxide emissions from an organic system that utilized both manure and legume green

manures as N sources, resulting in higher soil soluble N than the conventional treatment, and a correspondingly larger loss of nitrous oxide (a powerful greenhouse gas) during a prolonged spell of wet weather.

Exploring the Efficacy of Single-issue Projects

The systems approach taken by large, multi-issue projects reflects the holistic ethos of organic and sustainable agriculture itself. Since all components of the agroecosystem are connected, attempts to study or optimize one in isolation (reductionism) can lead to incorrect conclusions or unintended adverse consequences. Yet, the analysis of 189 OREI and ORG projects conducted between 2002 and 2014 revealed many that tackled one specific issue or problem, or even focused fairly narrowly on a single tactic, yet yielded outcomes of practical value to farmers, or at least provided data that can become the foundation for further research. Some of these projects took an integrated (multi-component) approach to a specific high-priority pest or other problem, and others evaluated a single management tactic that can be easily integrated into a sustainable organic farming system as one component of an overall strategy.

Examples of "one-issue" projects follow, with descriptions of projects and outcomes.

Example A. Emerging problems with new invasive exotic pests: Brown marmorated stink bug (BMSB, damages a wide range of fruit and vegetable crops), and spotted wing drosophila (SWD, causes severe damage to berries, grapes, and stone fruit).

OREI 2012-02222, Anne Nielsen, Rutgers University, $2.67M, September 2012-August 2015 and OREI 2011-01989 planning grant, Matthew Grieshop, Michigan State University, $46K

Whole-farm Organic Management of BMSB and Endemic Pentatomids through Behaviorally-based Habitat Manipulation

Brown marmorated stink bug (BMSB) was accidentally imported to the US (Allentown, PA) during the 1990s, and its populations began to spread and explode during the first decade of the 2000s, posing serious threats to a wide range of horticultural crops and certain grains as well (corn, soy, sorghum). It is especially difficult to control with organic methods and even conventional pesticides. Ted Rogers of USDA-ARS convened a nationwide working group in 2009 to address this threat to organic production. The group met by teleconference and at a three-day in person conference during fall of 2011 (as part of the planning grant) to develop the full proposal.

This was the fourth largest award, and one of just six OREI awards in the $2.5-3M range. Although the project focus was very narrow in one sense (organic control of one pest species) it tackled a broad topic in that BMSB itself is almost omnivorous (attacks a wide range of crops) and has become a problem in parts of the Northeast, Mid-Atlantic, upper South, Midwest, and Pacific Northwest. The project team attempted to develop organic management strategies based on the ecology, life cycle, aggregation and dispersal patterns, food plant selection, and overwintering site selection, of the pest. The team has discovered much that was not previously known about BMSB biology and behavior, and has identified several components of an organic management strategy, including trap cropping, natural enemies, and overwinter aggregation trapping.

Although a definitive integrated strategy has not yet been developed, the 2014 progress report outlined several outcomes of practical significance for producers. The team characterized the relationship of phenology (vegetative-flowering-fruit/seed) and attractiveness to BMSB for several susceptible crops (which can help predict how the pest might move from crop to crop on a diversified farm); trialed sunflower, sorghum, and pearl millet as trap crops (partially effective); and utilized aggregation pheromone traps as an effective and safe (no harm to beneficials) way to remove BMSB before they migrate from trap crop into production crop.

The team developed an overwintering trap to aggregate BMSB and facilitate their removal before they emerge to cause crop damage the next spring. One particularly innovative element of this effort was a "citizen science project" in which 300 volunteers counted and reported the numbers of BMSB on the exterior walls of their houses. This revealed that brown colored structures are most attractive to overwintering BMSB, and facilitated development of an effective trap.

In-depth studies of predation and parasitism on BMSB in the US, including video recordings of natural enemy attacks on egg masses, showed both the promise and limitations of biological control against this exotic pest. It also led to some interesting new discoveries; for example, native parasitoids can kill BMSB eggs but cannot successfully emerge from there (a serious limitation). The videos also documented katydids, earwigs, spiders and grasshoppers all preying on BMSB eggs. Several native flowering plants (cup plant, golden Alexander, sand coreopsis) attracted predators and enhanced egg predation in trials at Rutgers.

Experiments with physical barriers showed that cloth mesh fine enough to protect crops from BMSB also tend to exclude aphid predators causing an increase in aphid pest problems. Two NOP-allowed insecticides (Azera and Veratran D) gave partial control of BMSB.

Ironically, the hard winter of 2013-14 set back BMSB populations in parts of the eastern half of the US, making it a less severe problem in 2014 in some areas, and also hampering some trials that depended on substantial BMSB populations to yield definitive results.

Extension aspects of the project include on farm trials and field days emphasizing trap cropping and integrated strategies, numerous presentations, written and web based materials on BMSB identification, biology, and management tips based on project findings; a BMSB Facebook page and a web site hosted by North Carolina State University.

The final year of the project included further studies on trap cropping with the aggregation pheromone trap, natural enemies, on farm trials of integrated strategies, and continued development of extension materials.

OREI 2014-05378, A. Ahmad, University of Georgia, $50K planning grant

Co-developing Research and Extension Objectives for Organic Management of Spotted Wing Drosophila

Within three years after convening the BMSB task force, USDA ARS scientist Ted Rogers, launched a new task force to develop organic strategies for yet another new invader: spotted wing drosophila (SWD). After a year's delay caused by suspension of OREI funding in 2013, the team received a planning grant in 2014, and wrote a successful proposal during the 2015 funding cycle for a large nationwide REE project coordinated through University of Georgia.

Example B. Fire Blight management in apple and pear. This disease is so difficult to manage that NOP has allowed the use of certain antibiotic treatments (streptomycin) in organic production of apple and pear. However, the National Organic Standards Board (NOSB) plans to "sunset" this provision in the near future, and growers will have to implement non-antibiotic alternative strategies. This creates an urgent need for research, development, and extension of effective organic management strategies for this disease. A closer coordination between OREI and NOSB has been recommended by several researchers and advocates, and NOSB-identified organic research priorities have been integrated into OREI and ORG RFAs in the past few years.

OREI 2011-01965, K. B. Johnson, Oregon State University, $476K; September 2011-August 2015

Development of Non-antibiotic Programs for Fire Blight Control in Organic Apple and Pear

This project evaluates application to apple and pear at flowering of biological products—microbial antagonists to the fire blight pathogen (Erwinia amylovora), alone or in combination with flower thinning at early bloom, as non-antibiotic control strategies for fire blight.

No project progress reports were available on the CRIS database, which made it hard to evaluate the return on investment for this project. A presentation by Dr. Johnson, dated March 15, 2012 and posted on eOrganic gave some potentially valuable information regarding disease monitoring technology, efficacy of copper and several biological products (NOP allowed).

ORG 2013-03968, Matthew Grieshop, Michigan State University, $464K, September 2013-August 2016

Organic Management of Fire Blight in a Post-antibiotic Era: Developing, Evaluating, and Delivering Options for Apple Growers in Humid Climates.

This project focuses on fruit producing regions east of the Mississippi (different bioregion from OREI 2011-01965), and the project summary cites fire blight as a specific priority of the 2013 ORG RFA. An integrated strategy was tested, consisting of surface-sterilization with OxiDate, commercially available biological antagonists to the pathogen (Blossom Protect, Bloomtime), and Cu-based fungicides with lower Cu concentration (Cueva, Previsto) (all OMRI approved materials). Optimized strategies will be evaluated on three organic orchards in Michigan. Preliminary results reported (2014) indicate that the surface sterilization allows better colonization by the protective yeast in Blossom Protect.

ORG 2014-03386, K. B. Johnson, Oregon State University, $497K, September 2014-August 2017

Implementation of Non-antibiotic Programs for Fire Blight Control in Organic Apple and Pear in the Western United States

This is a direct continuation of OREI 2011-01965, and is intended to move non-antibiotic fire blight organic management protocols "from development to implementation." Temperature effects on the efficacy of the yeast antagonist biological material against fire blight will be evaluated. Field trials will be conducted in commercial orchards.

Example C: Managing gastrointestinal nematodes (GIN) in small ruminants. GIN has been a major constraint on organic goat and sheep husbandry for dairy, meat, or fiber. Organic producers cannot market products as organic if the animals receive synthetic wormers, yet cannot withhold medication from sick animals in an attempt to keep them organic. Thus, an urgent need exists for effective NOP allowed materials and methods for preventing or controlling GIN in sheep and goats.

OREI 2005-04426, J. M. Burke, USDA ARS Arkansas, $300K, September 2005 – September 2008

Development of Sustainable Gastrointestinal Nematode Control in Organic Small Ruminant Production.

The project team evaluated a tannin-rich forage plant, Sericea lespedeza, either as part of the pasture vegetation or as supplementary pellets of dried Sericea lespedeza in the feed ration, for reducing GIN loads. Fresh or pelleted lespedeza, low-dose copper oxide supplements, and rotational grazing all helped reduce but did not eliminate the problem. However, the team also identified the potential for genetically "parasite resilient" animals to remain GIN-free with just these NOP-allowed, non-chemical-wormer tactics.

Documentation of the potential to breed and select parasite resistant small ruminants warrants OREI investment in animal breeding for organic systems to realize potentials like this.

OREI 2010-01884, J. M. Burke, USDA ARS Arkansas, $968K, September 2010-August 2015

A Systems Approach to Control Gastrointestinal Nematodes in Organic Small Ruminant Production

This is a direct continuation and expansion of the preceding project. The latest progress report found was dated 2013, and it reported an adverse effect (slower weight gain and changes in blood levels of trace minerals) of long term (112 day) feeding of Sericea lespedeza, and switched to shorter term (56 day) protocols. Positive findings include: lespedeza proved effective in controlling coccidiosis, a major protozoan parasite disease of small ruminants; and giving copper oxide alone or with lespedeza to ewes/does near birth helps protect the young from GIN. Studies on time and method of harvesting and drying Sericea lespedeza for optimum tannin content were conducted. Genetic resistance was explored further through DNA sampling of GIN resistant Katahdin sheep sires to identify genetic resistance markers, and fecal egg counts from ewes and lambs on farms in AR, GA, NY, ME, and OH were taken to determine "breeding values" for GIN resistance.

The project team gave many presentations on integrated parasite management including copper oxide wire particles, lespedeza, other materials, and a decision tool to help farmers manage GIN. This team has made important progress on one of the toughest challenges faced by organic livestock producers, and has identified potential to breed animals for parasite resistance.

OREI 2012-02290, J. Kotcon, West Virginia University, $1.85M, September 2012-August 2016

Forage-based Parasite Control in Sheep and Goats in the Northeast US

This project uses the same approach—high condensed tannin (CT) forages—as the preceding two, but focuses on a different species, birdsfoot trefoil. Animals were grazed on pasture mixes that include BFT, and BFT varieties were evaluated to identify those with moderate to high condensed tannin levels as well as good pasture quality and regrowth traits. At the outset, the project investigators apparently believed that including BFT in pasture could by itself give adequate GIN control and that the high tannin forage in moderation would increase animal performance overall. Experimental protocols included challenging ewes and lambs with intentional exposure to contaminated pasture with and without BFT.

Some 50 high-tannin BFT lines were identified, but the most recent project report was from 2013, so it is hard to evaluate how the project is progressing in terms of practical outcomes. The team is developing methodology for evaluating GIN levels in animals on different pasture management (rotation) schedules, and pastures with different levels and varieties of BFT, and also for evaluating nematode responses to BFT tannins. It would be useful for the two project teams (ARS Arkansas and West Virginia University) to compare outcomes (both GIN control and other effects on animal growth and health) with BFT versus Sericea lespedeza.

Example D: Methionine nutrition for poultry. This is another example of single-topic research directed at a specific challenge posed by impending changes in NOP regulations. NOP allowance for the use of synthetic methionine in organic poultry production will "sunset" in October of 2017. Poultry, especially broiler chickens, apparently have higher dietary needs for the essential amino acid methionine than can be easily met through feeding of NOP allowed poultry feed, supplements, and pasture.

ORG 2004-05187, C. M. Owens, University of Arkansas, $305K, September 2004-August 2009

Slow-growing Broilers in Organic Poultry Production: an Alternative to Supplemental Methionine and a Marketing Opportunity

This project tested the simple hypothesis that the older, slower-growing breeds of broiler chickens would not be as dependent on methionine supplements as the modern industrial broiler to reach their potential for meat production (quantity and quality). However, the experiments did not show that the slower growing breeds had any lower methionine requirements than the modern birds. The team speculated on alternative sources of methionine that organic farmers can use (NOP currently prohibits feeding animal products to chickens as well as requiring the phasing out of synthetic methionine). Feeding sufficient plant based protein to meet the methionine requirement would stress the birds (too much total N in the diet) and increase ammonia emissions in chicken houses. Alternative methionine sources suggested include algae, earthworms, and insect larvae, but these were not evaluated during this project. The investigators stated in their final report, "It is important that when the ban becomes effective, organic broilers and layers have sufficient methionine with no negative effects on bird health, welfare, and performance."

While the negative result is disappointing, this important information was generated with a moderate investment of grant funds, and will help guide future efforts to solve the methionine problem.

ORG 2014-03379, S. E. Aggrey, University of Georgia, $500K, September 2014-August 2017

Strategies to Enhance De-novo Biosynthesis of Methionine for Organic Poultry

The goal of this project is to see if a combination of selected plant-based feed ingredients and "nutragenomics" can enhance de novo synthesis of methionine in organically managed broilers and layers, thereby reducing the need for dietary methionine. The nutrient content of the ingredients (derived from corn, soy, wheat, peas, sugar beet, alfalfa, and spinach) will be analyzed to identify a mix that might enhance methionine biosynthesis by poultry. Birds fed test diets will undergo extensive analysis to determine if methionine biosynthesis is indeed enhanced. Outreach and two on-farm trials are planned based on results of the in-depth studies.

This is an ambitious and complex study, but the specific nature of the objective may allow it to be completed on a half-million budget.

Example E. Soybean aphid suppression by a preceding rye cover crop. Soybean aphid can severely depress organic soybean yields in the upper Midwest.

ORG 2004-05204, G. E. Heimpel, University of Minnesota, $464K, September 2004-August 2008

Soybean Aphid Suppression Using a Fall-seeded Rye Cover Crop

This project tests a simple hypothesis: that a winter rye cover crop preceding soybean reduces soybean aphid populations by harboring grain aphids and their natural enemies' the latter then protect the subsequent soybean crop. In addition to research station and on-farm trials, the team planned to sample over 30 organic farms with or without rye cover crop before soybean.

Three years of trials did show lower aphid populations in soybean grown after winter rye than without rye, and there was a trend toward higher ratio of predators to aphids after the cover crop. In site-years with heavy aphid pressure, the rye effect on aphid numbers was more pronounced and sometimes led to higher soybean yields. In a few site-years, rye reduced soybean yield possibly by consuming soil moisture in dry years. Rye seemed to reduce subsequent aphid colonization of soybeans, rather than enhancing predator populations per se.

The project invested a fair amount of funds to address a very specific question through highly replicated trials, and it is not clear how much impact the finding is likely to have on organic soybean production overall. The progress and final reports also made no mention of the planned survey of 30-50 organic soybean farms with and without rye before soy.

Example F. Testing a new innovative physical weed control technology.

OREI 2014-05376, Sam Wortman, University of Illinois, $750K, September 2014-August 2018)

Blasting the Competition Away: Air-propelled Abrasive Grits for Intra-row Weed Management in Organic Grain and Vegetable Crops

This project is evaluating the efficacy of "sandblasting" young weeds in established crops with abrasive grits based on NOP allowed organic materials, including organic fertilizers that would also deliver crop nutrients. The objective is to reduce both labor and other direct costs of weed management, and to protect soil quality by reducing or eliminating the need for cultivation for weed control in organic crops. Grit application technology will be refined and tested for efficacy in within-row weed control on a range of grain and vegetable crops, including compatibility with other organic weed control tactics such as plastic and organic mulches, tillage, flame weeding, etc. On-farm trials and demonstrations/field days will be conducted in IL, MN, and SD.

This is a fairly high-budget project for such a specific focus. However, the engineering aspect (grit applicator design, grit material, nozzle type and spacing, etc.) and adapting the technique to a range of crops inevitably increases the cost of the project. In addition, the technology has already undergone initial research, testing and development, and has shown promise. Since managing weeds without degrading the soil is a major and widespread challenge in organic annual cropping systems, a project focused on a new non-chemical and non-tillage technology for removing within-row weeds from annual crops is a good way to invest ¾ of a million dollars. With many other OREI and ORG projects focused on the weed management/soil quality conundrum, and sometimes yielding disappointing or mixed results, a positive outcome with the grit applicator could provide a powerful new weed management tool for organic minimum till systems.

Example G. Flea beetle control in brassica crops. Flea beetles can be a major challenge in organic production of both leafy and head brassica crops.

ORG 2007-01391, C. B. MacConnell, Washington State University, $74K, September 2007-September 2010

Flea Beetle Control Treatment Demonstration in Western Washington State

This project field-tested seven different management tactics against crucifer flea beetles on eight working organic farms (each farm tried at least two treatments) over two seasons. Tactics included row cover, straw mulch, interplanted cover crop, living barrier (crucifer cash crop planted between rows of tall asparagus or pea crop), fabric wall of row cover material, trap crop (mustard every fourth row in broccoli), and a flea beetle trolley to disturb and trap out the pests. Cash crops in different trials included broccoli, arugula, mizuna, mustard greens, bok choi, and tatsoi. Farm field days demonstrated methods and outcomes.

Effective treatments included row cover (best), living barrier, fabric wall, and trap crop. Straw mulch, intercropped cover crop, and flea beetle trolley proved ineffective. Some of the growers who attended field days modified their flea beetle management strategies based on these findings.

For a very small budget, this project provided some valuable practical information for organic producers of crucifer crops in Washington and any region affected by the crucifer flea beetle, which includes much of the Southeast. Project outcomes will help producers develop more effective integrated flea beetle management strategies, which may include NOP allowed pesticide sprays, but may also reduce the farmers' reliance on such sprays and thereby reduce environmental impacts of their pest management systems.

Example H. UV light for control of powdery mildews in vegetable crops.

OREI 2014-05407, G. M. Gadoury, Cornell University, $50K planning grant

Novel Use of Light to Suppress a Broad Group of Plant Pathogens Affecting Sustainable Production of Organically Grown Crops

Initial experiments indicate that either UVB light or Light Emitting Diodes (LED) of certain wavelengths can disrupt sporulation in powdery mildew fungi that affect a range of vegetable crops. This planning project held a series of three meetings in conjunction with the NOFAs in all states in the Northeast region, to identify technological development needs to exploit this phenomenon for practical control of PM diseases in organic farming systems, and developed a full integrated grant proposal, which was submitted and awarded in 2015.

Powdery mildew is a serious disease in cucurbits and several other vegetable crops, and this project could lead to a new, non-toxic control of this group of fungal pathogens.

References

Sooby, J., J. Landeck, and M. Lipson. 2007. 2007 National Organic Research Agenda: Outcomes from the Scientific Congress on Organic Agricultural Research (SCOAR). Organic Farming Research Foundation, Santa Cruz, CA. 74 pp.

USDA National Agriculture Statistics Service, 2015. NASS 2014 Organic Production Survey.http://www.agcensus.usda.gov/Publications/2012/Online_Resources/Organics/

APPENDIX E.

Alignment of Awards with Legislative and RFA Priorities
Legislative Goals

The Organic Transitions Program (ORG) was established with the following general legislative goal:

The overall goal of the ORG program is to support the development and implementation of research, extension and higher education programs to improve the competitiveness of organic livestock and crop producers and those who are adopting organic practices.

The Organic Research and Extension Initiative (OREI) was established with eight legislative goals, which are presented in annual Request for Applications and remain the same year to year. The eight goals are listed below, with notes regarding the alignment of projects with these goals. Because ORG awards often addressed one or more of these goals, and seemed to emphasize the environmental goal during the 2009-2014 funding years, we noted alignment of both programs with these eight goals.

1. Facilitating the development and improvement of organic agriculture production, breeding, and processing methods.

- 118 OREI projects (95%) addressed production topics; some of these included breeding and/or processing.
- All 65 ORG projects addressed production topics.

2. Evaluating the potential economic benefits of organic agricultural production and methods to producers, processors and rural communities.

- 63 OREI projects (51%) included some form of economic analysis, such as enterprise budgets for organic commodities; cost-benefit analysis for a specific practice, tactic, integrated strategy or system; or (in a few studies) whole-farm economic analysis.
- 29 ORG projects, or 45%, included economic analysis.

3. Exploring international trade opportunities for organically grown and processed agricultural commodities.

- Only one OREI project directly addressed this statutory priority: Scientific foundation of organic standards for livestock health (OREI 2004-05216, William Lockeretz, Tufts U). The project's second objective was to apply this scientific understanding to "reconcile conflicting international standards for organic livestock."
- In addition, OREI 2007-01411, The Launch of eOrganic through Oregon State University (Alexandra Stone) mentioned "international certification requirements" as a topic to be addressed (in proposal), but none of the publications listed in the abstracts for this and two subsequent OREI funded eOrganic content development projects addressed this topic.

4. Determining desirable traits for organic commodities.

- A total of 39 OREI projects (31%) addressed quality aspects of organically produced plant (33) and/or animal (8) agricultural products.
- A similar proportion of ORG projects also addressed quality of organic products (18 projects, 28%).

5. Identifying marketing and policy constraints on the expansion of organic agriculture.

- A total of 25 OREI projects (20%) addressed marketing (constraints and/or opportunities), and just 7 projects (6%) addressed policy issues related to organic.

- The ORG program had a lesser emphasis on marketing (6 out of 65) and policy constraints (1 project), though the greenhouse gas (GHG) work of several ORG projects has policy implications.

6. Conducting advanced on-farm research and development that emphasizes observation of, experimentation with, and innovation for working organic farms, including research relating to production, marketing, food safety, socioeconomic conditions, and farm business management.

- It is difficult to define what would qualify as "advanced on-farm R&D". An estimate might be obtained by counting projects with a "high" or "very high" level of farmer engagement, and on-farm trials. A total of 55 OREI projects met these criteria, although final reports for four projects suggested that the projects entailed only limited on farm research and farmer engagement. As a result, this estimate was revised to 51 projects (41%). A total of 30 ORG projects (46%) also met these criteria, and appeared to follow through with plans for substantial on-farm research.
- This is a very rough approximation, as some "advanced R&D" might simply entail farmers hosting scientists to conduct trials (moderate level of farmer engagement), and some high-farmer-engagement projects may include simple or limited on farm trials (not advanced R&D) along with strong farmer roles in education, outreach, project planning, and/or evaluation.

7. Examining optimal conservation and environmental outcomes relating to organically produced agricultural products.

- A total of 31 OREI projects (25%) addressed environmental, conservation, and/or ecosystem services aspects of organic farming systems.
- The ORG program has a much greater environmental emphasis, with 42 ORG projects (65%) addressing C sequestration, net GHG emissions, water quality, or other environmental issues.

8. Developing new and improved seed varieties that are particularly suited for organic agriculture.

- A total of 19 OREI projects (15%) and one ORG project conducted breeding and variety development for vegetable or field crops.
- An additional 32 projects conducted some degree of variety evaluation and/or organic crop seed production.

RFA Priorities

The priorities given in annual RFAs for each program are summarized in Table 1 (OREI – organized by legislative goal) and Table 2 (ORG). Complete statements of RFA priorities for each year of OREI and ORG funding, with total number of projects and numbers of projects that address each priority, are shown on pages 153 - 167 of this Appendix.

Table 1.
OREI RFA priorities by year, and numbers of projects addressing each priority.[1]

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2014
Total number of projects funded	6	5	6	7	5	27	23	18	8	19
Number of projects that address current year RFA priorities	6	5	6	6	5	27	23	16	8	17
1. Organic production, breeding, and processing	5	5	6							
Soil microbiota in nutrient cycling & disease suppression	2	0	0							
Organic fertility management effects on crop & livestock health				2	4	14	7			
Crop IPM (weeds, crop pests, plant diseases)	2	4	5					9	5	11

Continued on pg. 152

Table 1 , cont.

Livestock parasite management	0	1	0							
Crop and livestock IPM (pests, weeds, diseases, parasites)				3	2	11	12			
Livestock production, animal health, and pest management								4	3	2
Catalog / select animal geno types for organic systems								0	0	0
Post-harvest handling and food safety						1	3	1	1	1
2. Economic benefits of organic	1	2	3	2	3					
3. International trade opportunities for organic products	1	0	0	0	0					
4. Desirable traits for organic products	0	1	1							
Nutritional value & other traits of organic vs. conventional						1	1			
5. Marketing and policy constraints on growth of organic	0	1	1							
6. Advanced on-farm research and development	2	3	1	2	2	13	6	8	6	6
7. Conservation and environmental outcomes:										
C sequestration & other environmental services						3	4			
8. New and improved seed varieties for organic; plant breeding	1	0	0							
Catalog vegetable crop germplasm for organic breeding programs						4	3			
Organic seed systems: seed & transplant production, plant breeding								3	4	5
Organic education & training systems & tools for agriculture professionals				3	2	2	4	0	0	0

1 Legislative priorities one through eight (when stated in RFA), related priorities, and educational priority. Shaded cells indicate priorities not listed in that year's RFA.

2 Organic sanitizers for food safety (2007), economic and policy issues (2011, 2014).

Table 2.
ORG RFA priorities by year, and numbers of projects addressing each priority.

	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14
Total number of projects funded	6	5	5	3	4	5	3	3	7	5	7	5	7
Projects that address current year priorities	3	5	4	3	4	5	2	3	6	5	7	5	7
Systems approach to weed management	2	4											
Systems approach to crop pest management			2										
Systems approach to crop & livestock pests				1	2	5	2						
Organic fertility management & crop health	2	4	2										
Org. fertility mgmt. & crop & livestock health				3	2	1	0						
Training in organic for agriculture professionals	0	3	0	0	0	1	0						
Formal courses for organic producers			0	0	0								
Scientific basis to expand / improve NOP standards			1	0	0								
Economic benefits of organic						0	1						
International trade opportunities for organic						0	0						
Advanced on-farm research and development						3	0						
Ecosystem services: water quality & quantity								3					
Ecosystem services: soil quality, erosion, C sequestration, greenhouse gases									6	5	7		
Ecosystem services, greenhouse gases, biodiversity												3	5
Methods & metrics: greenhouse gases & other ecosystem services									2	2	7	0	0
Alternatives to substances on NOP list[1]												1	2
Outreach to students and producers												2	2

1 Specifically, substances recommended for removal from National List of allowed synthetics.

2004 OREI Priority Areas

Six projects were funded and met one or more priorities

1. **Facilitate the development of organic agriculture production, breeding, and processing methods.**
   Five projects, including two on soil microbiology, two on crop IPM, and one on plant breeding.
   - Analyzing potential economic costs, returns and risks of organic production systems.
   - Using environmental valuation tools to quantify externalities of producing food, and compare externalities of producing organic and conventional food.
   - Analyzing price and market structures, including ability of small-, medium-, and large-scale growers to access different markets, in order to frame policies that minimize concentration within the industry.

- Analyzing marketing channels to document how organic food is distributed, what share of the organic food dollar is returned to the farmer, and the implications of large-scale manufacturers entering the organic market.

2. **Evaluate the potential economic benefits to producers and processors who use organic methods.** *One project.*
   - Analyzing potential economic costs, returns and risks of organic production systems.
   - Using environmental valuation tools to quantify externalities of producing food, and compare externalities of producing organic and conventional food.
   - Analyzing price and market structures, including ability of small-, medium-, and large-scale growers to access different markets, in order to frame policies that minimize concentration within the industry.
   - Analyzing marketing channels to document how organic food is distributed, what share of the organic food dollar is returned to the farmer, and the implications of large-scale manufacturers entering the organic market.
3. **Explore international trade opportunities for organically grown and processed agricultural commodities.** *One project.*
   - Compare compatibility of certification standards used in different parts of the world, with the ultimate goal of harmonization and reciprocity.
   - Undertake marketing studies of international consumer demand for U.S. produced organic goods.
   - Perform "welfare analyses" (quantified gains and losses for producers and consumers) of trade policies affecting international competitiveness, including implementation of the National Organic Program, domestic support programs such as the Conservation Security Act, country of origin labeling, GMO labeling, etc.
4. **Determine desirable traits for organic commodities.** *No projects.*
   - Examine relationships between nutrients in the soil and nutrients in the food grown on that soil, including long-term soil nutrient and crop nutrient profiles under conventional and organic management.
   - Perform comparisons of nutrient levels between organic and conventional crops and relationship, if any, between taste and nutrient profile.
   - Investigate the role of post-harvest handling and treatment in the maintenance of quality in fresh market organic products.
   - Determine the reasons for consumer preferences for organic goods.
5. **Identify marketing and policy constraints on the expansion of organic agriculture.** *No projects.*
   - Analyzing opportunities and constraints to organic agriculture resulting from provisions of the Farm Security and Rural Investment Act of 2002.
   - Investigating specific barriers to markets, such as scale-based regulations that restrict family farm access to processors and/or markets.
   - Studying negative lender perception of organic farming and ways to change this.
   - Analyzing regulatory barriers, such as lack of access to federal farm programs, and developing solutions to these challenges.
6. **Conduct advanced on-farm research and development that emphasizes observation of, experimentation with, and innovation for working organic farms, including research relating to production and marketing and to socioeconomic conditions.** (Note: Many topics from other goal areas can be conducted on working farms.) *Two projects.*
   - Develop rigorous on-farm systems research designs.
   - Conduct long-term, interdisciplinary systems research.

2005 OREI Priority Areas

Five projects were funded and met one or more priorities

1. **Facilitate the development of organic agriculture production, breeding, and processing methods.** *Five projects.*
   - Functionally identify soil microbial communities and ways to manage microbial dynamics to enhance nutrient cycling and disease suppression.
   - Develop systemic approaches to weed, insect and disease management (four projects).
   - Prevent, control, and treat internal and external parasites in various livestock species (one project).
   - Breed crops for disease and insect resistance, good yield in a biologically diverse system, compatibility with intercrops, good response to organic fertility sources, horizontal resistance (traits determined by multiple genes).

2. **Evaluate the potential economic benefits to animal and crop producers and processors who use organic methods.** *Two projects.*
   - Analyze potential economic costs, returns and risks of organic production systems.
   - Use environmental valuation tools to quantify externalities of producing food, and compare externalities of producing organic and conventional food.
   - Analyze price and market structures, including ability of small-, medium-, and large-scale growers to access different markets, in order to frame policies that minimize concentration within the industry.
   - Analyze marketing channels to document how organic food is distributed, what share of the organic food dollar is returned to the farmer, and the implications of large-scale manufacturers entering the organic market.
3. **Explore international trade opportunities for organically grown and processed agricultural commodities.** *No projects.*
   - Compare compatibility of certification standards used in different parts of the world, with the ultimate goal of harmonization and reciprocity.
   - Undertake marketing studies of international consumer demand for U.S. produced organic goods.
   - Perform "welfare analyses" (quantified gains and losses for producers and consumers) of trade policies affecting international competitiveness, including implementation of the NOP, domestic support programs such as the Conservation Security Act, country of origin labeling, GMO labeling, etc.
4. **Determine desirable traits for organic commodities.** *One project.*
   - Examine relationships between nutrients in the soil and nutrients in the food grown on that soil, including long-term soil nutrient and crop nutrient profiles under conventional and organic management.
   - Perform comparisons of nutrient levels between organic and conventional crops and the relationship, if any, between taste and nutrient profile.
   - Investigate the role of post-harvest handling and treatment in the maintenance of quality in fresh market organic products.
   - Determine the reasons for consumer preferences for organic goods.
5. **Identify marketing and policy constraints on the expansion of organic agriculture.** *One project.*
   - Analyze opportunities and constraints to organic agriculture resulting from provisions of the Farm Security and Rural Investment Act of 2002.
   - Investigate specific barriers to markets, such as scale-based regulations that restrict family farm access to processors and/or markets.
   - Study negative lender perception of organic farming and ways to change this.
   - Analyze regulatory barriers, such as lack of access to Federal farm programs, and develop solutions to these challenges.
6. **Conduct advanced on-farm research and development that emphasizes observation of, experimentation with, and innovation for working organic farms, including research relating to animal and crop production and marketing and to socioeconomic conditions.** (Note: Many topics from other goal areas can be conducted on working farms.) *Three projects.*
   - Develop rigorous on-farm systems research designs.
   - Conduct long-term, interdisciplinary systems research.

2006 OREI Priority Areas

Six projects were funded and met one or more priorities

1. **Facilitate the development of organic agriculture production, breeding, and processing methods.**

All six projects

- Functionally identify soil microbial communities and ways to manage microbial dynamics to enhance nutrient cycling and disease suppression (one project on organic production of farmed marine shrimp and the role of microbial communities in the water in shrimp production).
- Develop systemic approaches to weed, insect and disease management (five projects).
- Prevent, control, and treat internal and external parasites in various livestock species.
- Breed crops for disease and insect resistance, good yield in a biologically diverse system, compatibility with intercrops, good response to organic fertility sources, horizontal resistance (traits determined by multiple genes). (Two projects included variety evaluation.)

2. **Evaluate the potential economic benefits to animal and crop producers and processors who use organic methods.** *Three projects.*
   - Analyze potential economic costs, returns and risks of organic production systems (three projects).
   - Use environmental valuation tools to quantify externalities of producing food, and compare externalities of producing organic and conventional food.
   - Analyze price and market structures, including ability of small-, medium-, and large-scale growers to access different markets, in order to frame policies that minimize concentration within the industry.
   - Analyze marketing channels to document how organic food is distributed, what share of the organic food dollar is returned to the farmer, and the implications of large-scale manufacturers entering the organic market.
3. **Explore international trade opportunities for organically grown and processed agricultural commodities.** *No projects.*
   - Compare compatibility of certification standards used in different parts of the world, with the ultimate goal of harmonization and reciprocity.
   - Undertake marketing studies of international consumer demand for U.S. produced organic goods.
   - Perform "welfare analyses" (quantified gains and losses for producers and consumers) of trade policies affecting international competitiveness, including implementation of the National Organic Program, domestic support programs such as the Conservation Security Act, country of origin labeling, GMO labeling, etc.
4. **Determine desirable traits for organic commodities.** *One project.*
   - Examine relationships between nutrients in the soil and nutrients in the food grown on that soil, including long-term soil nutrient and crop nutrient profiles under conventional and organic management.
   - Perform comparisons of nutrient levels between organic and conventional crops and relationship, if any, between taste and nutrient profile.
   - Investigate the role of post-harvest handling and treatment in the maintenance of quality in fresh market organic products.
   - Determine the reasons for consumer preferences for organic goods.
5. **Identify marketing and policy constraints on the expansion of organic agriculture.** *One project.*
   - Analyze opportunities and constraints to organic agriculture resulting from provisions of the Farm Security and Rural Investment Act of 2002.
   - Investigate specific barriers to markets, such as scale-based regulations that restrict family farm access to processors and/or markets.
   - Study negative lender perception of organic farming and ways to change this.
   - Analyze regulatory barriers, such as lack of access to Federal farm programs, and developing solutions to these challenges.
6. **Conduct advanced on-farm research and development that emphasizes observation of, experimentation with, and innovation for working organic farms, including research relating to animal and crop production and marketing and to socioeconomic conditions.** *One project.*

   (Note: Many topics from other goal areas can be conducted on working farms.)
   - Develop rigorous on-farm systems research designs.
   - Conduct long-term, interdisciplinary systems research.

2007 OREI Priority Areas

Seven projects were funded and met one or more priorities

1. Evaluate the potential economic benefits from a production, marketing channel and/or sales revenue perspective to animal and crop producers and processors who use organic methods. *Two projects.*

2. Explore international trade opportunities and marketing channel structure or performance issues for organically grown and processed agricultural commodities. *No projects.*

3. Conduct advanced on-farm research and development that emphasizes observation of, experimentation with, and innovation for working organic farms, including research relating to animal and crop production and marketing and to socioeconomic conditions. – *Two projects.*

4. Develop and improve programs to address pest and pest-related problems to strengthen the livestock and crop systems approach of organic agriculture, including the effects of soil biology, cover crops, crop rotations, and crop/livestock integration on crop and livestock health and productivity and animal nutrient programs.

Two projects.

5. Identify the relationship of applied organic fertility management to crop health and the resistance of crops to pests and diseases as well as on livestock health and nutrition. *Two projects.*

6. Develop and demonstrate education and information training systems designed as education tools for county Cooperative Extension personnel and other agricultural professionals who advise producers regarding organic practices. This could include sharing or developing information on a national or regional level regarding pest mitigation, soil fertility building, best organic cultural practices, production and risk budgeting and planning; best marketing practices; livestock management, and cataloguing animal health problems for various species and listing approved health care options and allowed medications. Applications that propose to bring end-users together with research, education and extension teams that have been funded by the Integrated Organic Program will be considered. *Three projects, including eOrganic launch.*

One project did not directly address any of the above priorities: it evaluated organic-allowable sanitizers for food safety during post-harvest handling of produce.

2008 OREI Priority Areas

Five projects were funded and met one or more priorities

1. Evaluate the potential economic benefits from a production, marketing channel and/or sales revenue perspective to animal and crop producers and processors who use organic methods. *Three projects.*

2. Explore international trade opportunities and marketing channel structure or performance issues for organically grown and processed agricultural commodities. *No projects.*

3. Conduct advanced on-farm research and development that emphasizes observation of, experimentation with, and innovation for working organic farms, including research relating to animal and crop production and marketing and to socioeconomic conditions. *Two projects*

4. Develop and improve programs to address pest and pest-related problems to strengthen the livestock and crop systems approach of organic agriculture, including the effects of soil biology, cover crops, crop rotations, and crop/livestock integration on crop and livestock health and productivity and animal nutrient programs. *Two projects.*

5. Identify the relationship of applied organic fertility management to crop health and the resistance of crops to pests and diseases as well as on livestock health and nutrition. *Four projects.*

6. Develop and demonstrate education and information training systems designed as education tools for county Cooperative Extension personnel and other agricultural professionals who advise producers regarding organic practices. This could include sharing or developing information on a national or regional level regarding pest mitigation, soil fertility building, best organic cultural practices, production and risk budgeting and planning; best marketing practices; livestock management, and cataloguing animal health problems for various species and listing approved health care options and allowed medications. Applications that propose to bring end-users together with research, education and extension teams that have been funded by the Integrated Organic Program will be considered. *Two projects.*

2009 OREI Priority Areas

26 projects were funded and met one or more priorities

1. Conduct advanced on-farm research and development that emphasizes observation of, experimentation with, and innovation for working organic farms, including research relating to animal and crop production and marketing and socioeconomic conditions. *13 projects.*

2. Develop and demonstrate education and information training systems designed as education tools for county Cooperative Extension personnel and other agricultural professionals who advise producers regarding organic practices. This could include sharing or developing information on a national or regional level regarding pest mitigation, soil fertility building, best organic cultural practices, production and risk budgeting and planning, best marketing practices, livestock management, and cataloging animal health problems for various species

and listing approved health care options and allowed medications. Applications that propose to bring end-users together with research and extension teams that have been funded by the OREI will be considered. *Two projects.*

3. Examine post-harvest handling and processing practices to increased shelf-life of fresh products, increased yield of processed products, and increased food safety. *One project.*

4. Conduct research to determine the amount of carbon sequestration that occurs in organically managed systems as compared to conventionally managed systems. *Three projects*

5. Catalog and characterize germplasm from heirloom cultivars of vegetable crops to determine the best potential parents for advanced breeding programs leading to new cultivars that are uniquely suited to organic management systems. Four projects, plus four on grain crops and one on hops. Four of these (on potato, hops, perennial wheat, field crops) included plant breeding and variety development as well as variety evaluation.

6. Develop and improve programs to address pest and pest-related problems to strengthen the livestock and crop systems approach of organic agriculture, including the effects of soil biology, cover crops, crop rotations, and crop/livestock integration on crop and livestock health and productivity and animal nutrient programs. *11 projects.*

7. Identify the relationship of applied organic fertility management to crop health and the resistance of crops to pests and diseases as well as on livestock health and nutrition. *14 projects.*

2010 OREI Priority Areas

23 projects were funded and met one or more priorities

1. Conduct advanced on-farm research and development that emphasizes observation of, experimentation with, and innovation for working organic farms, including animal and crop production and marketing and socioeconomic issues. *Six projects.*
2. Develop and demonstrate educational tools for county Cooperative Extension personnel and other agricultural professionals who advise producers on organic practices. This could include sharing or developing information on a national or regional level regarding pest mitigation, soil fertility building, cultural practices, production and risk budgeting and planning, marketing practices, livestock management, and cataloging animal health problems and listing approved health care options and allowed medications. Applications that propose to bring end-users together with OREI-funded research and extension teams are encouraged. Development of online content should be coordinated with eXtension and the eOrganic Community of Practice. *Four projects.*
3. Develop organically allowable post-harvest handling and processing practices to increase food safety as well as shelf-life of fresh products and yield and quality of processed products. *Four projects.*
4. Evaluate carbon sequestration and other environmental services in organically managed systems. *Four projects (two of which were planning projects).*
5. Catalog and characterize germplasm from heirloom and other specialized cultivars of vegetable crops to determine the best potential parents for advanced breeding programs leading to cultivars better suited to organic management systems. *Three projects, plus three on field crops (corn, cotton, and dry bean); of these, the corn, cotton, and one vegetable project included breeding and variety development.*
6. Develop and improve systems-based programs to address pest and pest-related problems for organically grown livestock and crops, including the effects of soil biology, cover crops, crop rotations, and crop/livestock integration on crop and livestock health and productivity and animal nutrient programs. *12 projects (two of which were planning projects).*
7. Identify the relationship of organic fertility management to crop health, crop disease and pest resistance and livestock health and nutritional value. *Seven projects.*
8. Evaluate the nutritional value of organic products compared to products produced by conventional methods and methods to enhance the nutrient content of all products. *One project.*

2011 OREI Priority Areas

18 projects were funded and met one or more priorities

1. Conduct advanced on-farm research and development that emphasizes observation of, experimentation with, and innovation for organic farms, including animal and crop production and marketing and socioeconomic issues. These issues could include both identification of factors reducing yields, efficiency, productivity,

economic returns on organic farms and the economic and socioeconomic contributions of organic farming to producers, processors and local communities. *Eight projects.*

2. Develop and demonstrate educational tools for Cooperative Extension personnel and other agricultural professionals who advise producers on organic practices. Applications bringing end-users together with OREI-funded research and extension teams are encouraged. Development of online content should be coordinated with eXtension and the eOrganic Community of Practice, as described under the eXtension proposal type. *No projects.*
3. For both plant and animal–based organic products: develop, improve and evaluate allowable post-harvest handling, processing and food safety practices to reduce toxins and microbial contamination, while increasing shelf-life, quality and other economically important characteristics. *One project.*
4. Strengthen organic seed systems, including seed and transplant production and protection, and plant breeding and selection for organic production. Breeding and selection characteristics for organic systems may be different than in conventional systems. Goals of organic seed systems proposals can include, but are not limited to: disease and pest resistance, stress tolerance, quality and yield improvement, and genetic mechanisms to prevent inadvertent introduction of GMO traits through cross-pollination. *Three projects, two of which included breeding of carrot, soybean, and drybeans.*
5. Develop, evaluate and improve systems-based integrated pest management (IPM) programs to address pest and pest-related problems for organically grown crops. Systems-based evaluations can include the safety and efficacy of allowable pest management materials and practices. Proposals addressing management of diseases, nematodes, weeds and insect pests in the southern region are especially encouraged. *Eight projects, in one, the lead institution is from the southern region.*
6. Develop or improve systems-based animal production and pest management practices, especially in the areas of nutrition, grazing, pasture and confinement requirements, to improve animal productivity, health and welfare while retaining economic viability. *Four projects.*
7. Catalog, characterize and/or select animal genotypes and breeds adapted to organic systems. This would include, but is not restricted to: identification of and selection for pest and disease resistance; health and performance under organic pasture and feed regimens; and performance in small, mixed or innovative farming operations. *Two projects evaluated a limited number of poultry breeds.*

2012 OREI Priority Areas

Eight projects were funded and met one or more priorities

1. Conduct advanced on-farm research and development that emphasizes observation of, experimentation with, and innovation for organic farms, including animal and crop production and marketing and socioeconomic issues. These issues could include both identification of factors reducing yields, efficiency, productivity, and economic returns on organic farms and the economic and socioeconomic contributions of organic farming to producers, processors and local communities. *Six projects.*
2. Develop and demonstrate educational tools for Cooperative Extension personnel and other agricultural professionals who advise producers on organic practices. Applications bringing end-users together with OREI-funded research and extension teams are encouraged. Development of online content should be coordinated with eXtension and the eOrganic Community of Practice. *No projects.*
3. For both plant and animal–based organic products: develop, improve and evaluate allowable post-harvest handling, processing and food safety practices to reduce toxins and microbial contamination, while increasing shelf-life, quality and other economically important characteristics. *One project.*
4. Strengthen organic seed systems, including seed and transplant production and protection, and plant breeding and selection for organic production. Breeding and selection characteristics for organic systems may be different from those in conventional systems. Goals of organic seed systems proposals can include, but are not limited to: disease and pest resistance, stress tolerance, quality and yield improvement, and genetic mechanisms to prevent inadvertent introduction of GMO traits through cross-pollination. *Four projects, three of which included cultivar development for field crops, cucurbits, and quinoa.*
5. Develop, improve and evaluate systems-based IPM programs to address pest and pest-related problems for organically grown crops. Systems-based evaluations can include the safety and efficacy of allowable pest management materials and practices. Proposals addressing management of diseases, nematodes, weeds and insect pests in the Southern Region are especially encouraged. *Three projects.*
6. Develop or improve systems-based animal production and pest management practices, especially in the areas of nutrition, grazing, pasture and confinement requirements to improve animal productivity, health and welfare while retaining economic viability. *Three projects.*

7. Catalog, characterize and/or select animal genotypes and breeds adapted to organic systems. This would include, but is not restricted to: identification of and selection for pest and disease resistance; health and performance under organic pasture and feed regimens; and performance in small, mixed or innovative farming operations. *No projects.*
8. Develop cultural practices and other allowable alternatives to substances recommended for removal from the National Organic Program's National List of Allowed and Prohibited Substances (www.ams.usda.gov/AMSv1.0/nop). This may include effective substitutes or new technologies, cultural practices, cultivars or breeds that render the substance in question unnecessary under organic growing conditions. A systems approach is encouraged, but proposals narrower in scope will also be considered. For FY 2012, we are especially interested in alternatives to the use of antibiotics, such as tetracycline and streptomycin, to control diseases such as fire blight. *No projects.*

2014 OREI Priority Areas

19 projects were funded and met one or more priorities

1. Conduct advanced on-farm crop or livestock research and development that emphasize observation of, experimentation with, and innovation for organic farms, including production, marketing and socioeconomic issues. These issues could include both identification of factors reducing yields, efficiency, productivity, and economic returns on organic farms and the economic and socioeconomic contributions of organic farming to producers, processors and local communities. *Six projects.*
2. Develop and demonstrate educational tools for Cooperative Extension personnel and other agricultural professionals who advise producers on organic practices. Applications bringing end-users together with OREI-funded research, education and extension teams are encouraged. Coordination of the development of online content with eXtension and the eOrganic Community of Practice is strongly encouraged. *No projects.*
3. For both plant and animal–based organic products: evaluate, develop and improve allowable post-harvest handling, processing and food safety practices to reduce toxins and microbial contamination, while increasing shelf-life, quality and other economically important characteristics. *One project.*
4. Strengthen organic seed systems, including seed and transplant production and protection, plant breeding and selection for organic production. Breeding and selection characteristics for organic systems may be different from those in conventional systems. Goals of organic seed systems proposals can include, but are not limited to: disease and pest resistance, stress tolerance, quality and yield improvement, and genetic mechanisms to prevent inadvertent introduction of GMO traits through cross-pollination. *Five projects, including one planning grant for vegetable breeding, and three projects that included breeding and variety development for field corn, tomato, and several vegetable crops.*
5. Explore technology that meets the requirements of the National Organic Program and that can control weeds and pests while maintaining healthy water resources. Specifically, develop, improve and evaluate systems-based integrated pest management programs to address pest and pest-related problems for organically grown crops. Systems-based evaluations can include the safety and efficacy of allowable pest management materials and practices. Proposals addressing management of diseases, nematodes, weeds and insect pests in the Southern Region are especially encouraged. *11 projects.*
6. Develop or improve systems-based animal production, animal health and pest management practices, especially in the areas of nutrition, grazing, and pasture and confinement requirements to improve animal productivity, health and welfare while retaining economic viability. *Two projects.*
7. Catalog, characterize and/or select animal genotypes and breeds adapted to organic systems. This would include, but is not restricted to: identification of and selection for pest and disease resistance; health and performance under organic pasture and feed regimens; and performance in small, mixed or innovative farming operations. *No projects.*

2002 ORG Priority Areas

Six projects

1. Weed management programs that strengthen the systems approach of organic agriculture, including the effects of soil biology, cover crops, crop rotations, crop/livestock integration and grazing, on weed severity and impact. Two projects.
2. Understanding the relationship of applied organic fertility management to crop health and the resistance of crops to pests and diseases. Two projects.

3. Training systems designed to elevate the awareness of county Cooperative Extension personnel and other agricultural professionals who advise farmers about organic practices and information on a national or regional level with particular emphasis on weed management, insect pest management, soil fertility building, best organic cultural practices and livestock management. No projects.

In describing proposed work for this program, applicants should clearly state the type of production system for which their management strategies are appropriate (certified or transition). They should demonstrate the need for the proposed work, both in terms of stakeholder preferences, and the magnitude of the problem. The magnitude of the problem should be related to current numbers of producers and acres affected, as well as potential for increased production in the area of study which may result from developing and demonstrating ecologically based pest management strategies.

An outcome-oriented plan for disseminating information derived from the proposed work should be an integral part of the project.

Three projects did not directly address the above RFA priorities: one on potato clone evaluation, one on organic poultry, and one on organic nursery stock production.

2003 ORG Priority Areas

Five projects

This RFA priority list is qualitatively different from 2002 and 2004. It appears to be a misprint, as it discusses other aspects of proposal requirements rather than priority research topics.

1. Integrated, multifunctional research, education, and extension projects (i.e., those that contain research, education, and extension components) that foster new collaborations between individuals and institutions.
2. Projects that will assess the use and efficacy of available pest management tools, develop and demonstrate the efficacy of reduced-risk IPM alternatives, and/or identify possible transition or mitigation strategies that serve as viable IPM options for crops and agro-ecosystems at risk.
3. Projects that complement other CSREES programs such as the Pest Management Alternatives Program (PMAP), the Regional Integrated Pest Management Competitive Grants Program (RIPM), the Integrated Pest Management Implementation Program, the Pesticide Safety Education Program (PSEP), the Minor Crops Program (IR-4), and to pest management activities funded by the Sustainable Agriculture Research and Education and the National Research Initiative Competitive Grants Program (NRI).

All five projects addressed one or more of the 2002 RFA priorities:

1. Weed management. *Four projects.*
2. Organic fertility, crop health, and pest and disease resistance. *All five projects.*
3. Training for agricultural professionals. *Three projects.*

2002 ORG Priority Areas

Six projects

1. Weed management programs that strengthen the systems approach of organic agriculture, including the effects of soil biology, cover crops, crop rotations, crop/livestock integration and grazing, on weed severity and impact. Two projects.
2. Understanding the relationship of applied organic fertility management to crop health and the resistance of crops to pests and diseases. Two projects.
3. Training systems designed to elevate the awareness of county Cooperative Extension personnel and other agricultural professionals who advise farmers about organic practices and information on a national or regional level with particular emphasis on weed management, insect pest management, soil fertility building, best organic cultural practices and livestock management. No projects.

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An outcome-oriented plan for disseminating information derived from the proposed work should be an integral part of the project.

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All five projects addressed one or more of the 2002 RFA priorities:

1. Weed management. *Four projects.*
2. Organic fertility, crop health, and pest and disease resistance. *All five projects.*
3. Training for agricultural professionals. *Three projects.*

2004 ORG Priority Areas

Five projects

1. Develop and improve programs to address pest and pest-related problems to strengthen the systems approach of organic agriculture, including the effects of soil biology, cover crops, crop rotations, crop/livestock integration. *Two projects.*
2. Identify the relationship of applied organic fertility management to crop health and the resistance of crops to pests and diseases. *Two projects.*
3. Develop and demonstrate education and information training systems designed as education tools for county Cooperative Extension personnel and other agricultural professionals who advise producers regarding organic practices. This could include sharing or developing information on a national or regional level regarding pest mitigation, soil fertility building, best organic cultural practices, and livestock management. No projects,
4. Develop and implement formal courses for organic producers that address the complexity of issues surrounding organic agriculture. *No projects.*
5. Develop the scientific basis to improve current organic standards and to extend organic standards to commodities that are not currently covered by the USDA National Organics Program. *One project.*

One project did not directly address the above RFA priorities: its focus was dairy health.

2005 ORG Priority Areas

Three projects

1. Develop and improve programs to address pest and pest-related problems to strengthen the livestock and crop systems approach of organic agriculture, including the effects of soil biology, cover crops, crop rotations, and crop/livestock integration on crop livestock health and productivity and animal nutrient programs. *One project.*
2. Identify the relationship of applied organic fertility management to crop health and the resistance of crops to pests and diseases as well as on livestock health and nutrition. *Three projects.*

3. Develop and demonstrate education and information training systems designed as education tools for county Cooperative Extension personnel and other agricultural professionals who advise producers regarding organic practices. This could include sharing or developing information on a national or regional level regarding pest mitigation, soil fertility building, best organic cultural practices, livestock management, and cataloguing animal health problems for various species and listing approved health care options and allowed medications. *No projects.*
4. Develop and implement formal courses for organic livestock and crop producers that address the complexity of issues surrounding organic agriculture. *No projects.*
5. Develop the scientific basis to improve current organic standards and to extend organic standards to commodities that are not currently covered by the USDA National Organics Program, including animal products and processing. *No projects.*

2006 ORG Priority Areas

Four projects

1. Develop and improve programs to address pest and pest-related problems to strengthen the livestock and crop systems approach of organic agriculture, including the effects of soil biology, cover crops, crop rotations, and crop/livestock integration on crop livestock health and productivity and animal nutrient programs. *Two projects.*
2. Identify the relationship of applied organic fertility management to crop health and the resistance of crops to pests and diseases as well as on livestock health and nutrition. *Two projects*
3. Develop and demonstrate education and information training systems designed as education tools for county Cooperative Extension personnel and other agricultural professionals who advise producers regarding organic practices. This could include sharing or developing information on a national or regional level regarding pest mitigation, soil fertility building, best organic cultural practices, livestock management, and cataloguing animal health problems for various species and listing approved health care options and allowed medications. *No projects.*
4. Develop and implement formal courses for organic livestock and crop producers that address the complexity of issues surrounding organic agriculture. *No projects.*
5. Develop the scientific basis to improve current organic standards and to extend organic standards to commodities that are not currently covered by the USDA National Organics Program, including animal products and processing. *No projects.*

2007 ORG Priority Areas

Five projects

1. Evaluate the potential economic benefits from a production, marketing channel and/or sales revenue perspective to animal and crop producers and processors who use organic methods. One project.
2. Explore international trade opportunities and marketing channel structure or performance issues for organically grown and processed agricultural commodities. *No projects.*
3. Conduct advanced on-farm research and development that emphasizes observation of, experimentation with, and innovation for working organic farms, including research relating to animal and crop production and marketing and to socioeconomic conditions. *Three projects.*
4. Develop and improve programs to address pest and pest-related problems to strengthen the livestock and crop systems approach of organic agriculture, including the effects of soil biology, cover crops, crop rotations, and crop/livestock integration on crop and livestock health and productivity and animal nutrient programs. *Five projects.*
5. Identify the relationship of applied organic fertility management to crop health and the resistance of crops to pests and diseases as well as on livestock health and nutrition. *One project.*
6. Develop and demonstrate education and information training systems designed as education tools for county Cooperative Extension personnel and other agricultural professionals who advise producers regarding organic practices. This could include sharing or developing information on a national or regional level regarding pest mitigation, soil fertility building, best organic cultural practices, production and risk budgeting and planning; best marketing practices; livestock management, and cataloguing animal health problems for various species and listing approved health care options and allowed medications. Applications that propose to bring end-users together with research, education and extension teams that have been funded by the Integrated Organic Program will be considered. *One project.*

2008 ORG Priority Areas

Three projects

1. Evaluate the potential economic benefits from a production, marketing channel and/or sales revenue perspective to animal and crop producers and processors who use organic methods. *One project.*
2. Explore international trade opportunities and marketing channel structure or performance issues for organically grown and processed agricultural commodities.
3. Conduct advanced on-farm research and development that emphasizes observation of, experimentation with, and innovation for working organic farms, including research relating to animal and crop production and marketing and to socioeconomic conditions. *No projects.*
4. Develop and improve programs to address pest and pest-related problems to strengthen the livestock and crop systems approach of organic agriculture, including the effects of soil biology, cover crops, crop rotations, and crop/livestock integration on crop and livestock health and productivity and animal nutrient programs. *Two projects.*
5. Identify the relationship of applied organic fertility management to crop health and the resistance of crops to pests and diseases as well as on livestock health and nutrition. *No projects.*
6. Develop and demonstrate education and information training systems designed as education tools for county Cooperative Extension personnel and other agricultural professionals who advise producers regarding organic practices. This could include sharing or developing information on a national or regional level regarding pest mitigation, soil fertility building, best organic cultural practices, production and risk budgeting and planning; best marketing practices; livestock management, and cataloguing animal health problems for various species and listing approved health care options and allowed medications. Applications that propose to bring end-users together with research, education and extension teams that have been funded by the Integrated Organic Program will be considered.

One project did not directly address the above RFA priorities: its focus was a comparative study of dairy health on organic, non-organic grazing, and non-organic confinement dairies, based on a survey of 300 farms.

2009 ORG Priority Areas

Three projects

1. The impact of organic cropping systems on water quality and/or quantity. *Two projects.*
2. The impact of organic animal production systems on water quality and/or quantity. *One project.*
3. The impact of mixed use (crop and animal production systems) on water quality and/or quantity. *No projects.*

2010 ORG Priority Areas

Seven projects

1. Documenting and understanding the effects of organic practices such as crop rotation, organic mulch and compost additions, cover crops, and reduced tillage on soil quality, erosion, and carbon sequestration. *Six projects.*

   Project examples include:
   - Comparing the results of organic practices and/or their interactions on erosion in organic systems using both field measurements and erosion predictor models.
   - Optimizing tillage and rotation practices to reduce erosion and increase carbon sequestration during the transition to organic agricultural systems and practices.
   - Examining soil dynamics in fields under long-term organic soil management.
   - An example of an animal-based organic system project in this priority area is assessing the environmental, conservation, GHG emission reduction, and/or climate change mitigation potential of pasture-based organic dairy systems.
2. Improved technologies, methods, model development and other metrics to document, describe, and optimize the environmental services and climate change mitigation ability of organic farming systems. *Two projects.*

   Project examples include:
   - Comparing current models with field data.

- Developing tools that could be used to select an optimal suite of organic practices for a particular farming system.
- Developing better tools for assessing contributions of organic practices in future carbon markets.
- Validating estimates of conservation outcomes, environmental services, and carbon sequestration potential determined by current models using areas under long-term organic management.

One project did not directly relate to the above priorities: it consisted of an innovative educational and on-farm research project in which sustainable agriculture students (Texas A&M University) conducted on-farm trials addressing farmers' priorities. While the proposal made brief mention of GHG mitigation assessments, the work focused primarily on organic weed and pest management and variety evaluations.

2011 ORG Priority Areas

Five projects

1. Documenting and understanding the effects of organic practices such as crop rotation, organic manure, mulch and/or compost additions, cover crops, and reduced or conservation tillage on soil quality, soil erosion, soil carbon sequestration and/or greenhouse gas emissions. *All 5 projects.*

   Project examples include:
   - Comparing the results of organic practices and/or their interactions on erosion in organic systems using both field measurements and erosion predictor models.
   - Optimizing tillage and rotation practices to reduce erosion and increase carbon sequestration during the transition to organic agricultural systems and practices.
   - Examining soil dynamics in fields under long-term organic soil management.
   - Generating data sets on nitrous oxide emissions from organic systems utilizing different sources of nitrogen, rotation practices and tillage levels.
   - An example of an animal-based organic system project in this priority area is assessing the environmental, conservation, greenhouse gas emission reduction, and/or climate change mitigation potential of pasture-based organic dairy systems.
2. Improved technologies, methods, model development and other metrics to document, describe, and optimize the environmental services and climate change mitigation ability of organic farming systems. *Two projects.*

   Project examples include:
   - Comparing current models with field data.
   - Developing tools that could be used to select an optimal suite of organic practices for a particular farming system.
   - Developing better tools for assessing contributions of organic practices in future carbon markets.
   - Validating estimates of conservation outcomes, environmental services, soil carbon sequestration potential and/or greenhouse gas mitigation determined by current models using areas under long-term organic management.

2012 ORG Priority Areas

Seven projects

1. Documenting and understanding the effects of organic practices such as crop rotation, organic manure, mulch and/or compost additions, cover crops, and reduced or conservation tillage on soil quality, soil erosion, soil carbon sequestration and/or greenhouse gas emissions. *All seven projects.*

   Project examples include:
   - Comparing the results of organic practices and/or their interactions on erosion in organic systems using both field measurements and erosion predictor models.
   - Optimizing tillage and rotation practices to reduce erosion and increase carbon sequestration during the transition to organic agricultural systems and practices.
   - Examining soil dynamics in fields under long-term organic soil management.
   - Generating data sets on nitrous oxide emissions from organic systems utilizing different sources of nitrogen, rotation practices and tillage levels.
   - Assessing the environmental, conservation, greenhouse gas emission reduction, and/or climate change mitigation potential of pasture-based organic dairy systems.

2. Improved technologies, methods, model development and other metrics to document, describe, and optimize the environmental services and climate change mitigation ability of organic farming systems. *All seven projects.*

   Project examples include:

   - Comparing current models with field data.
   - Developing tools that could be used to select an optimal suite of organic practices for a particular farming system.
   - Developing better tools for assessing contributions of organic practices in future carbon markets.
   - Validating estimates of conservation outcomes, environmental services, soil carbon sequestration potential and/or greenhouse gas mitigation determined by current models using areas under long-term organic management.

2013 ORG Priority Areas

Five projects

1. Documenting and understanding the effects of organic practices such as crop rotation, organic manure, mulch and/or compost additions, cover crops, and reduced or conservation tillage on ecosystem services, greenhouse gas mitigation, and biodiversity. *Three projects.*

   Project examples include:

   - Optimizing tillage, cover crop and rotation practices to reduce erosion and increase carbon sequestration during the transition to organic agricultural systems and practices.
   - Assessing the environmental, conservation, greenhouse gas emission reduction, and/or climate change mitigation potential of pasture-based organic dairy systems.
   - Examining soil dynamics in fields under long-term organic soil management compared to that during the transition.
   - Generating data sets on nitrous oxide emissions from organic systems using different sources of nitrogen, rotation practices, and tillage levels.
   - Evaluating the effect of transitioning to organic production on biodiversity.
2. Improved technologies, methods, model development, and other metrics to document, describe, and optimize the environmental services and climate change mitigation ability of organic farming systems. *Three projects.*

   Project examples include:

   - Developing tools that could be used to select an optimal suite of organic practices for a particular farming system.
   - Developing better tools to assess the contributions of organic practices in future carbon markets.
   - Comparing estimates of conservation outcomes, environmental services, soil carbon sequestration potential, and/or greenhouse gas mitigation determined by current models during the transition to areas under long-term organic management.
3. Develop cultural practices and other allowable alternatives to substances recommended for removal from NOP's National List of Allowed and Prohibited Substances (www.ams.usda.gov/AMSv1.0/nop). This may include effective substitutes or new technologies, cultural practices, cultivars, or breeds that render the substance in question less limiting to production under organic growing conditions. We encourage a systems approach, but will also consider proposals that are narrower in scope. For FY 2013, we are especially interested in the following substances that have been recommended for removal: a) antibiotics used to control diseases such as fire blight in organically grown crops; and b) methionine for use in poultry rations. *One project (fire blight).*
4. Outreach to students and producers: Projects may target students or their information providers (such as college teaching faculty) for information delivery on organic agriculture. This activity may include the development of college curriculum or other resources in the area of organic agriculture, with a focus on the transition period. Projects may also target producers directly or through the development and demonstration of educational tools for Cooperative Extension personnel and other agricultural professionals who advise producers on organic practices. The development of online content for producers and advisors should be coordinated with eXtension and the eOrganic Communities of Practice (COP) as described below. T*wo projects (one modeled on Texas A&M University student-on-farm research program)*

2014 ORG Priority Areas

Seven projects

1. Documenting and understanding the effects of organic practices such as crop rotation, organic manure, mulch and/or compost additions, cover crops, and reduced or conservation tillage on ecosystem services, greenhouse gas mitigation, and biodiversity. *Five projects.*

   Project examples include:

   - Optimizing tillage, cover crop and rotation practices to reduce erosion and increase carbon sequestration during the transition to organic agricultural systems and practices.
   - Assessing the environmental, conservation, greenhouse gas emission reduction, and/or climate change mitigation potential of pasture-based organic dairy systems.
   - Examining soil dynamics in fields under long-term organic soil management compared to that during the transition.
   - Generating data sets on nitrous oxide emissions from organic systems using different sources of nitrogen, rotation practices, and tillage levels.
   - Evaluating the effect of transitioning to organic production on biodiversity.

2. Improved technologies, methods, model development, and other metrics to document, describe, and optimize the environmental services and climate change mitigation ability of organic farming systems. *Three projects.*

   Project examples include:

   - Developing tools that could be used to select an optimal suite of organic practices for a particular farming system.
   - Developing better tools to assess the contributions of organic practices in future carbon markets.
   - Comparing estimates of conservation outcomes, environmental services, soil carbon sequestration potential, and/or greenhouse gas mitigation determined by current models during the transition to areas under long-term organic management.

3. Develop cultural practices and other allowable alternatives to substances recommended for removal from NOP's National List of Allowed and Prohibited Substances (www.ams.usda.gov/AMSv1.0/nop). This may include effective substitutes or new technologies, cultural practices, cultivars, or breeds that render the substance in question less limiting to production under organic growing conditions. We encourage a systems approach, but will also consider proposals that are narrower in scope. For FY 2013, we are especially interested in the following substances that have been recommended for removal: a) antibiotics used to control diseases such as fire blight in organically grown crops; and b) methionine for use in poultry rations. *Two projects (fire blight, poultry methionine).*

Note: 2014 priorities missing the 2016 ORG priorities include the first three from 2013, plus a fourth priority related to barriers to organic transition".

APPENDIX F.

Further Analysis of Producer Engagement, Outreach and Dissemination, and Project Outcomes, Impacts and Benefits

CONTENTS

List of Projects for which Additional Information was Gathered

Analysis of producer engagement, outreach and dissemination, and project outcomes, impacts and benefits for all 189 projects was based in part on reports posted on the CRIS database. In addition, the following 47 OREI and ORG projects were explored further through interviews or informal conversations with project participants, visits to project websites, and/or review of project products. This additional information helped our team gain a deeper understanding of OREI and ORG program efficacy in terms of engaging farmers and other stakeholders, developing practical outcomes that producers can implement on their farms, and delivering outcomes to end users.

ORG 2002-03799, D. Rouse, University of Wisconsin, $140K

Identification and characterization of potato clones for organic production systems

and

OREI 2009-01429, Amy Charkowski, University of Wisconsin, $541K

Organic certified seed potato production in the Midwest

>Visited website of ongoing Organic Potato Project, informal conversation with Wisconsin farmer/consultant who is familiar with the project.

ORG 2003-04559, Deborah Stinner and Larry Phelan, Ohio State University, $493K

Biological buffering and pest management in organic farming systems: the central role of organic matter

>Interview with farmer participant, informal conversation with representative of NGO partner.

ORG 2003-04625, Ron Morse, Virginia Tech, $346K

Integrating no-tillage with farmscaping and crop rotations to improve pest management and soil quality in organic vegetable production

>Interview with farmer participant; in addition, consultant Mark Schonbeck was a major participant in this project during 2003-07, and was thus familiar with project activities and impacts.

OREI 2004-05153, Mark Mazzola, USDA-ARS, Wenatchee,WA, $303K

Use of resident biological resources for the management of replant disease in organic tree fruit production systems

and

OREI 2008-01245, Mark Mazzola, USDA-ARS, Wenatchee, WA, $518K

Predictive management of soil microbial communities using defined amendments to enhance production in organic cropping systems

>Interview with PI, viewed Powerpoint Presentation of project findings.

OREI 2004-05205, M. Jahn, Cornell University, $894K

Organic Seed Partnership (OSP)

>Informal conversation with project co-PI, interview with farmer participant.

OREI 2005-04473, Sieglinde Snapp, Michigan State University, $754K

Partnering to cultivate organic agriculture in Michigan and the Midwest

>Informal e-mail exchange and telephone conversation with project participant Vicki Morrone at Michigan State University. Viewed several project info sheet links sent by Dr. Morrone.

OREI 2007-01411, A. Stone, Oregon State University, $612K

E-Organic: Extension for organic agriculture

and

OREI 2009-01434, A. Stone, Oregon State University, $317K

E-Organic: the national online information, training, and networking system for organic agriculture

>Explored the eOrganic and eXtension websites in depth, had e-mail conversation with current eOrganic coordinator Alice Formiga, who provided a 3 page summary of the web links, webinars, articles, and other products of ~60 OREI and ORG projects that have used eOrganic for networking and outreach.

OREI 2007-01417; Karen Renner; Michigan State University, $106K

Building organic weed management knowledge in organic systems

>Obtained and read project product, a MSU Extension bulletin, Integrated Weed Management: Fine-Tuning the System (132 pp), a supplement to an earlier bulletin on non-organic integrated weed management.

OREI 2008-01237, Bernadine Strik, Oregon State University, $470K

Integrated weed management and fertility in organic highbush blueberry production systems to optimize plant growth, yield, and grower return

>Interview with co-PI, viewed informational materials on eOrganic.

OREI 2009-01332, Sieglinde Snapp, Michigan State University, $1.05M

Practical perennials: partnering with farmers to develop a new type of wheat crop

>Interview with PI.

OREI 2009-01333, S. Chris Reberg-Horton, North Carolina State University, $1.18M

Farmer-driven breeding: addressing the needs of southeastern organic field crop producers

and

OREI 2012-02236, S. Chris Reberg-Horton, North Carolina State University, $1.26M

Creating an organic plant breeding center

>Visited project web site, communicated with NGO project partner, received additional information on project outcomes (new varieties) that was not available on CRIS database.

OREI 2009-01343, Organic Seed Alliance, $46K

The seed we need??? Working group, symposium, and action plan for the advancement of organic seed systems.

>Visited project web site and read summary of on-line report The State of Organic Seed.

OREI 2009-01366, Ellen Mallory, University of Maine, $1.32M

Enhancing farmers' capacity to produce high quality organic bread wheat

>Interview with two farmer participants.

OREI 2009-01377, Mary Barbercheck, Pennsylvania State University, $2.55M

Improving Weed and Insect Management in Organic Reduced-Tillage Cropping Systems
>Interview with manager of NGO research farm who was a partner on the project.

OREI 2009-01402, Brian McSpadden-Gardener, Ohio State University, $1.09M

Enhancing productivity and soilborne disease control in intensive organic vegetable production with mixed species green manures

>Interview with PI.

ORG 2009-05488, D. L. Osmond, North Carolina State U, $659K

Water quality evaluation of long term organic and conventional vegetable production under conservation and conventional tillage

>Interview with PI.

OREI 2010-01869, Jennifer W. MacAdam, Utah State University, $1,019K

Improved organic milk production through the use of the condensed tannin-containing forage legume birdsfoot trefoil

>Read project report given at 2015 Organic Agricultural Research Symposium (OREI 2014-05388).

OREI 2010-01904, Karen Renner, Michigan State University, $964K

Organic Dry Bean Production Systems

>Viewed pdf file of webinar on eOrganic web site.

OREI 2010-01916; PI Fausti; South Dakota State University, $44K

Sustainable organic tribal bison production using an intra-tribal supply chain management system: a planning proposal.

>Interview with PI.

OREI 2010-01932, A. Brito, University New Hampshire, $31K

Research and extension needs assessment of the organic dairy industry in the Northeast (planning project)

OREI 2011-01950, A. Brito, University New Hampshire, $2.86M

Assisting organic dairy producers to meet the needs of new and expanding milk markets

>Interview with PI.

OREI 2010-01975; PI King; University of Minnesota, $1.273M

Tools for organic transition: financial data and educational resources for farmers and agricultural professionals

>Visited project website, reviewed a few of the farmer profiles.

OREI 2010-02363, Paul Scott, USDA-ARS Ames, IA, $2.86M

Strengthening public corn breeding to ensure that organic farmers have access to elite cultivars

and

OREI 2014-05340, Paul Scott, USDA-ARS, Ames, IA, $1.97M

Breeding non-commodity corn for organic production

>Interviews with PI and farmer participant, visited project web site, read transcript of presentation on successful breeding of N-efficient, N-fixing, high protein corn, given by project participant Walter Goldstein (Mandaamin Institute) given at 2015 Organic Agriculture Research Symposium (OREI 2014-05388).

OREI 2010-03392, James R. Myers, Oregon State University, $2.31M

Northern Vegetable Improvement Collaborative (NOVIC)

and

OREI 2014-05402, James R. Myers, Oregon State University, $2M

NOVIC II

>Visited project web site, informal conversations with two project co-PIs (university plant breeder and NGO partner representative), reviewed proposal narrative for NOVIC II.

ORG 2010-03954, Michele Wander, University of Illinois, $650K

Organic systems and climate change

>Interview with PI.

ORG 2010-03990; Raul T. Villanueva. Texas A&M University, $697K

Integrating community college students and organic farmers throughout feasibility studies in pest management and horticulture production in south Texas

>Interview with PI.

OREI 2011-01955, Ann Marion Donoghue, USDA-ARS, Fayetteville, AR, $1.23M

Use of natural strategies to alleviate enteric pathogens in organic poultry

>Read project report from 2015 Organic Agriculture Research Symposium (OREI 2014-05388)

OREI 2011-01959, $2.30M

Multi-functional cover crop cocktails for organic systems

>Interview with farmer participant, read farmers' guide/info sheet for selecting cover crop mixtures (posted on eOrganic website).

OREI 2011-01962, Philipp W. Simon, USDA-ARS Peoria, IL, $2.10M

Carrot improvement for organic agriculture with added grower and consumer value

>Visited project web site.

OREI 2011-02002, Michael S. Lilburn, Ohio State University, $896K

A whole farm approach incorporating pasture raised organic poultry and a novel cereal grain (naked oats) into an organic rotation.

>Interview with farmer participant.

ORG 2011-04958, Tim Reinbott, University of Missouri, $742K

Identification of factors affecting carbon sequestration and nitrous oxide emissions in three organic cropping systems

>Interview with PI, and additional perspective provided by research associate via e-mail.

OREI 2012-02222; Anne Nielsen; Rutgers University (New Jersey); $2.672M

Whole farm organic management of BMSB and endemic pentatomids through behaviorally based habitat manipulation

>Participated in planning grant (OREI 2011-01989) that led to successful full proposal (prior to current OREI analytical project); interviews with PI and farmer participant, visited project web site and read detailed progress reports.

OREI 2012-02292, Michael R. Mazourek, Cornell University, $1.96M

Addressing critical pest management challenges in organic cucurbit production

>Informal conversations with project PI and with farmer-breeder who received support from the project; visited project web site.

ORG 2013-03971, Russell F. Mizell, University of Florida, $461K

Improvement and implementation of organic pecan systems in the southeastern United States

>Interview with project PI, visited pecan IPM website utilized by the project.

ORG 2013-03973; Craig Sheaffer, University of Minnesota, $718K

Principles for transitioning to organic farming: e-learning materials and decision case studies for educators

>Visited project website, communicated by e-mail with project co-PI who sent two completed decision case studies and provided update on project progress.

OREI 2014-05324, J. E. Creech, Utah State University, $1.56M

Compost carryover and cover crop effects on soil quality, profitability, and cover crop selection in organic dryland wheat

>Interviews with PI and farmer participant, participated in webinar held in November 2015.

OREI 2014-05325, Jared Zystro, Organic Seed Alliance, $43K

Planning for organic plant breeding and seed production in the Southeast

>Read full proposal developed by planning team (consultant Mark Schonbeck wrote letter of support).

OREI 2014-05378, Ashfaq Ahmad, University of Georgia, $50K

IPM for spotted wing drosophila (SWD)

>Visited web site established for execution of full project (awarded in 2015).

OREI 2014-05388; PI Tracy; University of Wisconsin, $50K

Organic Agriculture Research Symposium

>Accessed program and downloaded written transcripts of several talks that reported outcomes of other OREI and ORG projects noted above.

OREI 2014-05405, Lori A. Hoagland, Purdue University, $1.99M

Practical approach to controlling foliar pathogens in organic tomato production through participatory breeding and integrated pest management

>Visited project web site.

OREI 2014-05408, Douglas Doohan, Ohio State University, $2M

Practiced by farmers but untested by scientists: unifying both in participatory research and education to explain the effects of soil balancing.

>Interviewed farmer participants, informal conversation with representative of NGO partner.

Stakeholder Engagement

In a majority of OREI and ORG funded projects, producers played active roles in proposal development, planning and/or performing the research, conducting or hosting trials on their farms or ranches, disseminating project findings through field days or other means, or evaluating project outcomes or products (Table 1). Some projects involved producers and other stakeholders to a high degree throughout the project, and several took innovative approaches to stakeholder engagement. Examples include the following.

ORG 2002-3799, University of Wisconsin

Potato Clones for Organic

and

OREI 2009-01429

>Strong network of farmers linked with UW breeders and other professionals; farmers engaged in disease-free potato seed production, variety evaluation for organic systems, and potato breeding (especially notable, as potatoes are a challenging crop to breed). The projects established an ongoing farmer-scientist network, the Organic Potato Project, with active on farm trials and seed production in 2015.

ORG 2003-04559, Ohio State University

Organic Matter and Pest management

>Farmers served as advisors and conducted on farm research; one developed a management strategy for giant ragweed that was evaluated in replicated multi-site trials.

OREI 2004-05205, Cornell University

Organic Seed Partnership

>217 farmers worked with LGU public breeders in five "hubs" around the US to conduct on-farm vegetable variety trials and develop new varieties for organic systems.

OREI 2005-04473, Michigan State University

Partnering for Organic Ag in Midwest

>This project included biweekly to monthly teleconferences in which a group of 15 farmers met with agriculture professionals to discuss current issues encountered in organic production and marketing in the region. A telephone conversation with one of the PIs on the project confirmed that this unique format proved extremely effective as a mutual learning opportunity for producers and researchers.

OREI 2007-01417, Michigan State University

Integrated Weed Management

>In response to farmer feedback in a survey regarding MSU's Extension bulletin, Integrated Weed Management, One Year's Seeding (2005, 112 pp), the project team developed an excellent supplemental manual to address the weed management needs of organic and sustainable producers, Integrated Weed Management, Fine-Tuning the System (2008, 132 pp). Organic producers participated in developing the new manual, providing examples of crop rotations and organic weed management strategies from several North Central region states. The manual includes ten farmer-designed on-farm trials of experimental IWM methods.

OREI 2008-01247, Washington State University

Organic Strategies for Stewardship and Profit

>Farmers hosted 39 farm walks, reaching a total of 900 participants. In a follow-up survey, 75% of 228 respondents applied project-related findings on their farms.

OREI 2010-02363, USDA ARS Ames, IA

Public corn breeding for organic

>Farmers played integral role in corn breeding, variety evaluation, and organic seed production endeavors. Cooperative network among farmers, vegetable seed vendors, and scientists was well established by 2013 to promote germplasm exchange, variety trials, seed production, and release of new varieties.

ORG 2013-03973, University of Minnesota

e-learning and decision case-studies for organic transition

>This project is developing learning modules and decision case studies for transitioning organic producers. Farmers play a central role throughout the process, including listening sessions and learning groups linking producers, researchers, and educators. Farmers select topics, case study topics and farms.

A significant minority of projects had little or no farmer participation in planning or conducting the project. These included projects that required the controlled conditions of laboratory or experiment station, projects that built a research foundation for more on-farm or producer-participatory work later, and a few projects that appeared to have suffered from the lack of farmer engagement from the outset. Examples include the following.

OREI 2004-05153, USDA-ARS-Washington State

Orchard Replant Disease

>Initial research on mustard seed meals and resistant rootstock provided basis for additional work, OREI 2008-01245, which engaged farmers to a greater degree (major trials on a working organic orchard), and led to important new understanding of how the mustard seed meal suppresses disease by stimulating beneficial components of the soil food web, and not via biofumigation. Thus, whereas farmer engagement in the initial research was very limited, project findings have important practical implications and potential benefits for organic orchard production.

OREI 2005-04484, Iowa State University

Organic management of Asian soybean rust (ASR)

>Field station research and a survey of the occurrence of ASR in the state led to practical methods to detect and manage Asian Soybean rust. While the research itself did not engage farmers, the outcomes were widely and effectively disseminated to organic and conventional soybean producers,

OREI 2006-02047, University of Florida

Crop Diversification in Humid Tropics

>Farmers were not involved in the initial research and data collection. The project team received continuation funding under ORG 2007-03671, which increased farmer engagement, especially in outreach activities with other farmers as practical outcomes began to accrue.

OREI 2009-01346, University of Guam

Organic inspector training

>Farmers were not directly involved in this project training of agricultural professionals in organic agriculture and in conducting inspections for USDA organic certification. Project resulted in the first 11 organic inspectors on Guam and nearby Pacific Island nations, and also stimulated Guam farmer and general public interest in organic.

ORG 2009-05488, North Carolina State University

Water quality in vegetable systems

>Farmers had little role in the design, execution, or evaluation of this study of water quality impacts of farming systems. The "organic" system included corn production year after year with heavy applications of poultry litter, and performed poorly in terms of water quality impacts. Thus, project findings could discourage adoption of organic practices, based on a protocol that did not reflect good organic practices. Greater farmer involvement in project planning and treatment design would likely have resulted in project findings more relevant to the organic community.

ORG 2010-03958, University of Florida

Transitioning to organic via sod-based rotation and strip tillage in south coastal plain.

>Research project including intensive measurements of soil biotic communities, C sequestration, and nutrient dynamics during transition using bahiagrass. Promising results include significant C sequestration, which is a notable accomplishment in sandy soils and hot climates.

ORG 2010-04008, North Carolina State University

Winter cover crops for C sequestration in degraded soils transitioning to organic

>This project analyzed soil C and N dynamics in depth under different cover crops and cover crop termination methods. Farmers were not involved in the research; however, urban educational farms and a community gardening NGO worked with university students in the educational aspects of the project.

ORG 2011-04960, Montana State University

Targeted sheep grazing to reduce tillage intensity

>Crop-sheep integration for minimum till organic grain and pulse production in semiarid interior Northwest. Sheep were used to manage weeds and terminate cover crops. No farmer involvement or on farm trials was planned or done, though farmers are the major target audience. It has been suggested by one agricultural professional not directly involved in the project that greater engagement of producers in project design might have yielded a more successful experimental system.

ORG 2011-04952, Michigan State University

Cover crops, N2O, soil C and N

>No explicit farmer engagement in this primarily research project on soil C and N dynamics in relation to nitrous oxide and other GHG emissions. Several ORG-funded GHG studies between 2009-12 used sophisticated analytical methods to track net GHG emissions and conducted research mostly at LGU experiment stations; in other cases, farmers hosted trials but LGU scientists did most or all of the data collection and analysis.

OREI 2014-05341, University of Missouri

Organic weed management systems for Missouri

>This project explores integrated weed management systems for organic grain cropping systems, including innovative use of cover crops, no-till, and weed control strategies such as mechanical weed pullers and hot water for within-row weeds. The proposal mentions collaboration with farmers but gives no details of farmer involvement in planning, execution, outreach, or evaluation of project outcomes.

Some projects appeared to promise a high to very high level of producer/processor engagement in the Proposal sections on the Abstract (nontechnical summary, objectives, approach), yet progress and final reports evidence a much more limited producer role. This could reflect a shift in project emphasis away from farmer involvement, or underreporting of farmer roles in the CRIS abstracts. Examples include the following.

OREI 2007-01441, University of Minnesota

Sanitizers for organic production and processing

>The proposal mentioned an "active contribution of farmers," but the work consisted mostly of laboratory testing of experimental alternatives to chlorine bleach for sanitizing produce and prep areas.

OREI 2009-01311, Cornell University

Summer cover crops for weed suppression and soil quality in organic vegetables in the Great Lakes region

>On farm trials were planned, but were canceled due to unsuccessful results with initial trials on research stations.

OREI 2009-01333 and 2012-02236, North Carolina State University

Farmer-driven breeding of field crops, creating an organic plant breeding center

>Proposals emphasized development of a farmer-breeder network, and 1st year report noted farmer input via RAFI, but later progress reports appeared to focus on research station outcomes with wheat, soy, corn, peanut breeding for organic, and did not mention farmer-participatory breeding or farmer-scientist network. However, a separate, up to date summary from the PI clearly stated major farmer engagement in identifying breeding objectives, as well as hosting on-farm trials and participating in plant breeding itself. Thus, this project exemplifies substantial farmer roles that were not clearly reflected in reports in the CRIS database.

ORG 2010-03956, Iowa State University

Cover crops, amendments, reduced till, and C sequestration in organic systems

>Proposal indicated that farmers provided major input into proposal development, selection of cover crops and organic inputs used for experimental treatments, that they are on project advisory board, and that some field trials would take place in grower cooperators' fields. However, reports thus far focus on research station trial outcomes and make no mention of farmer trials or other aspects of farmer involvement.

ORG 2011-04944, University of Maryland

Cover crops, reduced tillage, soil quality, GHG

>A replicated, randomized complete block field trial at a working farm in Hawaii was proposed, but was not mentioned in reports through 2013 (year two of four-year project).

ORG 2011-04958, University of Missouri

C sequestration and N2O in 3 organic cropping systems

>The proposal included four farms hosting replicated trials with and without cover crops (three replicates per farm), with farmers hosting tours. However, none of this farmer engagement was mentioned in 2014 report (year three of four-year project). An interview with the PI and a research associate confirmed that farmers did indeed play a greater role than was reflected in the 2014 report.

Producer participation tended to be greater in OREI projects than ORG, especially in project planning and evaluation (Table 1). The ORG program is focused more on research into organic transition and into comparisons of environmental and agronomic performance of various organic and non-organic systems, whereas OREI is intended to integrate research, educational, and extension components, with the goal of achieving practical outcomes within the life of the grant.

The OREI/ORG difference was greatest during grant years 2009-2012, during which the ORG program prioritized comparative evaluation of greenhouse gas (GHG) mitigation, carbon (C) sequestration, and other ecosystem services of organic versus conventional, and tilled versus no-till or minimum till systems. These studies entailed high tech measurements of soil C and nitrogen (N) dynamics, C sequestration, and net GHG emissions in different farming systems. Analyses were conducted in the laboratory, in experiment station fields, and sometimes in farmer fields with project scientists conducting most of the measurements. In 2013, ORG awards funded research into a broader range of topics, and reports from four of the five projects indicated high levels of farmer involvement.

Table 1.
Producer and processor involvement in projects

	OREI (124)		ORG (65)		Total (189)	
	No.	%	No.	%	No.	%
Proposal development/application[1]	58	47	17	26	75	40
Research team [2]	82	66	33	51	115	61
On-farm research [3]	71	57	41	63	112	59
Results dissemination [4]	64	52	34	52	98	52
Project evaluation [5]	65	52	24	37	90	48
Overall level of producer/processor engagement: [6]						
Low	12	10	12	18	24	13
Moderate	21	17	15	23	36	19
High	55	44	26	40	81	43
Very High	34	27	12	18	46	24
Cannot estimate from CRIS abstracts	2	2	0	0	2	1

1 Indicates that organic farmers, ranchers, and/or processors played a significant role in identifying research needs and priorities, developing experimental protocols or outreach methods, reviewing proposal drafts, and/or otherwise helping to shape the proposal. In a minority of projects, producers were part of the proposal-writing team.

2 Indicates significant producer/processor role in conducting research, collecting and/or interpreting data, trying new tools and techniques, etc.

3 Indicates that producers hosted field trials. In most cases, the farmer also played a role in carrying out the experiment; in a few, the work was done mostly by project team scientists.

4 Includes hosting farm field days, farmer-to-farmer learning and networking, or other outreach activities.

5 Includes post-event surveys of producer and processor participants in project workshops, field days, courses, etc., as well as farmer evaluation of informational materials, decision tools, new varieties, and other project products.

6 Qualitative assessment based on consultant's reading of the project abstracts on CRIS database.

Dissemination of Project Outcomes

Most projects included a substantial outreach (extension and education) component, using multiple media to get their information to target audiences and to promote dialogue and/or participatory learning among farmers and other stakeholders, the project team, and other agricultural professionals. Projects communicated findings through multiple media, most often oral presentations, written materials, and farm tours and field days (Table 2).

Only a few projects appeared weak on outreach during the life of the grant; generally, these were proposed primarily as research projects with a limited outreach component. However, the practical outcomes of at least a few projects apparently became much less available to producers after grants expired. This may be related to a lack of "durable" project products such as written information sheets and manuals that remain in print or available on line, a lack of funding to maintain project websites beyond the life of the grant, or a failure of CRIS reports to provide links to project products. See "Valuable Outcomes Lost or 'Stuck on the Shelf'" below.

The establishment of eOrganic through OREI grants in 2007, 2009, and 2010 provided a major outreach venue for other OREI projects, which may help prevent the loss of valuable outcomes from USDA funded organic research. However, not all projects utilize eOrganic, and it can be more difficult to track down their practical implications without better reporting on the CRIS database.

Table 2.
Dissemination media utilized by projects as reported in CRIS abstracts

Media	No. projects	% of total
Written or recorded informational materials	155	82
Conference talks, workshops, minicourses, training events	176	93
Farm tours, farm field days, agriculture experiment station field days	125	66
eOrganic and organic resource area of eXtension	73	39
Project website (in some cases, via eOrganic)	80	42
E-mail list serve	25	13
Other[1]	20	11
Radio, newspaper, and other traditional news media	16	8
Other[2]	14	7

1 – University or NGO web sites not devoted exclusively to project, teleconferences, etc.

2 – Individual consulting (6 projects), roundtable discussions and farmer-researcher learning groups (three projects),

Target audiences were discussed in the proposal and progress/final reports of most projects; attention was paid especially to the latter to discern what audiences the project actually reached, and to what degree. Almost all OREI and ORG projects strove to communicate outcomes to organic and transitioning-organic farmers and ranchers; most also delivered findings to scientists, educators, Extension, and other agricultural professionals; and many also included students, the general public, and other audiences in their outreach. There was little difference between OREI and ORG in target audiences (Table 3).

Table 3.
Target audiences to whom project outcomes were disseminated

	OREI (124)		ORG (65)		Total (189)	
	No.	%	No.	%	No.	%
Producers	122	98	65	100	187	99
Processors	40	32	10	15	50	26
Scientists/researchers	110	89	53	83	164	87
Extension, NRCS, other service providers	94	76	48	74	142	75
Teachers, professors, other educators	47	38	25	38	72	38
Students (K-12, college, graduate)	54	44	35	54	89	47
General public (consumers, gardeners, etc.)	33	27	22	34	55	29
Other: 1	49	40	16	25	65	34
Policy makers, gov't agencies	20	16	7	11	27	14
Agricultural input & equipment suppliers	10	8	2	3	12	6
Marketers and distributors	7	6	1	2	8	4
Organic certifiers, NOP & NOSB	5	4	3	5	8	4
Non-profit/NGO representatives	7	6	1	2	8	4
Veterinarians	3	2	2	3	5	3
Lenders	4	3	0	0	4	2
Miscellaneous	8	6	4	6	12	6

1 Some projects disseminated outcomes to more than one "other" category; thus the sums for the sub-categories exceed totals for "other."

Project Products

OREI and ORG projects have developed a wide range of project products (Table 4). Again, owing to the nature of the source of these data (CRIS abstracts), some of the data in Table 4 may be underestimates. For example, while about two thirds of the projects specifically cited educational and extension materials ranging from extension bulletins to videos illustrating project outcomes, to longer publications such as manuals (such as the organic weed management manual, project OREI 2007-01417), it seems likely that nearly every project would have developed at least succinct written information sheets, brochures, or project summaries, either in hard copy or on line. Nearly half of project abstracts reported publishing articles in refereed scientific journals, a resource more often used by researchers and other agricultural professionals than by producers.

Table 4.
Project products

	OREI (124)		ORG (65)		Total (189)	
	No.	%	No.	%	No.	%
Educational and extension materials for producers[1]	78	63	44	68	122	65
User-ready decision tools for producers & processors	16	13	8	12	24	13
Producer-ready crop varieties & livestock breeds	13	10	0	0	12	6
New input materials or methods for organic systems	8	6	8	12	16	8
On-line courses and webinars available anytime	41	33	15	23	56	30
Academic course curricula[2]	16	13	12	18	28	15

Interactive website for info exchange/technical asst.	11	9	3	5	14	7
Networks[3]	38	31	6	9	44	23
Scientific publications in refereed journals	59	48	32	49	91	48
Other:	36	29	11	17	47	25
MS thesis or PhD dissertation(s) complete[4]	17	14	6	9	23	12
Full OREI proposal (for planning project)	11	9				
Miscellaneous[5]	8	6	5	8	13	7

1 Information sheets, Extension bulletins, reports, manuals, videos, etc.

2 Any level from elementary school through university undergraduate or graduate courses; figures include integration of project products or findings into existing curricula, as well as development of entire course curricula.

3 Linking producers with one another and with processors, distributors, public breeders, researchers, Extension, NRCS, and/or other agricultural professionals.

4 Likely an underestimate

5 Examples: field detection kit for Asian Soybean Rust (disease), new research/measurement protocols, organic demonstration site, new student farm, mentoring program, white paper on climate change.

Relatively small numbers of projects yielded products such as decision support tools, farmer-ready crop varieties, and new materials, methods, and integrated strategies for managing pests and diseases. No new animal breeds were developed or released through OREI or ORG projects. Since these products represent relatively "major" research advances, it is not surprising that only a minority of OREI and ORG funded projects have yielded such outcomes within a 2-5 year grant cycle. Note that the figures in Table 4 for decision tools, crop varieties, and new materials and methods do not include projects that made significant progress toward such products but not yet farmer-ready (for example, "advanced breeding lines" or variety trial outcomes that lay groundwork for new variety development).

Over one-quarter of projects created online webinars, short courses, and other training materials posted on publicly accessible web sites, thereby making project outcomes and products available to producers and other stakeholders beyond the life of the grant. This kind of product was much more frequently provided through projects funded from 2009-2014 than earlier-funded projects, which likely reflects the improvement in user-friendliness of webinar and other online information technologies.

Twenty-eight projects (15%) provided new material on organic production and farming systems for inclusion in curricula for college or university courses in agriculture, horticulture, agroecology, organic farming systems, or environmental sciences. A few of these projects developed entire course curricula, and a few also provided curricular materials for elementary, middle, and high school levels. A number of projects engaged graduate, undergraduate, and sometimes high school students in research, providing professional development through summer internships or longer-term engagements. Masters or PhD students completed their theses/dissertations based entirely or primarily on OREI- or ORG-funded work in at least 23 projects (12%).

At least 44 projects (23%) established new networks or expanded and strengthened existing networks linking growers with one another and/or with Extension, researchers and other agricultural professionals for mutual learning, exchange of information and ideas, and/or resource sharing. A few networks engaged processors, distributors, and/or marketers as well. For example, OREI 2009-01366 *(Building organic farmer capacity to produce high quality bread wheat*, University of Maine) developed a "vibrant network of farmers, millers, and bakers" as part of an integrated project with the goal of establishing an organic bread industry on locally produced organic wheat.

A few projects also developed interactive websites through which project participants, farmers, and other stakeholders can provide and exchange information related to the project topic. Examples include nationwide efforts to develop organic management strategies for two invasive pests: the brown marmorated stink bug (planning project OREI 2011-01989 and full project OREI 2012-02222), and spotted wing drosophila (planning project OREI 2014-05378, full project funded in 2015). Both planning projects used the website to develop full proposals and to make current state-of-the-art information on organic management of these pests publicly available.

Other project products included full OREI proposals arising from OREI funded planning grants (14 proposals submitted, 6 funded); new tools for field research measurements (3 projects), a new farmer mentoring program, a new student organic farm, and at least one new demonstration farm site.

All projects that released new crop varieties to farmers were funded by OREI, and a large majority of grower and grower-professional networks were established with OREI funding. These trends probably reflect the fact that 42 OREI projects included crop breeding and/or variety evaluation (versus only nine for ORG); many of these took a farmer-participatory approach and established strong farmer-breeder and farmer-scientist networks. Other differences between OREI and ORG in project products were small (Table 4).

Project Impacts and Benefits: Return on Investment

An attempt was made to assess project impacts and benefits based on abstracts available through CRIS with this important caveat: *actual impacts and benefits can be accurately evaluated only through interviews with project participants and with farmers and other stakeholders in the project's intended audience*. For this initial analysis, the intent (expressed in the proposal) and actual outcomes reported were taken into account in assessing categories of impacts (production, economic, environmental). Degree of impact and project beneficiaries (producers, processors, agriculture professionals, etc.) were assessed primarily on what was actually accomplished and reported. For the 2013 and 2014 grant years, assessments of likely project impacts were based on content of the proposal. For projects whose proposal and reports suggested an as-yet unrealized potential for substantial impacts, of impact was rated as "potential" rather than low, medium, or high.

Actual or potential impacts of most projects in both programs appeared substantial, with a strong focus on improving or expanding operations (Table 5). Impacts of nearly two-thirds of the projects included farm profitability, and half included environmental impacts ranging from improved soil quality and reduced pesticide use to evaluations of net GHG impacts of different farming systems. There was a trend toward greater emphasis on economic benefits in the OREI program and a greater emphasis on environmental benefits and ecosystem services in ORG.

At least 168 projects (89%) yielded benefits to producers, ranging from information related to organic production, profitability, and/or conservation; to more concrete benefits such as decision tools, new pest management strategies, or new seeds. A similar number (160 projects, 85%) clearly benefited researchers, extension personnel, and/or other agricultural professionals, ranging from new research questions or crop breeding lines for organic systems, to practical information that improves their capacity to assist organic producers. Forty projects (21%) offered benefits to organic processors, ranging from information on locally available organic farm products, and on quality of existing or new crop varieties, to improvements in food safety and local or regional networks with organic producers.

Table 5.
Project impacts

	OREI (124)		ORG (65)		Total (189)	
	No.	%	No.	%	No.	%
Improve or expand operations	105	85	50	78	155	82
Enhance profitability	85	69	35	55	120	64
Improve conservation or environment	53	43	42	65	95	50
Use of practical outcomes 1	57	46	22	34	79	42
Overall level of project impact[2]						
Low	5	4	3	5	8	4
Medium	7	6	6	9	13	7
High	42	34	17	27	59	31
Very high	28	23	8	12	36	19
Potential[3]	36	29	24	38	60	32
Cannot evaluate	6	5	7	11	13	7

1 Includes projects whose reports documented use of project products or outcomes by farmers, or whose products and outcomes are clearly ready for practical application and are available to producers.

2 Qualitative assessment based on review of the abstracts, and, additional information gathered through interviews, web site visits, etc., for 42 projects listed earlier. Not intended for statistical analysis.

3 These are projects for which outcomes and findings are not yet ready for application by farmers or processors, but which have the potential for significant impacts in the future. Projects that were just getting started (awarded in 2013 or 2014 grant years) were rated "potential" except when significant impacts appear imminent or are documented in the latest report.

Students benefited substantially from internships and other learning opportunities through some 40 projects (21%), while another 21 projects (11%) directly benefited the general public through improved nutrition, food safety, and information about organic farming systems and products. While community scale benefits may accrue from many of the projects, it was difficult to assess this impact for most projects. In a few cases, clear and direct benefits were noted for rural communities (10 projects) or urban communities (3 projects). Again, direct interviews with a wider range of stakeholders and a sampling of the general public in the region of a given project is the best way to assess community level benefits.

Cost-Effective Projects/Success Stories:

A number of projects seemed especially cost-effective in terms of practical outcomes and impacts per dollar invested. Many of these utilized simple field methods combined with sound science to develop practical information and tools, and many also engaged farmers in participatory plant breeding or other research activities. Some larger projects used more sophisticated methods effectively to achieve valuable practical outcomes or build a solid foundation for future work, thereby representing a good return on investment. Examples include the following:

ORG 2002-3799, University of Wisconsin, $140K

Potato Clones for Organic

>Built network of producers engaged in variety evaluation for organic systems, which grew into a breeding and organic disease-free seed production network under a continuation grant OREI 2009-01429 ($541K) and other funding. For additional information, see "A few cost effective projects in greater depth" below.

ORG 2002-03805, Washington State University, $164K

Organic Transition in Organic Dryland Grain Production

>On a budget of just $164 K, this project evaluated nine different crop rotations during transition to organic, and generated a lot of information with practical applications for organic producers in this region. Successes include the use of legume green manures and forage crops in the rotation to enhance N nutrition and yields in dryland wheat, which gave wheat yields as high as 65 bu/ac. For additional information, see "A few cost effective projects in greater depth" below.

ORG 2004-05169, Cornell University, $518K

Transitioning Dairy

>Developed a rapid, accurate method to detect six major foodborne pathogens in milk (organic or conventional), which is now in widespread use across the Northeast.

OREI 2004-05205, Cornell University, $894K

Organic Seed Partnership

>This partnership built farmer-breeder networks around five LGU-linked "hubs" across the US, engaged 217 farmers in on-farm variety evaluation and/or crop breeding, and yielded 26 new vegetable varieties that addressed organic producer needs and priorities. For comparison, development of a single patented GMO variety may entail a $50-100M investment.

ORG 2007-01391, Washington State University, $74K

Flea Beetle Control Demonstration

>Eight organic farms hosted and conducted trials of seven different tactics for control of flea beetle in organic crucifer crops, identified several that were effective and several that were not. The outcomes of this project have been implemented by other growers in the region. For additional information, see "A few cost effective projects in greater depth" below.

OREI 2007-01411, Oregon State U – eOrganic Extension for Organic Agriculture , $612K

and

OREI 2009-01434, Oregon State U – eOrganic Extension for Organic Agriculture , $317K

>These two projects, funded at $612K. and $317K respectively, launched and developed the eOrganic Community of Practice, which has become an important outreach venue for OREI, ORG, and other organic research teams.

OREI 2007-01417, Michigan State University, $106K

Integrated weed management – fine-tuning the system

>The project team developed a 132 page manual on organic weed management, described in more detail under "Stakeholder engagement".

OREI 2007-01418, Michigan State University

Integrated Organic Apple and Pork Production

>Excellent preliminary results with pigs grazing in orchards to clean up apple drops (codling moth and curculio damage significantly reduced, hogs adequately nourished). Project budget just $33K. Additional research is needed to fine tune system for extension to farmers, but this initial finding generated considerable interest among organic pork producers and orchardists.

OREI 2009-01343, Organic Seed Alliance, $46K

Organic seed systems symposium

>The Organic Seed Alliance held a symposium on organic seed production and crop breeding needs, and issued a State of Organic Seed Report & Action Plan through an iterative process of farmer input and review at Symposium and via web site. The Report is still available at the web site and is scheduled for a major review and update every five years.

OREI 2010-01869, Utah State University, $1.02M

Organic milk production & birdsfoot trefoil

>In a report at the 2015 Organic Agriculture Research Symposium in LaCrosse, WI (OREI 2014-05388), the PI presented excellent results with a tannin-containing forage (birdsfoot trefoil) for pastured dairy. BFT pasture gave higher forage production in summer, higher milk production and higher omega-3 levels in dairy products compared with cool season grasses, which in turn gave better quality dairy products (higher omega-3) than confinement dairy. This could be a substantial breakthrough for dryland organic pastured dairy.

OREI 2009-01366, University of Maine, $1.32M

High quality organic bread wheat production

>This was a larger grant, but it launched an integrated approach to building a locally-based, sustainable organic bread industry in New England. Project activities range from wheat breeding and agronomic practices to optimize organic production and baking quality, to development of a "vibrant network of farmers, millers, and bakers." The team received $999 K in additional OREI funding in 2015 to continue and expand this work.

OREI 2009-01415, University of California, $372K

Nutrient cycling & N management on organic farms

>This project undertook in-depth exploration of soil-plant-microbe N dynamics using sophisticated methodologies, yet engaged farmers in landscape scale analysis to help identify factors that favor "tight" N cycling and effective crop N nutrition despite low soil inorganic N levels (and hence low risk of NO3- leaching and N2O GHG emissions). Based on outcomes, farmers implement changes to improve N cycling efficiency.

OREI 2010-01899, Farmers Legal Action Group, $109K

Organic Farmers' Guide to Contracts

>FLAG completed and published an Organic Farmers' Guide to Contracts including a toolkit to help producers review and negotiate contracts, and discussion of 100 different types of contract provisions. The goal is to promote equitable contracts that benefit farmer and buyer equally; many distributors, processors, retailers apparently supportive.

OREI 2010-01916, South Dakota State University, $44K

Organic bison planning grant

>As a result of this planning grant, the Flandreau Santee-Sioux Tribe (FSST) initiated a transition to organic bison ranching in 2011 with Minnesota Crop Improvement Association as the certifier; re-seeded and restored pasture in fall 2011; and undertook selection of bison breeding stock for organic calf production. In addition, South Dakota State University collaborated with Intra Tribal Bison Council (ITBC) in pilot projects to assess acceptance of bison meat in diets of at-risk tribal populations (diabetic, youth, elderly); and to provide bison to FSST until their organic bison operation is up and running. Although the full proposal was not awarded and the tribe could not complete the transition to organic, substantial pasture management and herd health practices have been implemented.

OREI 2010-01944, University of Vermont, $760K

Organic dairy tech training for service providers

>This project's training and outreach activities over 62,000 service providers by the end of 3rd year of a 5-year project. "Durable" informational products included recorded videos and an on line course with a second course planned. Lack of a 4th year report (2014) on the CRIS database made it hard to assess the full extent of project impact. The project team identified severe economic challenges to organic dairy in the proposal, and it would be valuable to determine how effectively project outputs have enhanced economic sustainability of organic dairy in the Northeast.

OREI 2010-03392, Oregon State University, $2.3M

Northern Vegetable Improvement Collaborative

NOVIC accomplished a tremendous amount of classical breeding, variety evaluation, and organic seed production for vegetable crops; developed robust farmer-scientist breeding networks around four hubs across the northern US; and maintained excellent farmer engagement and extensive outreach. Continuation funding was awarded in 2014, thereby providing some of the long term investment that plant breeding requires.

OREI 2011-01982, Northeast Organic Farming Association, NY, $50K

Organic Research Symposium

>This project facilitated effective dialog among farmers and researchers as equals. In a follow-up survey, 57% of the 153 attendees implemented significant changes as a result of what they learned at the symposium; 68% made new connections.

Preliminary Findings: follow-up needed to realize return on investment

Many projects have given promising preliminary outcomes to date but require additional research and development in order to realize their potential for delivering farmer-ready solutions, practices, decision tools, products, or seeds. This is the nature of research at the cutting edge of an expanding field like organic agriculture. Projects that appeared to give this kind of intermediary outcome include:

- Completed projects whose final reports indicate substantial progress toward key organic research objectives, but have not yet yielded farmer-ready products or outcomes. For example, crop breeding often requires more than 3-5 years to yield farmer-ready public varieties, yet the initial grant could yield an important foundation in the form of advanced breeding lines with key traits for organic systems. Many projects that tackled especially complex issues such as greenhouse gas emissions and carbon sequestration in different farming systems, or integrated approaches to soil health, nutrient, and weed management, also gave intermediary results that provide a basis for further research, rather than farmer-ready guidance, decision tools, or other products.
- Planning projects that developed strong hypotheses and submitted full OREI proposals that addressed top priority organic production challenges, but were not funded.
- Projects that tested valid hypotheses but used non-optimum experimental treatments or protocols that did not reflect best organic management, or that contradicted the spirit or letter of USDA organic standards.
- Projects still in progress at the time of the analysis, or for which reporting on the CRIS database or via eOrganic and other venues was not up to date.

Sufficient follow-up research and development is needed for these endeavors projects to realize the potential benefits, and lack of follow-up could represent lost potential. Examples include:

ORG 2004-05207, University of California

Functional Biodiversity on an organic farm

One preliminary outcome is that, under certain conditions, green manures and other organic inputs can cause large bursts of N2O emissions in organic systems. This is such a powerful greenhouse gas that one such event could seriously compromise the net GHG mitigation benefits of the farming system. Two other projects also showed N2O bursts from organic systems when high-N organic inputs immediately preceded heavy rainfall (ORG 2011-04958, ORG 2011-04952). These findings merit follow-up to develop practical guidelines for avoiding this unintended consequence of organic amendments.

OREI 2005-04426 and OREI 2010-01884, USDA ARS Southern High Plains

Small Ruminant Parasites

These projects made progress toward integrated parasite management in organic small ruminants, but more research is needed to develop practical strategies and farmer-ready protocols. Notably, the project team documented substantial genetic variation in parasite resistance in sheep sires, and estimated that breeding and selection for the resistance trait could reduce the need for parasiticide treatments by 75 to 100%. This would be a major breakthrough for organic, as small ruminant parasites are the #1 barrier to organic production of these livestock. For additional information, see "A few cost effective projects in greater depth" below.

OREI 2005-04497, University of Nebraska

Organic systems across Nebraska agroecoregions

OREI 2007-01437, University of Nebraska

Wheat Breeding for Organic

The first project identified wheat breeding objectives and priorities for organic producers; the second project evaluated at least 56 wheat varieties and breeding lines for performance under organic management and milling/baking/nutritional qualities, with ongoing farmer and processor input on breeding objectives. While no new varieties were developed, significant variation among varieties in priority traits was documented, providing a foundation for future breeding efforts.

ORG 2006-02030, Cornell University

Optimizing biological N fixation

This project made important progress toward understanding N fixation and N dynamics in legume-nonlegume cover crop mixes but not yet ready for on farm application.

ORG 2006-02057, Washington State University

Developing wheat varieties for organic

There are 20 varieties "being considered for release" and the project also developed an "organic ideotype" for wheat breeding. Additional funding is likely needed to complete the process of developing improved wheat varieties for organic.

ORG 2007-01380, Ohio State University

Grafting Organic Vegetables

This project provided breeding for more resistant rootstocks with good scion compatibility and good fruit quality.

OREI 2007-01418, Michigan State University

Integrated Organic Apple and Pork Production

This project included pigs in orchard clean up apple drops to reduce pest levels. As noted above (Cost effective projects, success stories) promising preliminary results attracted the interest of organic pork and apple producers; a modest additional investment in follow-up work to refine the system could lead to practical applications.

OREI 2009-01340, Cornell University

Organic grain and vegetable research and extension

This project is itself a continuation of OREI-2004-05218; additional research is apparently needed on four grain cropping systems and four vegetable cropping systems before farmer-ready practical applications. The project website was last updated in 20

OREI 2009-01415, University of California

Nutrient cycling & N management on organic farms

Quoting the proposal: "Developing new plant-soil N testing tools based on plant gene expression, soil bioassays and chemical properties would require substantial effort over the next decade by many stakeholders. This project proposes to explore the potential of this approach, rather than provide end products." The overall hypothesis is that this approach can lead to better N management tools for organic producer than those offered by current approaches to N management on conventional farms, but the investigators did not expect to reach the goal within the life of this grant. The final report noted the project was extended by two years and methods were changed/improved based on initial findings. Farmers are already implementing changes based on findings to date. A few more years' research with strong farmer participation could yield breakthrough practical applications. There is also the need for additional research to expand the inference base beyond California irrigated tomato production.

OREI 2010-01870, Texas A&M University

Cultivars & IPM for organic cotton

This Cotton Improvement Program (CIP) addresses multiple breeding goals: drought, salinity, pathogens, nematodes, and thrips. This project focused on thrips resistance/tolerance and significant progress was made, with one cultivar and three breeding lines released. Additional funding is warranted to realize the full potential of work done to date.

OREI 2010-01904, Michigan State University

Organic dry bean production

This project includes a strong breeding component, and has developed advanced breeding lines of dry bean with enhanced nitrogen fixation efficiency and/or other traits valuable to organic producers.

OREI 2010-01965, Washington State University

C sequestration and ecosystem services from organic

This project is refining and evaluating a tool (OFoot) to estimate the ecosystem services and net Greenhouse Gas footprint of organic farms. The tool shows promise in initial testing, but is not ready for wide use as of the latest available report in 2013, the third year of this five year project).

ORG 2010-03957, University of New Hampshire

GHG in transition to organic dairy

The proposal focused on a potentially powerful tool for estimating the GHG footprint and water quality impacts of dairy farms in the Northeast, based on a C and N cycling model to be improved and validated at two UNH dairies, GIS soils and climate data, and farm specifics. However, a lack of progress or final reports on the CRIS database make it impossible to determine whether the new tool has been developed and implemented, or whether more research and development is needed.

OREI 2011-01942, University of Minnesota

Improving soybean, dry bean, rhizobia for organic

Significant progress was made in breeding soybeans and dry beans for root vigor, N fixation, and other traits for organic systems; now at F5 generation. A few more years are needed to develop farmer ready varieties.

OREI 2011-01962, USDA ARS

Carrot improvement for organic agriculture

The project yielded practical findings on existing cultivars, demonstrated wide heritable variation in priority traits, and developed new germplasm ready for seed increase. Additional work is likely needed to fully realize the potential for developing farmer-ready varieties with superior seedling vigor, weed tolerance, flavor, and other market traits.

ORG 2011-04948, Washington State University

GHG, soil quality, and organic reduced till

The final report for this three year project was submitted but the project outcomes could not be ascertained.

Several project teams engaged in plant breeding for organic systems; integrated approaches to soil, nutrient, and weed management; and some high-priority challenges like organic management of orchard replant disease and gastrointestinal nematodes in sheep and goats, and poultry nutrition have received continuation funding and have successfully brought projects closer to completion. Examples include:

ORG 2005-04474, University of Maine

Reducing Off-farm Grain Inputs in Organic Dairy

In this case, the project team raised funds from a different program to follow through on the initial research findings regarding on-farm forage and silage production.

ORG 2007-03671, University of Florida

Crop Diversification and Beneficials in Humid Tropics

This is a continuation of OREI 2006-02047. The team is making gradual progress toward practical outcomes on insect pest management; "negative" results thus far on weeds, pest nematodes, soil quality and nutrients.

OREI 2009-01325, University of Vermont

Organic apple research and extension

This is a continuation of OREI 2006-02051; practical project outcomes widely disseminated.

OREI 2009-01371, University of Nebraska

Improving organic systems and ecological impacts

A continuation of OREI 2005-04497 and OREI 2007-01437), these projects address organic production in each of three agro-ecoregions in Nebraska. The 2009 project continued the agronomic research on wheat, corn, and soy production with substantial farmer involvement, and conducted some limited variety evaluations. However, it did not follow through on wheat breeding for organic systems, for which the earlier projects included substantial foundational work.

OREI 2009-01429, University of Wisconsin

Organic certified seed potato production

This is a continuation of ORG 2002-3799, University of Wisconsin, Potato Clones for Organic.

OREI 2009-01434, Oregon State University

Continued development of eOrganic

This is a continuation of OREI 2007-01411, Oregon State University, eOrganic Extension for Organic Agriculture.

OREI 2012-02236, North Carolina State University

Organic plant breeding center

This is a continuation of OREI 2009-01333, North Carolina State University, Farmer-driven breeding of field crops. The second project has already released several new corn, soy, and wheat varieties.

ORG 2014-03386, Oregon State University

Non-antibiotic control of fire blight in apple and pear

This is a continuation of OREI 2011-01965, Oregon State University, Development of non-antibiotic strategies for fire blight. The second project brought the team closer to practical application.

OREI 2014-05340 USDA- ARS

Breeding non-commodity corn for organic

This is a continuation of OREI 2010-02363, USDA ARS Ames IA, Public corn breeding for organic. The 2010 project developed strong farmer-university public breeder-seed company networks in several regions. In their 2014 report, project PIs stated that another five years were needed to realize the full benefits. In a 2015 presentation, one project co-PI announced a substantial breakthrough in breeding field corn for organic systems; thus, the award of OREI 2014-05430 is an important "success story" for continuation funding.

OREI 2014-05402, Oregon State University

Northern Vegetable Improvement Collaborative II

This is a continuation of OREI 2010-03392. The new project will allow more promising breeding lines to be advanced to public cultivar development and release.

A few endeavors have been dropped, including planning grants with excellent hypotheses that did not receive full funding, as well as full projects that apparently ran out of funds before farmer-ready outcomes could be achieved. These appear to represent lost investments. Specific examples include the following.

OREI 2009-01327, Washington State University

Organic no-till – planning grant

Farmers who participated in the planning symposium and/or subsequent focus groups were so enthusiastic about the topic and practices discussed that they implemented changes (e.g., reduced tillage) on their farms, and continued to network with each other and project agriculture professionals beyond the life of the grant. Additional focus groups and proposal planning followed.

OREI 2009-01332, Michigan State University

Perennial wheat variety development

This outside-the-box concept, originated at Wes Jackson's Land Institute, could provide a vital tool for soil conservation and improvement in semiarid grain producing regions. Although the current breeding lines do not yet fully meet yield and net financial return criteria, substantial environmental benefits (C sequestration, soil and water quality) were demonstrated, and project participant farmers were eager to continue this endeavor. The team did not receive additional OREI or ORG funding, and additional investment in this promising production-conservation strategy seems warranted.

OREI 2010-01916, South Dakota State University

Organic bison planning grant

The team submitted two proposals (2011 and 2012) that were not funded, yet the planning process itself led to substantial outcomes (see Cost Effective Projects/Success Stories). The report did not include any details of the proposal, but the fact that the planning process itself led to substantial changes in herd and pasture management suggests a strong team that merits funding for a full OREI project.

OREI – 2011-02005, Oregon State University

Functional agricultural biodiversity planning grant

This planning grant built upon and strengthened a regional (OR, WA, CA, ID) network with very strong farmer leadership on Functional Agricultural Biodiversity; held stakeholder meetings to identify key constraints to farmer implementation of functional biodiversity for resource conservation and improved production, and developed an excellent proposal based on a solid foundation of four years' work. Not funding the full proposal seems like a missed opportunity to advance this important topic.

Projects with non-optimum protocols may merit follow-up research with experimental systems more representative of best organic management. Examples include the following.

ORG 2008-01284, Iowa State University

Reduced till cover crop systems for C sequestration

The project evaluated continuous no till using single species cover crops in organic systems. These treatments did improve soil quality substantially, but weeds flourished and yields suffered badly. Continuous no-till is generally not practical in organically managed annual crop rotations. High diversity cover crops are known to give better outcomes including better weed suppression, higher biomass, and more diverse soil food web activity than single species covers. Treatments entailing reduced tillage, rotational no-till, or ridge till, combined with cover crops of two or more dissimilar but phenologically matched species, might give better yields and weed control while still enhancing soil quality.

OREI 2009-01311, Cornell University

Cover crops for weed suppression and soil quality

The project team tested sudangrass, mustard, and buckwheat singly as late-summer weed suppressing cover crops in northern locations (MI, Il, NY), and were so disappointed with outcomes (inadequate weed control) that they canceled on farm trials. Cover crop mixes of three or more species from grass, and at least two broadleaf plant families, are likely to occupy weed niches more completely than either grass or buckwheat alone. For example, the complementary plant architecture of sudangrass, mustard, and buckwheat would likely have shaded the ground and occupied the soil profile more quickly and thoroughly than any one alone. The addition of forage soybean could further enhance efficacy by ensuring good broadleaf coverage in areas of lower N availability.

OREI 2009-01405, University of Hawaii

Vermicompost for organic seedling production media

The hypothesis is that locally produced vermicompost is a valuable amendment for organic seedling production. Treatments started with a peat-perlite mix with or without liquid organic fertilizer, and a rate series of 25, 50, 75 and 100% (by volume) vermicompost (the balance = peat-perlite) without liquid fertilizer. Existing research and farmer experience has shown that optimum vermicompost rates are 5-10% by volume, with reduced growth at rates of 20% or more, possibly because of high salt content. Also, the baseline mix is devoid of biology and nutrients and sets a low bar for a "successful" treatment. Apparently, the investigators discovered that a lower use rate is more economically feasible: ". . . the volume of vermicompost that can be feasibly employed in seedling production is low due to its cost. However, the unique properties of the material can be leveraged to enhance the performance of other less-optimal, but less expensive local materials like green waste based composts." Had the project started with a vermicompost rate that previous research had found optimal and looked into other local resources as co-ingredients, progress might have been faster.

ORG 2009-05488, North Carolina State University

Water quality in vegetable systems

The goal was to evaluate nutrient loss and attendant impacts on water quality from organic versus non-organic production systems, each with conventional versus conservation tillage. However, the cropping system was continuous sweet corn with crimson clover winter cover (organic) and continuous sweet corn with wheat cover (conventional). Planting the same crop year after year does not comply with USDA National Organic Program (NOP) requirements for crop rotation and biodiversity, and also does not accurately represent most organic production systems. The "organic" system included poultry litter applications to deliver 180 lbs. N/ac, which is virtually guaranteed to aggravate phosphorus (P) overloads and losses via runoff, which were documented. The "organic" system suffered severe (65%) yield losses regardless of tillage, so that the yield: water pollution ratio was best by far with conventional inputs and no till. Because the protocol does not accurately represent organic production systems as defined by NOP or as practiced by most organic and sustainable growers, results gave an unrealistically negative picture of organic impacts on water quality.

OREI 2010-01943, Idaho State University

Host plant choice by Colorado Potato Beetle and variation in yield loss to CPB among potato varieties

Overall, this was an excellent and cost-effective project. The one concern is that trials were conducted on a site previously used for CPB research, and, as a result, pest populations were extremely high. Varietal performance and attractiveness to CPB might have shown more substantive differences in organic production areas with more typical CPB levels. For additional information, see "A few cost effective projects in greater depth" below.

OREI 2010-01945, University of Arizona

Food safety and quality of organic greens

Mostly, the hypothesis (plant based antimicrobials as organic-friendly alternative to chlorinated wash water, etc.) is excellent, as was the training and outreach aspect of the project. However, the team did not address one concern with treating food with "edible antimicrobial films." Even if based on natural essential oils allowed by NOP, what is the impact on the essential microbiome in the human GI tract of consuming produce treated with an "edible antimicrobial film" strong enough to kill off E coli 0157H7, Salmonella, Listeria, etc.? There was brief mention of evaluating both health benefits and health detriments of proposed treatments, but no details addressed the concern about antimicrobial films and human microbiomes.

ORG 2011-04944, University of Maryland

Cover crops, reduced tillage, soil quality, GHG

This project included production, economic, and environmental evaluation of cover crop-based reduced till systems for organic vegetables. The crop rotations proposed are low diversity and may not meet NOP requirements: eggplant-pepper-eggplant with winter cover of crimson clover and tillage radish each year (MD) and cucumber-lettuce-cucumber (HI). MD rotation diversified a bit to eggplant-corn-eggplant, and winter cover of rye-clover-radish. However, with the same disease prone vegetable crop twice in a three-year rotation (eggplant in MD, cucumber in HI), probability of horticultural and economic success is compromised, and the systems still may not fully meet NOP criteria for the Rotation standard.

ORG 2012-02978, North Carolina State University

GHG mitigation potential of organic versus conventional production systems

This project included intensive analysis of greenhouse gas emissions, C sequestration, soil C and N dynamics, and certain parts of the soil food web (mycorrhizal fungi, arthropods) in six farming systems: conventional tilled, conventional no till, conventional "long rotation," organic tilled, organic reduced till, organic "long rotation." Higher mycorrhizal activity was reported in conventional than organic systems. However, the conventional systems received 150 lb. N, 30 lb. P, and 50 lb. K per acre annually, while the organic systems received five tons/ac chicken litter, analysis not stated. Such applications may have delivered as much as 100 lb. P/ac annually, which could have suppressed mycorrhizal activity. This much chicken litter is also excessive for many soils, and could even be out of compliance with state nutrient management guidelines for some soils. Experimental outcomes would be more relevant if inputs for the organic systems were adjusted to give same P input as conventional, with the option of supplementing N with legume cover crops and/or feather meal or other organic N fertilizer.

Valuable Outcomes Lost or "Stuck on the Shelf"?

Some projects apparently generated valuable information, tools, or products for farmers to use, but it was not clear from reports available through the CRIS abstracts whether these outcomes are reaching farmers adequately to realize their potential benefits. Without adequate funding or support for outreach and education efforts beyond the life of the original grant, some of these valuable products or findings may become or remain inaccessible to farmers and other stakeholders.

The eOrganic website and Communities of Practice (OREI 2007-01411 and 2009-01434 , Oregon State University) has provided an important new venue for dissemination of OREI, ORG, and other organic research outcomes and products in readily accessible forms. Provided that the eOrganic network and eXtension websites continue to receive adequate ongoing support, these products, tools, and outcomes should remain publicly available indefinitely beyond the time spans of the projects that generated the products. At least 60 OREI and ORG projects since 2007 have utilized eOrganic. In addition, some other projects have posted outcomes and practical tools on university and other websites, or made them available through other venues. In many cases, project reports on the CRIS database did not provide enough information on outcomes and products for farmers or other stakeholders to find and utilize them.

Thus, while important outcomes of a few projects may indeed be lost, more often it is a matter of knowing and using the correct venue to find them. Improved and consistent reporting on CRIS, with key outcomes and links to products and tools listed for each project, would help both farmers and agricultural professionals to locate both practical tools and intermediary findings, in addition to facilitating future analyses of USDA organic agricultural research.

Some examples of projects whose practical outcomes may not be as widely available (or at least could not be located within the scope and time budget of the current analytical project) include the following.

ORG 2003-04618, University of Illinois

Organic Transition Strategies – Weeds, pests, fertility

Many publications presenting significant project outcomes with practical value are listed in "New Agriculture Network" at http://www.new.ag.msu.edu, but this website is no longer available, as the coordinator of the network has retired.

ORG 2004-05204, University of Minnesota

Soybean aphid suppression by rye cover

Rye cover crop reduced aphid levels and sometimes increased soy yields, but it was unclear from the abstract to what extent this information reached growers.

OREI 2005-04473, Michigan State University

Partnering for Organic Ag in Midwest

This project was highly effective in developing vital practical information through farmer/agriculture professional dialogue (see above in Farmer Engagement section). However, while these teleconferences were recorded on the New Agriculture Network, much of this information is no longer available because the network itself is no longer active and the web site is closed.

OREI 2005-04497, University of Nebraska

Organic systems across Nebraska agroecoregions

Several key practical outcomes were communicated via field days, presentations, and e-mail list serve during the project, but it was not clear from the CRIS abstracts whether these outcomes remain available at this time through written info sheets or other media.

OREI 2006-02014, Ohio State University

Transition Strategies – weeds & soil quality

Practical information on cover crops, crop diversity, and nutrient management was generated but apparently not delivered to producers; perhaps PIs believed that more research was needed before widespread dissemination.

OREI 2006-02018, University of Florida

Organic rabbiteye blueberry production

This project generated important practical information on fertility, mulching, and pest management, but it is not clear whether, how, and to what extent this information reached producers.

ORG 2007-01391, Washington State University

Flea beetle control demonstration

Field days during this project reached just 93 people. Handouts and the web site reached more, but the website, while still available, provides minimal data, and not the substantive practical findings summarized in the Abstract.

ORG 2007-01405, University of Maine

Soil and plant health, pests, diseases

More research may be warranted, but significant practical outcomes regarding mustard green manure and microbial products for disease management were obtained, yet dissemination was either minimal or underreported.

OREI 2009-01361, USDA ARS Beltsville

Nutrient management in organic grains

The final report is missing from CRIS database. The latest progress report in 2012 did not document "durable" project products that are widely available or used currently.

ORG 2009-05499, Iowa State University

Organic practices, crop rotation, and water quality

Research revealed consistent water quality benefits of diversified organic crop rotation (corn-soy-oats-alfalfa, or grass-legume sod) versus conventional corn-soy over four years. Project reports document only one field day and three conference presentations reaching 328 people; no extension bulletins, webinars, handbooks, videos, or other means to deliver these important findings to producers after the end of the grant were listed.

Cost-effective projects in greater depth

Example A: Potato variety evaluation and organic potato seed production – Wisconsin and Upper Midwest, Idaho

ORG 2002-03799, D. Rouse, University of Wisconsin, $140,144, August 2002-July 2005

Identification and Characterization of Potato Clones for Organic Production systems

In this project, some 500 clones of potato (Solanum tuberosum), were evaluated for yield and quality in organic systems, and disease and pest resistance. Clones evaluated included named cultivars of all colors (red, blue, yellow, white) grown in organic and niche market systems, heirloom varieties, advanced breeding lines, and a few widely grown 'mainstream' varieties for comparison. Variety evaluation took place over three seasons at two organically managed sites, and a third location at which mechanisms of disease and pest resistance and nitrogen response were examined.

The Approach section of the abstract described a low-tech approach to clone evaluations during the second and third year: "Most of these evaluations require only careful and timely observation with appropriate record keeping. A few of the evaluations require rudimentary facilities for tasks such as evaluating internal defects and tuber condition following storage, or for cooking quality of the material." The one "high tech" aspect of the project was a tissue culture technique to free certain cultivars from viruses in the event that certified virus-free seed could not be found. Emphasis on simple methods allowed the team to get a lot done for a very modest budget. In fact, the number of varieties and breeding lines actually evaluated was more than double the number stated in the proposal (200).

The project identified significant differences among clones in yield and quality, with many giving satisfactorily high yields (200-300 cwt./ac) similar to conventional potato production in the upper Midwest. Best performers cited in the abstract included red (Chieftain, Alaska Red, NY129 and Colorado Rose, and Papa Cacho fingerling), yellow (Satina, Saginaw Gold, and Mrs. Meohler's Yellow), white (CF7523-1 and Nipigon), and blue (Adirondack Blue) cultivars. Some heirlooms gave very high yields, but had quality problems such as scab, deep eyes, and irregular shape. Significant differences in attractiveness to Colorado potato beetle were also documented.

Classical plant breeding with potato appears a bit more complicated at first, because this species propagates primarily by asexual means (tubers), forms relatively few mature seed balls, and has small, delicate seedlings that require a couple seasons to become full sized tuber-bearing plants. However, for less than $150,000, this project yielded a wealth of valuable genetic information that upper-Midwest organic potato producers can utilize to optimize variety selection and production, and that potato breeders and participating farmers can use—and are in fact beginning to use—to develop new improved varieties for organic and sustainable production systems.

In terms of cost efficacy (benefit to farmers, agricultural professionals, and consumers per dollar invested), this project may well lead the entire body of research funded during this period. In addition, follow-up has been excellent and sustained from 2005-present, thereby ensuring that the initial findings and outputs from project 2002-03799 are effectively utilized and built upon.

Follow-up on the above project includes an OREI funded project conducted from 2009-2013, and an active, ongoing, farmer-interactive web site and Organic Potato Project.

OREI 2009-01429, Amy Charkowski, Wisconsin, $541,172, September 2009-August 2013

Organic Certified Seed Potato Production in the Midwest

The objectives of this project were to develop organic methods to produce disease-free, virus-free seed potatoes, to conduct an economic analysis of organic seed potato production as an enterprise, and to continue evaluating heirloom and specialty potato varieties for organic systems. Project partner, Seed Savers Exchange, provided heirloom clones for evaluation. Part of the work of the project was to remove viruses via the above-mentioned tissue culture procedure.

While the proposal projected collecting/providing 20-70 pathogen free varieties and lines and on-farm evaluation of "at least 12" varieties, the 2013 final report indicated that "over 90 heirloom and specialty lines were trialed on organic farms over the course of this project." Participating farmers identified resistance to potato leaf hopper, early blight, and early dying as variety selection priorities. Organic seed production practices that yield satisfactory control of Potato Virus Y (aphid vectored) were identified.

While this project had a much higher "price tag" than the first, it also well exceeded its goal in terms of the number of varieties evaluated on farms. In addition, the quality and scope of the work of the ongoing Organic Potato Project (described next) should be noted.

Website

Although the web page given in the abstract for project 2002-03799, http://plantpath.wisc.edu/organicpotatoresearch, is no longer active, another web page for an Organic Potato Project, http://labs.russell.wisc.edu/organic-seed-potato/, describes ongoing trials of potato varieties for organic production, including trials of commercially available varieties on six farms in 2011 and seven farms in 2012. Results and explanation are given in user friendly form, and farmers interested in doing variety trials on their farms are invited to contact the University of Wisconsin Organic Potato Project. These more recent results again cited Chieftain, Colorado Rose, Papa Cacho, Satina, and Adirondack Blue as top performers (corroborating some of the initial results).

The Organic Potato Project blog page, maintained by Ruth Genger and updated weekly, includes a report on a 2014 variety trial that emphasized heirloom varieties not widely available (1/19/15) and an invitation to farmers to participate in 2015 research trials including breeding, seed potato production, and weed management (1/12/15). The 1/12 blog also includes a link to a news story about successful breeding and variety trial efforts in the Andes (region of origin and greatest genetic diversity of potato) to enhance potato varietal resilience to climate changes (melting glaciers, shifting frost dates, warmer temperatures).

The 2015 activities include farmer participatory breeding, i.e., making actual crosses through true seed, supported with "how to" videos and written instructions, and a statement on the blog that "crossing potatoes is surprisingly easy." Other options include growing out True Potato Seed (produced and provided by the University of Wisconsin team or independent breeder Tom Wagner), participating in ongoing variety trials (focusing on heirlooms from Seed Savers Exchange and other sources), organic production of disease-free and virus-free seed, and weed management (straw mulch versus cultivation and manual weeding).

The Organic Potato Project web site also includes a Resource Page for organic potato production.

This project emerges as one of the most successful in terms of practical, farmer ready results and long term follow-through, with an active and expanding program, including actual potato breeding, in 2015, ten years after the original grant funding finished.

OREI 2010-01943, Erik J. Wenninger, University of Idaho, $108,815, September 2010–August 2013

Host Plant Choice of Colorado Potato Beetle and Variation in Defoliation and Yield Losses among Organically Grown Commercial Potato Varieties

In this project, ten varieties representing five potato types (red, yellow, russet, white, blue/purple) were evaluated for their degree of attractiveness to and defoliation by CPB, and final yield. PIs worked with farmers to develop enterprise budgets for different varieties with and without organic pesticide use. CPB pressure at the trial site was intense because of prior CPB focused research, and one aspect of the field research (caged no-choice CPB feeding trials on different varieties) had to be abandoned because many CPBs emerged within the cages.

Despite these limitations and relatively little varietal difference in attractiveness to CPB, some valuable information was developed: one variety (King Harry) bred for pest resistance and three others (Purple Viking, Yukon Gold, Dark Red Norland) generally gave higher yields than the others, and organic pesticides generally improved yields. The

project team also collected data on wireworm damage (not part of original protocol) that identified four varieties with significantly less damage.

Varietal yield and pest tolerance information in this bioregion could complement that generated for the upper Midwest, and may provide additional information for future potato breeding efforts.

Example B: Evaluating crop rotation strategies during the three-year organic transition period

ORG 2002-03805, R. S. Gallagher, Washington State University, $164,701, August 2002-August 2006

Various Strategies to Achieve Ecological and Economic Goals in the Transition Phase of Eastern Washington Organic Dryland Grain Production

This project explored alternative crop rotation strategies for the three-year transition to organic dryland grain production in the Palouse region of eastern Washington. Strategies were evaluated in terms of soil quality, soil fertility (N availability) weed and pest management, and "economic consequences of profit-maximizing versus soil quality-maximizing approaches to the organic transition period and subsequent certified organic production."

The Approach was fairly ambitious for such a modest budget: "Nine crop rotations have been designed specifically for the three-year transition period to certified organic grain production in eastern Washington. These rotations will include combinations of cash grains, perennial and annual forages, and legume, brassica, and grass green manure crops. The specific components of the crop rotations will depend on the goal of the system with respect to short-term profitability during the transition period, the long-term enhancement of soil quality and pest management, and the post-transition profitability. In the fourth and fifth year of the study, all plots will be planted to indicator crops of spring and winter wheat, respectively. Grain yields and quality parameters will be measured."

The final report (2006) in the abstracts touches on several important results that farmers in the region can apply now:

- Soil N is a critical constraint on organic production of winter or spring wheat.
- Field pea planted in spring for grain production was pest and disease prone, competed poorly with weeds, and left little N for a subsequent wheat crop. However, a winter pea green manure largely out-competed perennial and spring annual weeds, and developed "large quantities of N-rich biomass" resulting in higher soil N and earthworm populations.
- An alfalfa-clover-oat-pea forage rotation yielded a harvestable product during transition, and made "a respectable contribution to the soil fertility" (available soil N).
- Reduced surface tillage (rotary harrow before planting, rotary hoe during wheat establishment) provided adequate weed control where existing weed pressure was light, and helped conserve soil.
- Spring wheat planted after forage- or green manure-intensive transition systems gave good yields (55-65 bu/ac) and fewer weeds than other systems.

Longer term impacts also appear substantive: "The greatest impact from this research has been the increased awareness among growers and researchers that direct-seed, organic grain production in the Palouse region appears to be quite feasible. Grower interest and correspondence with our research team continues to increase."

Another interesting finding was a tight negative correlation between wheat yield (spring or winter) and weed biomass, illustrating the vital importance of good weed management.

Although it was a little harder to evaluate the practical outputs and impacts and longer term follow-up of this project than the last one (due to limited information in abstracts), the trends and findings (above) by themselves provide a lot for organic producers to utilize (again, for a small price tag in terms of grant funding). An online search found a web page with an overall description of the Washington State University Department of Soil and Crop Sciences organic research program, that seems to summarize the work in several OREI and ORG projects, but presentation of results was only general.

Example C: Managing gastrointestinal nematodes (GIN) in small ruminants.

GIN have been a major constraint on organic goat and sheep husbandry for dairy, meat, or fiber. Organic producers cannot market products as organic if they receive synthetic wormers, yet cannot withhold medication from sick animals in an attempt to keep them organic. Thus, an urgent need exists for effective NOP allowed materials and methods for preventing or controlling GIN in sheep and goats.

OREI 2005-04426, Joan M. Burke, USDA ARS Arkansas, $299,632, Sept 2005-Sept 2008

Development of Sustainable Gastrointestinal Nematode Control in Organic Small Ruminant Production

The project team evaluated a tannin-rich forage plant, Sericea lespedeza, either as part of the pasture vegetation or as supplementary pellets of dried Sericea lespedeza in the feed ration, for reducing GIN loads. Fresh or pelleted lespedeza, low-dose copper oxide supplements, and rotational grazing all helped reduce but did not eliminate the problem; however the team also identified the potential for genetically "parasite resilient" animals to remain GIN-free with just these NOP-allowed, non-chemical-wormer tactics.

For a modest sum, this project established promising leads toward effective organic GIN management through a combination of genetics, rotation management, and NOP-allowed treatments.

OREI 2010-01884, Joan M. Burke, USDA ARS Arkansas, $967,916, Sept 2010-August 2015

A Systems Approach to Control Gastrointestinal Nematodes in Organic Small Ruminant Production

This is a direct continuation and expansion of the preceding project. The latest progress report found was dated 2013, and it reported an adverse effect (slower weight gain and changes in blood levels of trace minerals) of long term (112 day) feeding of Sericea lespedeza, and switched to shorter term (56 day) protocols. Positive findings include: lespedeza proved effective in controlling coccidiosis, a major protozoan parasite disease of small ruminants; and giving copper oxide alone or with lespedeza to ewes and does near birth helps protect the young from GIN. Studies on time and method of harvesting and drying Sericea lespedeza for optimum tannin content, and genetic resistance were explored further through DNA sampling of GIN resistant Katahdin sheep sires to identify genetic resistance markers, and fecal egg counts from ewes and lambs on farms in AR, GA, NY, ME, and OH were taken to determine "breeding values" for GIN resistance.

The project team provided many presentations on alternative and integrated parasite management including copper oxide wire particles, lespedeza, other alternative materials, and a decision tool to help farmers manage GIN.

The grant is much larger this time, but the study has expanded in area (covering many states and different climate regions) and depth (exploration of the potential of breeding for parasite resistance), and significant progress has been made.

Example D. On-farm evaluation of flea beetle management strategies

ORG 2007-01391, Craig B. MacConnell, Washington State University, $74,394, Sept 2007-Sept 2010

Flea Beetle Control Treatment Demonstration in Western Washington State

This project field-tested seven different management tactics against crucifer flea beetles on eight working organic farms (each farm tried at least two treatments) in WA in each of two seasons: row cover, straw mulch, interplanted cover crop, living barrier (cash crop planted between rows of tall asparagus or pea crop), fabric wall of row cover material, trap crop (mustard every 4th row in broccoli), and a flea beetle trolley to disturb and trap out the pests. Cash crops in different trials included broccoli, arugula, mizuna, mustard greens, bok choi, and tatsoi. Farm field days demonstrated methods and outcomes.

Effective treatments included row cover (best), living barrier, fabric wall, and trap crop. Straw mulch, intercropped cover crop, and flea beetle trolley proved ineffective. Some of the growers who attended field days modified their flea beetle management strategies based on these findings.

For a very small budget, this project provided some valuable practical information for organic producers of crucifer crops in Washington and any region affected by the crucifer flea beetle, which includes much of the Southeast. Project outcomes will help producers develop more effective integrated flea beetle management strategies—which may include NOP allowed pesticide sprays, but may also reduce the farmers' reliance on such sprays and thereby reduce environmental impacts of their pest management systems.

APPENDIX G.

Complete List of OREI and ORG Projects on Plant Breeding and Genetics for Organic Systems.

Farmer-participatory, on-farm plant breeding and public cultivar development offer several key advantages. First, selection takes place under the conditions in which the resultant cultivars will be grown. This is especially critical for organic producers, since most currently-available crop varieties have been bred and selected for conventional production with soluble fertilizers and synthetic pesticides. Thus, plant breeding and variety evaluation conducted on organic farms is the most direct and efficient way to identify and further improve crop germplasm for performance in organically managed soils and agro-ecosystems. Priority traits for organic producers include resistance to diseases, pests, drought, and other stresses; competitiveness against weeds; ability to obtain N and other nutrients from slow-release organic sources; enhanced positive interactions with soil biology; ability to exclude cross-pollination with genetically engineered crops; and superior flavor, nutritional quality, and other characteristics demanded by organic markets. Developing new cultivars with these traits could remedy a critical missing link that currently constrains organic crop yields and profitability.

Second, on-farm breeding and selection within a particular region yields cultivars adapted to that region's climate, soils, and pest-weed-disease complex. Individual farmers can save and select seed from publicly held cultivars or breeding lines to further refine adaptation to the farm's microclimate, soil biology, and management practices. Farmers do not have this option with privately owned patented varieties.

Third, when farmers participate as full partners in a crop breeding endeavor, the team will identify and address farmers' breeding priorities more directly and effectively. Fourth, farmer engagement in cultivar development accelerates dissemination and adoption of new, improved cultivars. Finally, classical plant breeding and cultivar development in farmers' fields can be quite cost-effective, as the above-listed projects have shown.

Other projects conducted the breeding work itself at university or ARS experiment stations with farmer input on priorities and on-farm variety trials. Some teams collaborated with seed companies or NGO plant breeding organizations. Examples include:

- *Public Corn Breeding for Organic Farmers* (OREI 2010-02363, USDA-ARS Ames, IA, $2.86M) and *Breeding Non-Commodity Corn for Organic Production* (OREI 2014-05340, USDA-ARS, Ames, IA, $1.97M). Plant breeding was conducted by ARS, Mandaamin Institute, and other partners; farmers hosted variety trials.
- *Cultivars and IPM Strategies for Organic Cotton* (OREI 2010-01870, Texas A&M University, $661K) developed one thrips-resistant cultivar and helped launch a Cotton Improvement Program to develop non-GMO cotton varieties with pest, disease, and drought resistance.
- *Breeding for Southeastern Organic Field Crop Producers* (OREI 2009-01333, North Carolina State University, $1.17M) focused on breeding soybeans and wheat for weed competitiveness, peanuts for disease resistance, and corn to exclude GMO pollination. They also developed simple field methods for breeding and selection for weed and disease tolerance, and launched a more farmer-participatory effort (Organic Plant Breeding Center, OREI 2012-02236, North Carolina State University, $1.26M).

At the 2015 Organic Agriculture Research Symposium (OREI 2014-05388), Dr. Walter Goldstein of Mandaamin Institute, a partner in the USDA-ARS corn breeding endeavor, presented results of crossing Corn Belt breeding lines with highland Mexico land races with high N-use efficiency and an ability to fix up to half of their N requirement. Some crosses retained these traits, gave good grain yields in low-N soils, and had high protein and methionine content. Mandaamin Institute is developing inbreds and hybrids with these traits for commercial release. If successful, these varieties will improve yields and profits in organic grain rotation, protect water quality (by needing less soluble N), and provide improved poultry feed that might address organic poultry farmers' need for alternatives to synthetic methionine.

OREI and ORG grants for plant breeding (19 integrated projects, two symposia and one planning grant) amount to approximately $27M. The cost efficacy of this investment must be considered in relation to the estimated $136M the private industry spends to bring just one genetically engineered, patented variety to market. In addition to releasing at least 43 new public cultivars, these projects have built strong farmer-scientist plant breeding networks and selected hundreds of breeding lines for organic systems, providing a solid foundation for future efforts.

One university plant breeder noted that, without the vital support from OREI, classical plant breeding endeavors would be "in hibernation." He confirmed that, in addition to varieties already released, OREI funded plant breeding projects have the potential to release additional varieties in the near future. In order to sustain funding for plant breeding and keep cultivars in the public domain, the university licenses new releases to seed companies who return a percentage of profits to the breeding program. Individual farmers can save and select seed for their own use at no charge.

Plant breeding endeavors require long-term commitments to realize their full potential to develop new farmer-ready cultivars. The 2009 and 2010 OREI requests for applications included a long term funding category for projects that require multiple grants to achieve their goals, with renewals conditional on satisfactory progress toward goals. At least two plant breeding teams received their initial OREI funding under this category, but the long-term funding option was removed from later requests for applications. While one team received additional OREI funding to continue, the other did not, and the PI noted that this represents a missed opportunity, as the team's breeding objectives would require about ten years to attain.

Crop germplasm adapted to organic systems is as important to the success of organic farming as soil health and effective weed management. Thus, farmer participatory plant breeding and public cultivar development for organic systems merit a long-term commitment of support through OREI and ORG. Renewed funding for Northern Organic Vegetable Improvement Collaborative (NOVIC), USDA-ARS corn breeding, and the North Carolina State University southeastern organic field crop breeding program are important steps in this direction. However, there remains an urgent need to establish an organic vegetable breeding network or collaborative in the southern half of the US. In addition, NIFA should consider reinstating the long term funding category to help ensure ongoing support for farmer-participatory breeding networks and public cultivar development for organic systems.

Organic producers need new crop varieties better adapted to organic production in their regions, as well as information on the suitability of existing varieties for organic production systems. Following is a synopsis of OREI and ORG projects that funded public plant breeding and cultivar development, and/or crop variety evaluation that can help farmers select the best cultivars for their farms, and provide a foundation for future breeding efforts. A few projects that included variety evaluation as a minor component, or developed educational materials related to plant breeding (e.g., eOrganic) are not included in this listing.

CONTENTS

Plant Breeding – Vegetable Crops

OREI 2004-05205, Molly Jahn, Cornell University, $894, 450, 2004-2008

The Organic Seed Partnership

Crop(s): Squash, melon, cucumber, tomato, pepper, broccoli

Activities: Farmer participatory breeding and selection in organic systems, farmer based trialing networks; evaluated ~590 varieties/lines of 29 crops, >200 farms participating.

Objectives: Disease resistance for CMV (pepper), PM (cucurbits), late blight (tomato), broad (horizontal?) resistance, market qualities, overall regional adaptation.

Outcomes: 3 bell pepper, 3 butternut, 7 sum squash, 4 cucumber, 4 melon, 2 tomato, 3 broccoli varieties released or ready for release.

Project website: http://www.plbr.cornell.edu/psi/OSP%20home.htm.

OREI 2009-01429, Amy Charkowski, University of Wisconsin, $541,172, 2009-2014

Organic Certified Seed Potato Production in the Midwest

Continuation of ORG 2002-03799 (variety evaluation, page 191)

Crop(s): Potato

Activities: Extensive farmer-participatory variety evaluation including heirloom and specialty varieties (100 lines at two research stations and 12 farms); on farm production of certified disease-free and certified organic seed potatoes.

Objectives: Performance under organic systems, disease resistance (virus, late blight, early blight, early dying, common scab), pest resistance (potato leafhopper), weed suppressive ability, quality (flavor, antioxidants).

Outcomes: Some heirloom varieties "well suited to organic" were identified; two graduate students in projects have jobs in potato breeding and tissue culture. The project led to establishment of an ongoing network, the Organic Potato Project, which includes farmer participatory breeding (making crosses and gathering, growing, and selecting potatoes from true seed) as well as variety trials and production of organic, disease-free "seed" tubers.

Project web site: http://labs.russell.wisc.edu/organic-seed-potato/

OREI 2010-03392, James R. Myers, Oregon State University, $2,308,246, 2010-2014

Northern Vegetable Improvement Collaborative (NOVIC)

Crop(s): Peas, broccoli, sweet corn, carrots, winter squash; also tomatoes, peppers, beets, dry beans, kale

Activities: Develop nationwide organic vegetable crop breeders network. Begin with farmer participatory variety evaluation (including trials of "materials at various stages of development") and input regarding breeding priorities. Four breeding hubs with research farm and participating organic market farms—farmers engaged in identifying priority traits, making selections, growing and releasing seed.

Objectives: Disease resistance, flavor and quality.

Outcomes: One variety each of snap pea, snow pea, and sweet corn ready for release as of 2012; and two broccoli varieties ('Solstice' and 'Myers Best" – west coast). 'Iron Lady' tomato with resistance to three major diseases. In addition, the project has 92 advanced breeding lines of squash undergoing multi-site field evaluation, and has provided carrot lines for OREI 2011-01962 (carrot breeding).

Variety trials have led farmers to adopt new varieties, especially 'Honeynut' (C. moschata winter squash developed by Cornell University). A regional seed company is "following closely" the progress and activities of NOVIC; chefs in the Northwest are enthusiastic about several pepper varieties in NOVIC trials, opening market opportunities for organic producers. The project also published two books, *Organic Crop Breeding and The Organic Seed Grower.*

OREI 2014-05402, James R. Myers, Oregon State University, $1,997,986, 2014-2018

Northern Vegetable Improvement Collaborative (NOVIC) II

Continuation of OREI 2010-03392

Crop(s): Tomato, pepper, sweet corn, cabbage, winter squash

Activities: Breeding, variety trials, and "evaluation of material at various stages of development." Growers engaged in identifying relevant traits, on farm trials, participatory breeding, and seed production and release. Outreach includes variety trial field days and participatory breeding workshops. Activities will take place in and around four "hubs' across the northern US. Project evaluation through case studies of NOVIC participant farmers, breeders, and researchers.

Objectives: "Breeding will be conducted for late-blight resistant, good-tasting tomatoes, high quality, cold-tolerant OP cabbage, high-quality, early-maturity sweet corn, early, good tasting and high-yielding peppers, and high-quality, short-season winter squash." Good germination in cold soil, weed competitiveness, disease resistance, nutrient efficiency, and post harvest storage are other breeding objectives

Outcomes: Project has completed first year.

Project website: http://eorganic.info/group/5751.

OREI 2011-01962, Philipp W. Simon, USDA-ARS Peoria, IL, $2,097,770, 2011-2015

Carrot Improvement for Organic Agriculture with Added Grower and Consumer Value

Crop(s): Carrot

Activities: Breeding and variety trials with organic farmer participation; evaluate large number of accessions of variously colored carrots.

Objectives: yield, flavor, resistance to diseases (Alternaria leaf blight, bacterial blight, Cercospora leaf spot, and powdery mildew) and root knot nematode, pest resistance, weed competitiveness including improved/accelerated germination and large vigorous top growth, storage capability, and nutritional value. Understand cultivar responses to organic production conditions, identify additional desired traits. Develop breeding model applicable to other vegetable crops for organic production.

Outcomes: Seed increase of "promising genetic stocks" underway in 2013; wide genetic (heritable) diversity confirmed for: seedling vigor and canopy size, disease (Alternaria) and nematode resistance, flavor and nutrient (carotenoid, anthcyanin) content, with high performing lines in orange, yellow, purple, and red carrot types. Genetic differences are consistent across regions and production systems; great potential exists for genetic selection for multiple desired traits. Regarding field selection for weed tolerance, "preliminary results indicate that selection of lines that favor early and full top canopy growth can be used as a low input integrated weed management tool." Seed production has been initiated for carrot germplasm to be released.

Project website: http://eorganic.info/group/7645.

OREI 2012-02292, Michael Mazourek, Cornell University, $1,962,562, 2012-2016

Addressing Critical Pest Management Challenges in Organic Cucurbit Production

Crop(s): Cucumber, melon, summer squash

Activities: Trials of breeding lines and existing cultivars on organic farms; breeding and selection within organic systems, in conjunction with management practices for disease/pest control. Build partnerships between Northeast and Southeast breeding and pest/disease management efforts.

The goal is breeding lines and farmer-ready varieties.

Objectives: Disease and pest resistance, including downy mildew, aphid-vectored viruses, striped cucumber beetle and bacterial wilt; also quality and yield improvement

Outcomes: Two DM resistant cucumber varieties and one DM resistant melon released (Cornell), extensive variety evaluation in NY and NC, vital technical support for farmer breeder in VA developing cucumber, melon, and winter squash resistant to DM and other pests and diseases. Additional varieties, including a disease resistant, high vigor butternut squash (derived by the VA farmer from a Seminole X Waltham cross), are in development.

Project website: http://eorganic.info/cucurbits.

OREI 2014-05405, Lori A. Hoagland, Purdue U, $1,987,150, 2014-2018

Practical Approach to Controlling Foliar Pathogens in Organic Tomato Production through Participatory Breeding and Integrated Pest Management

Continuation of OREI 2010-01913 (variety evaluation, page 11) (Hoagland co-PI on 2010-01913)

Crop(s): Tomato

Activities: Tomato variety selection as part of integrated disease management that includes stimulating plant resistance responses through beneficial soil micro-organisms, and organic fungicide protocols that reduce the use of copper. Project includes farmer participatory breeding and release of varieties with desired traits. Replicated trials in IN, WI, NC, and OR.

Objectives: Disease resistance, including "durable resistance" (horizontal or multi-gene based) to foliar pathogens causing early blight, late blight, and septoria leaf spot; and genetic potential for induced systemic resistance responses, with maintenance of good flavor.

Outcomes: Project completed first year in 2015.

Project website: http://eorganic.info/tomi.

Plant Breeding – Field Crops

OREI 2005-04497, Charles A. Shapiro, U Nebraska, $762,949, 2005-2010

Improving Organic Farming Systems Across Nebraska Agroecoregions

Crop(s): Wheat (primarily), anso proso millet, soybean, corn

Activities: Extensive evaluation/screening of wheat varieties for performance as production grain or as cover crop under organic conditions, integrated into ongoing wheat breeding program.

"Crop research land was transitioned to organic and certified at four UNL sites: Agricultural Research and Development Center near Mead-45 acres; Haskell Agricultural Laboratory near Concord-25 acres; South Central Agricultural Laboratory near Clay Center-17 acres; and High Plains Agricultural Laboratory near Sidney-76 acres." Proso millet variety trials at HPAL mentioned in 2008 and 2009 progress reports, soybean variety trials at SCAL in 2008 report, and one organic farmer initiated a corn variety trial in 2005-06.

Objectives: "Based on discussions with organic small grains producers, an initial list of ideal winter wheat cultivar traits was used as the basis for screening: competitive grain yield, excellent end use quality, excellent disease and insect resistance, ability to extract soil nutrients, and ability to provide early season ground cover to suppress or tolerate weeds."

Outcomes: Additional grant obtained for: "Small Grains Breeding Trials-expansion of wheat breeding research program to evaluation of varieties for organic production and cover crops."

ORG 2006-02057, S. Jones, Washington State University, $690,557, 2006-2009

Developing Wheat Varieties for Organic Agricultural Systems

Crop(s): Wheat

Activities: Breeding varieties for organic farmer needs in the Pacific Northwest is the central focus of the project; farmers host trials of varieties and elite lines.

Objectives: Milling quality, disease resistance, weed competitiveness, nutrient use efficiency from organic sources, yield.

Outcomes: 20 elite lines "under consideration for release" at the end of a three-year project.

OREI 2007-01437, Peter S. Baenziger, U Nebraska, $755,937, 2007-2012

Developing Small Grain Cultivars and Systems Optimally suited for Organic Production

Crop(s): Wheat

Activities: Extensive variety/breeding line evaluation at university field experiment stations; farmers and processors help identify breeding objectives.

Objectives: Performance under organic nutrient management and production systems, disease resistance, grain/milling/nutritional quality, performance as weed suppressive cover crop.

Outcomes: 56 varieties evaluated, some significant differences amongst varieties identified.

OREI 2009-01332, Sieglinde Snapp, Michigan State University, $1,049,674 2009-2013

Practical Perennials: Partnering with Farmers to Develop a New Type of Wheat Crop

Crop(s): Wheat/perennial wheat

Activities: Extensive breeding program for perennial wheat, including farmer participatory breeding.

Objectives: Perennial wheat varieties that can serve dual purpose (grain, forage) while conserving soil and sequestering carbon; drought tolerance/water use efficiency, nutrient efficiency.

Outcomes: Substantial benefits to C sequestration and soil N recovery in some perennial wheat lines compared to annual wheat. Fall soil moisture is critical for the wheat to function as perennial. Additional breeding and production research is needed to obtain better yields and more consistent perennial traits.

Project developed participatory breeding tool kit.

OREI 2009-01333, S. Chris Reberg-Horton, North Carolina State University, $1,174,942, 2009-2013

Farmer-driven Breeding: Addressing the Needs of Southeastern Organic Field Crop Producers

Crop(s): Field corn, wheat, soybean, peanut.

Activities: Develop and activate public breeding network including farmer participatory breeding and on farm variety trials.

Objectives: Weed competitiveness (wheat, soy), allelopathy against weeds (wheat), resistance to soilborne seedling diseases (peanut), genetic isolation from GMO varieties (corn), performance in organic systems (all).

Outcomes: Built strong farmer-public breeder network. Research showed that, in wheat, morphological and developmental traits (erect growth, vigorous tillering, rapid early growth, and early maturity) appear much more important than allelopathy in wheat competitiveness toward weeds. Soybean lines showed considerable variability in weed competitiveness. Evolutionary breeding (mass selection) has yielded a genetically diverse pool of peanuts with increased resistance to root diseases, though progress has been slow.

OREI 2012-02236, S. Chris Reberg-Horton, North Carolina State U, $1,262,855, 2012-2015

Creating an Organic Plant Breeding Center

Continuation of OREI 2009-01333

Crop(s): Field corn, soybean, wheat, peanut.

Activities: Build on previous OREI project to create public plant breeding center; farmers work with breeders to define objectives, evaluate cultivars, and build farmer led organic seed production/improvement network.

Objectives: Resistance to GMO contamination (corn), weed competitiveness (soybean), resistance to seedling diseases (peanut), allelopathy (wheat), improved performance under organic systems (all).

Outcomes: As of the end of 2015, three new soybean and two new wheat varieties released, several corn backcrosses with new GMO pollen-excluding trait, and additional work on the evolutionary breeding of peanut disease resistance.

OREI 2010-01870, Jane K. Dever, Texas A & M U, $661,437, 2010-2015

Development of Cultivars and IPM Strategies for Organic Cotton Production

Crop(s): Cotton

Activities: Breeding within the Cotton Improvement Program of Texas A&M University; variety trials hosted on one organic farm.

Objectives: Introduce resistance or tolerance to thrips (from Gossypium barbadense) into existing cotton (G. hirsuitum) cultivars while maintaining drought and cold tolerance and fiber quality. Long term goal is ongoing breeding program to develop and release non-GMO cotton varieties suited to organic production.

Outcomes: Four "cultivars" and 16 "advanced breeding lines" under field evaluation, and one thrips-resistant cultivar planned for release as of 2014.

2010-01904 OREI, Karen A. Renner, Michigan State U, $963,762, 2010-2015

Organic Dry Bean Production Systems

Crop(s): Dry bean (Phaseolus vulgaris)

Activities: Expand the MSU dry bean breeding program to include breeding for organic systems. Farmer participatory field evaluation of varieties (~4) and advanced breeding lines (~30).

Objectives: Overall performance (yield) in organic systems, competitiveness toward weeds, nitrogen fixing capacity and N use efficiency, disease resistance, pest resistance, tolerance to mechanical weed control operations.

Outcomes: Breeding lines with superior N fixing capacity to be used in future breeding efforts; quantitative trait loci identified related to N fixation, etc.

OREI 2010-02363, Paul Scott, USDA ARS Ames, IA, $2,864,478, 2010-2015

Strengthening Public Corn Breeding to Ensure that Organic Farmers Have Access to Elite Cultivars

Crop(s): Corn

Activities: Extensive evaluation of elite and experimental hybrids for performance in organic systems, engaging farmers; independent, NGO, and university public breeders, USDA ARS; extensive breeding program launched, accelerated breeding using organic winter site in Puerto Rico.

Objectives: Disease and pest resistance, grain quality including nutritional value as livestock feed (methionine content), ability to exclude pollination from neighboring GMO corn.

Outcomes: Hybrid and OP varieties being developed for organic systems, tested on one-three farms in each of 11 states (total 15 sites). One variety released as commercially available organic corn seed as of 2012; no progress reports available since then on web site. "Number of organic varieties available" to organic growers increased as a result of project as of 2012.

OREI 2014-05340, Paul Scott, USDA ARS, Peoria, IL (& Ames, IA?)

Breeding Non-commodity Corn for Organic Production Systems

Continuation of OREI 2010-02363

Crop(s): Corn – "non-commodity" corn including blue corn.

Activities: Cross germplasm adapted to different regions to obtain varieties with wide geographic range, develop molecular marker systems for desired traits, create open pollinated corn variety network, and videos on how to select varieties for breeding and production. Develop inbred lines and test in hybrid combinations in farmer cooperative trials. Test "advanced hybrids" through United States Testing Network (41 locations in eight states) established through Practical Farmers of Iowa during earlier (2010) OREI project. Data in catalog of breeding germplasm developed in 2010 OREI project will be used to select breeding germplasm. Promising inbred lines with wide geographic adaptation may be developed into open pollinated varieties for release.

Objectives: High yield and superior agronomic performance in organic production systems, nitrogen use efficiency, disease resistance, ability to yield in weedy conditions, increased nutritional value for poultry (high methionine, high protein), and gametophytic incompatibility to exclude GMO pollen.

Increased corn seed production through the project and release/licensing of new varieties.

Outcomes: Project just starting. NGO project partner, Mandaamin Institute, developing advanced breeding lines with N-efficient and N-fixing (symbiotic diazotroph bacteria in rhizosphere) traits by crossing Corn Belt varieties with land races carrying these traits, and selecting in low-available-N soils.

Project website: http://eorganic.info/cornbreeding.

OREI 2011-01942, James H. Orf, University of Minnesota, $1,450,922, 2011-2014

Improving Soybean and Dry Bean Varieties and Rhizobia for Organic Systems

Crop(s): Soybean, dry bean (pinto, kidney, heirloom varieties).

Activities: Expand University of Minnesota soybean and dry bean breeding programs to develop varieties for organic, and develop improved rhizobia strains for organic soybean and dry bean production. On farm variety evaluation. Project combines variety development with agronomic practices (weed management, rotation, spacing, tillage) for organic soy and dry bean production.

Objectives: Weed competitiveness, vigorous root systems (soy and dry beans), N fixation potential and residual N (soybean), healthy extensive root systems that support early and prolonged effective rhizobial nodulation (heirloom dry bean), maintain high yields and desirable quality (both protein and oil content, etc.), drought tolerance, resistance to iron-deficiency chlorosis, root rot resistance.

Outcomes: Improved lines advanced through F4 to F6 generations using winter nursery in tropics, two soy and two dry bean rhizobia strains with superior N fixing capacity identified.

OREI 2011-01994, Mark Earl Sorrels, Cornell University, $2,356,999, 2011-2015

Value-added Grains for Local and Regional Food Systems

Crop(s): Wheat, ancestral wheat (spelt, einkorn, emmer).

Activities: Plant breeding and selection, organic seed production, on-farm work includes identifying varieties and land races well suited to organic systems; variety evaluations in ND, NY, PA.

Objectives: Flavor, nutritional value, baking quality, disease resistance, lodging resistance.

Outcomes: "Promising varieties of emmer and einkorn" identified in Cornell trials.

OREI 2012-02270. Kevin M. Murphy, Washington State University, $1,603,653, 2012-2016

Developing Adapted Varieties and Optimal Management Practices for Quinoa in Diverse Environments

Crop(s): Quinoa

Activities: Evaluate and select varieties and breeding lines – farmer participatory process, multistate trials; breeding for organic systems as part of existing Washington State University quinoa breeding program.

Objectives: End-use quality and nutritional value, disease and insect resistance, yield, heat and salinity tolerance. 26 varieties and six breeding lines evaluated in multi-site trials; 800 breeding lines being evaluated at Washington State University.

Outcomes: No updates since 2012-13; no outcomes or results given in abstracts at CRIS web site.

Variety Evaluation – Vegetable and Other Specialty Crops

ORG 2002-03799, D. Rouse, University Wisconsin, $140,444, 2002-2005

Identification and Characterization of Potato Clones for Organic Production Systems

Crop(s): Potato

Activities: Evaluation of cultivars and clones, including heirloom and niche varieties.

Objectives: Yield and quality under organic production (slow-release N sources), disease and pest resistance; production of certified disease-free and certified organic seed.

Outcomes: Evaluated nearly 500 varieties and breeding lines/clones, and identified many with yields approaching yields under conventional production in the region. Many organic potato producers utilize information from this project to choose best varieties for their farms.

Project website: http://plantpath.wisc.edu/organicpotatoresearch

OREI 2005-04494, Joseph W. Kloepper, Auburn University, $561,828, 2005-2010

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

Crop(s): Tomato, pepper

Activities: Variety evaluation at three sites in AL.

Objectives: Disease resistance, yield performance in hot summer conditions.

Outcomes: "Tomato-spotted wilt virus resistant variety Amelia, out-performed Celebrity and Mountain Fresh, especially in dry weather when thrips were a greater problem. [In] pepper variety trials: Hungarian Hot Wax consistently performed the best."

OREI 2006-02018, Peter C. Anderson, University of Florida, $364,156, 2006-2009

Organic Production of Blueberries in the Southeastern United States: Development of Best Management Practices

Crop(s): Rabbiteye blueberry

Activities: Limited variety evaluation, several cultivars.

Objectives: Pest resistance.

Outcomes: Cultivar 'Oneal' sustained the most damage from leaf beetle (Colaspsi pseudofavosa) followed by Austin, Climax, Emerald and Star.

OREI 2006-02051, Lorraine Berkett, University of Vermont, $666,839, 2006-2010

Using New Alternatives to Enhance Adoption of Organic Apple Production Through Integrated Research, Education, and Extension

Crop(s): Apple

Activities: Variety observations as part of organic/transition apple project.

Objectives: Performance under organic production systems, disease and pest resistance.

Outcomes: Differences among cultivars in resistance to scab, rust, Japanese beetles; success of top grafting were documented.

OREI 2009-01325, Lorraine Berkett, University of Vermont, $946,675, 2009-2014

Using New Alternatives to Enhance Adoption of Organic Apple Production Through Integrated Research and Extension

Continuation of OREI 2006-02051

C*rop(s):* Apple

Activities: Evaluation of 5 newer popular cultivars for organic production.

Objectives: Tree growth/yield, disease and pest resistance, apple quality.

Outcomes: Information on cultivar performance delivered to producers.

ORG 2007-01380, D. M. Francis, Ohio State University, $858,507, 2007-2012

Grafting to Improve Organic Vegetable Production in Field and High Tunnel Systems

Crop(s): Tomato

Activities: Variety evaluation of 36 rootstocks, including on farm trials.

Objectives: Evaluate different scions and rootstocks for grafted seedling production.

Outcomes: Several rootstocks enhanced yield, root system development, and ability to produce under deficit irrigation. Challenges include incompatibility between some rootstock/scion combinations, risk of disease introduction through graft cuts, costs of grafting, and yield/quality tradeoff. However, several commercial propagators adopted grafting for vegetable starts as a result of the project.

OREI 2009-01383, Kevin Murphy, Washington State University, $410,077, 2009-2013

Plant Breeding and Agronomic Research For Organic Hop Production Systems

Crop(s): Hops

Activities: Variety evaluation: 20 varieties at two WA farms for three years; additional variety trials in MI and VT.

Objectives: Overall performance under organic systems, disease resistance (PM, DM), pest resistance (aphids, mites).

Outcomes: "Varieties that performed optimally in organic systems were identified.

OREI 2010-01905, Gregory Alan Lang, Michigan State University, $616,492 2010-2014

Holistic Integration of Organic Strategies and High Tunnels for Midwest / Great Lakes Fruit Production

Crop(s): Cherry, raspberry

Activities: Variety observations as part of larger project.

Objectives: Disease and pest resistance.

Outcomes: 2 experimental lines of cherry with PM resistance showed substantially less PM than five commercial varieties in the study.

OREI 2010-01913, Kevin Gibson, Purdue U, $1,288,010, 2010-2015

Economics, Ecology, Education: An Integrated Approach to Ensure the Success of Organic Vegetable Growers

Crop(s): Tomato

Activities: Cultivar evaluation (modern and heirloom varieties), as first step in breeding program for organic systems.

Objectives: Evaluate cultivar interaction with soilborne pathogens; screen varieties for yield, flavor, pest and disease resistance under organic management.

Outcomes: More than 20 varieties tested annually; promising lines with disease and pest resistance and good yields identified for further testing in 2013-14 (See also OREI 2014-05405 on page 4).

OREI 2010-01940, Bernadine C. Strik, Oregon State U, $2,428,677, 2010-2015

Organic Blackberry Production Systems for Improved Yield, Fruit Quality and Food Safety in Fresh and Processed Markets

Crop(s): Blackberry

Activities: Evaluation of a limited number of erect, semi-erect, and trailing cultivars of blackberry in organic systems.

Objectives: Performance under organic production, fruit quality – antioxidants, shelf life.

Outcomes: Cultivars suited to organic production identified; some variations among cultivars in shelf life and antioxidant content documented. Latest report available is from 2013.

OREI 2010-01943, Erik J. Wenniger, University of Idaho, $108,815, 2010-2013

Host Plant Choice of Colorado Potato Beetle and Variation in Defoliation and Yield Losses among Organically Grown Commercial Potato Varieties

Crop(s): Potato

Activities: Variety evaluation – 10 varieties studied in replicated trials.

Objectives: Pest resistance (Colorado potato beetle), performance in organic production.

Outcomes: Significant variations among cultivars in tolerance to CPB (ability to yield despite foliar damage), little difference in attractiveness to CPB or level of defoliation. Four of ten varieties showed resistance to wireworm (less tuber damage). 'King Harry' bred for pest resistance performed well.

ORG 2013-03971, Russel Mizell, University of Florida, $460,937, 2013-2015

Crop(s): Pecan

Activities: Evaluation of limited number of cultivars.

Objectives: Disease resistance, especially pecan scab.

Outcomes: Resistant cultivars documented, low disease pressure at one farm because resistant cultivars were grown.

ORG 2013-03943, Alexis Racelis, University of Texas Pan-American, $746,973, 2013-2016

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

Crop(s): Tomato

Activities: Variety evaluation – student research project to trial six heirloom varieties thought to be heat and disease tolerant, and thus suited to south Texas.

Objectives: Heat tolerance, disease resistance.

Outcomes: Not presented in abstract.

ORG 2014-03389, Shirley McCalleff, University of Maryland, 499,995, 2014-2017

Evaluating the Effect of Muskmelon Cultivar and Cover Crops on Soil Biodiversity, and Plant and Human Disease Suppression During Organic Production

Crop(s): Muskmelon

Activities: Field and greenhouse evaluation of ten cultivars.

Objectives: Disease resistance: Fungal foliar diseases (anthracnose, gummy stem blight and Alternaria leaf blight); bacterial wilt; fruit anthracnose, powdery and downy mildews; also fruit palatability / flavor.

Outcomes: TBD. Project recently started.

Variety Evaluation – Field Crops

ORG 2002-03806, Craig Sheaffer, University of Minnesota, $424,091, 2002-2007

Integrated Weed and Soil Management Options for Organic Cropping Systems in Minnesota

Crop(s): Hairy vetch

Activities: Evaluation of varieties and land races; minor component of overall project on co-management of soil quality and weeds in organic crop production.

Objectives: Overwintering and ground coverage in MN.

Outcomes: Local land races overwintered significantly better than out-of-state seed sources. (Overwintering in MN for any winter annual legume is a major accomplishment).

OREI 2006-02014, John Cardina, Ohio State University, $545,102, 2006-2009

Transition Strategies that Control Perennial Weeds and Build Soil

Crop(s): Teff as cover crop.

Activities: Evaluation of eight teff varieties in greenhouse and field.

Objectives: Growth and weed suppression.

Outcomes: Seven of the eight varieties suppressed Canada thistle significantly.

OREI 2009-01366, Ellen Mallory, University of Maine, $1,320,378, 2009-2014

Enhancing Farmers' Capacity to Produce High Quality Organic Bread Wheat

Crop(s): Wheat

Activities: Extensive four-year variety trials (no actual breeding) as part of a larger effort to enhance organic wheat yield and quality to support development of a local organic bread industry.

Objectives: Regional adaptation and performance under organic soil/nutrient management practices in Northeast; weed competitiveness, disease resistance, milling and baking quality.

Outcomes: Farmers (21 out of 30 in survey) utilized variety trial outcomes to choose wheat varieties.

OREI 2009-01371, Charles A. Shapiro, University of Nebraska, $1,419,710, 2009-2014

Improving Organic Farming Systems and Assessing their Environmental Impacts Across Agroecoregions

Crop(s): Corn, soybean, wheat, sunflower

Activities: Variety evaluation at three sites representing different agro-ecoregions in Nebraska.

Objectives: Antioxidant content of commodity grains.

Outcomes: Cultivar had greater effect on antioxidant content of corn and soybean than treatment conditions.

OREI 2009-01416, Ian Burke, Washington State University, $1,040,210, 2009-2014

Sustainable Dryland Organic Farming Systems in the Pacific Northwest

Crop(s): Wheat

Activities: Limited variety observations for yield, performance under organic production conditions.

Objectives: Weed competitiveness, compatibility with cover crop, performance under organic systems.

Outcomes: Interesting observation that variety may influence the interaction between a wheat crop and a preceding clover cover crop, impacts on yield and N nutrition/grain protein levels.

OREI 2012-02290, James Kotcon, West Virginia University, $1,850,360, 2012-2016

Forage-based Parasite Control in Sheep and Goats in the Northwest US

Crop(s): Birdsfoot trefoil

Activities: Screen 51 accessions with potentially high tannin content; evaluate high, medium, and low tannin varieties in the field.

Objectives: Tannin content (anti-gastro-intestinal-nematode parasite activity), growth and yield, leafhopper resistance

Outcomes: As of 2014, two years of evaluation of agronomic performance have been completed, 20 best cultivars identified; methodology for evaluating anti-helminthic tannin activity still being developed.

OREI 2014-05324, J. Earl Creech, Utah State University, $1,555,053, 2014-2018

Compost Carryover and Cover Crop Effects on Soil Quality, Profitability, and Cultivar Selection in Organic Dryland Wheat

Crop(s): Wheat

Activities: Develop long term on farm research sites in UT, WY, and WA to study and demonstrate organic dryland wheat management strategies for increased water use efficiency, weed management, soil quality, wheat yield and quality, and economic viability. Variety selection trials of ten varieties per location: two locally adapted standards, two varieties that have performed well in organic systems (Golden Spike and Deloris, released 2002), and six advanced breeding lines from public breeding programs with excellent end use quality and disease resistance.

Objectives: Stand establishment, overwintering, disease resistance, yield in organic dryland production systems, end use quality, and net economic return.

Outcomes: Project just beginning, building on successful long-term agronomic study showing substantial and long lasting (over ten years) yield and soil quality benefits from a single 22 t/ac compost application. Variety selection and future breeding will build on this initial success.

Conference and Planning Projects in Plant Breeding and Genetics

OREI 2009-01343, Mattew Dillon, Organic Seed Alliance, $46,281, 2009-2010

The Seed We Need?? Working Group, Symposium, and Action Plan for the Advancement of Organic Seed Systems

Crop(s): All, primarily vegetables

Activities: Symposium to convene organic seed working group.

Objectives: Build understanding of needs and develop capacity of organic seed systems through breeding, networking, etc.

Outcomes: Developed and published a State of Organic Seed Report, to be updated every five years.

OREI 2009-01389, R. Valenzuela, The Kohala Center (Hawaii), $47,500, 2009-2010

Hua Ka Hua – Restore Our Seed: a Symposium to Develop a Hawaii Public Seed Initiative

Crop(s): All

Activities: Symposium to identify organic farmers seed needs and launch a Hawaii Public Seed Initiative and revive breeding efforts with focus on organic.

Objectives: Identify organic breeding and variety needs in Hawaii.

Outcomes: Reports not available.

OREI 2014-05325, Jared Zystro, Organic Seed Alliance (Washington), $42,951, 2014-2015

Planning for Organic Plant Breeding and Seed Production in the Southeast

Crop(s): Lettuce and other greens, other vegetables TBD through farmer surveys and focus groups.

Activities: Stakeholder sessions and regional planning meeting to identify priority crops and objectives, and develop full OREI proposal during 2015 that will "use organic plant breeding, seed production, and variety trial research and education to support the success of Southeastern organic seed producers; increase the availability of quality organic seed options for the Southeast; and ultimately ensure the long-term success of organic agriculture in the Southeast."

Objectives: Identify needs, gaps, resources, and priorities based on series of six stakeholder meetings, and develop research and education project proposal for germplasm evaluation, variety trials, plant breeding, and organic seed production.

Outcomes: Proposal not funded in 2015, will resubmit in 2016.

APPENDIX H.

eOrganic Outreach for Organic Farming Research Projects

This information was written and provided by Alice Formiga, Oregon State University, eOrganic coordinator, alice.formiga@oregonstate.edu

eOrganic provides public outreach for many OREI, ORG and other USDA research and outreach projects focused on organic agriculture. As a result, eOrganic staff have directly assisted over 200 organic research projects in conducting webinars or presentations at live streamed conferences, creating websites, producing videos, or publishing articles about their findings. All resources are publicly available at http://www.extension.org/organic_production and http://eorganic.info.

eOrganic was awarded startup funding from two OREI grants in 2007 and 2009. In addition, a NIFA OREI grant was awarded to the eOrganic dairy team in 2010 specifically for the creation of organic dairy farming course materials for publication on eXtension.org and on the eXtension Campus. Some supplemental funding was provided by the eXtension foundation; however, eXtension no longer funds its communities. Currently, eOrganic funding comes from subawards and fees from OREI, ORG, RMA, Beginning Farmer and SARE projects. Since 2009, a total of 52 funded projects have included subawards or fees for eOrganic. At least 18 additional OREI and ORG projects, and over 30 SARE projects included eOrganic in their plans of work or produced materials for eOrganic, but did not include funding.

Since the launch of our public website in 2009, eOrganic has published more than 280 peer-reviewed articles, over 400 videos and 150 webinars for the public. Our website at eXtension.org has over two million views, and there are also over 2 million views of the eOrganic YouTube channel.

eOrganic initiated our webinar series in 2009, which had been attended by over 17,000 participants. Recorded webinars are available for public viewing in the eOrganic archive and on the eOrganic YouTube channel where they have been viewed over 350,000 times. Examples of OREI and ORG project webinars include the following:

- Putting the Pieces Together: Lessons Learned from a Reduced-Tillage Organic Cropping Systems Project, William Curran, Ron Hoover, John Wallace, Penn State University
- Organic Blackberry Production, Bernadine Strik, Luis Valenzuela, Oregon State; David Bryla, USDA-ARS Corvallis, OR
- Non-antibiotic Control of Fire Blight: What Works as We Head Into a New Era, Ken Johnson, Oregon State University; Rachel Elkins, University of California Extension; Tim Smith, University of Washington Extension
- Managing Bad Stink Bugs Using Good Stink Bugs, Yong-Lak Park, West Virginia University
- Food Safety in Organic Leafy Greens, Sadhana Ravishankar, University of Arizona
- Late Blight of Tomato and Potato: Recent Occurrences and Management Experiences, Margaret T. McGrath, and Christine Smart, Cornell University; Beth Gugino, Penn State University; Amanda Gevens, University of Wisconsin; Pamela Roberts, University of Florida
- Birdsfoot Trefoil as a Forage on Organic Dairy Farms, Jennifer MacAdam, Utah State University
- Economics of Organic Dairy Farming, Bob Parsons, University of Vermont
- Trap Cropping in Organic Strawberries to Manage Lygus Bugs in California, Diego Nieto, University of California Santa Cruz
- Organic Dry Bean Production Systems and Cultivar Choices, Thomas Michaels, University of Minnesota
- A Novel Nutritional Approach to Rearing Organic Pastured Broiler Chickens, Michael Lilburn, The Ohio State University
- Integrating Livestock into Dryland Organic Crop Rotations, Lynne Carpenter-Boggs and Jonathan Wachter, Washington State University

- Amending Soils in the Organic Dairy Pasture, Cindy Daley, California State University Chico
- Mastitis Management on Your Organic Dairy, Dr. Guy Jodarski, DVM, Organic Valley CROPP Cooperative
- Behavior Based Grazing Management: A Plant-Herbivore Interaction Webinar, Darrell Emmick, USDA NRCS (emeritus)

Farmers have reported changes in practices as a result of attending eOrganic webinars. For example, an average of 81% of participants of the eOrganic dairy webinars said they gained a better understanding of the webinar topics addressed; and 72% said they intended to make a change on their farm or in their work with farmers based on what they learned. Further, webinar follow up surveys revealed that webinar participants indicated a number of changes in practices as a result of what they learned, including: selling organic produce in a new hoophouse from NRCS EQIP funds, increased use of hairy vetch as a cover crop, increased efforts to provide dry bedding for dairy cows, planting quinoa, grafting tomatoes, and more.

Three OREI and ORG funded conferences were broadcast and/or recorded by eOrganic:

- International Quinoa Research Symposium
- 2nd International Organic Fruit Symposium
- Organic Agriculture Research Symposium

eOrganic also broadcast and recorded presentations from the USDA ERS Organic Farming Systems Conference, which featured presentations from many more organic research projects. eOrganic has also broadcast or archived presentations from the Organic Seed Growers' Conferences in 2012 and 2014, the Illinois Specialty Crops and Agritourism Conference, the NOFA NY Conference, Vermont Grazing Conference, and the Carolina Organic Commodities and Livestock Conference.

In addition to supporting NIFA OREI and ORG projects, eOrganic has conducted three webinars given by staff at the NOP and has disseminated information on the NOP Organic Literacy Initiative, the NOP Insider, and other NOP announcements in our newsletter and in articles. We have also conducted five webinars on USDA NRCS programs and conservation practices for organic farmers. The new NRCS National Organic Farming Handbook refers readers to many eOrganic resources.

eOrganic hosts 11 public websites for OREI and ORG projects.

- Breeding Non-commodity Corn for Organic Production Systems
- Brown Marmorated Stink Bug in Organic Farming Systems
- Carrot Improvement for Organic Agriculture
- NOVIC Website
- Organic Agriculture Research Symposium 2015
- Organic Cucurbit Research: Critical Pest Management Challenges
- Organic Management of Spotted Wing Drosophila
- Organic Reduced Tillage in the Pacific Northwest
- Principles for Transitioning to Organic Farming
- Tomato Organic Management and Improvement Project (TOMI)
- Tools for Transition

These project websites are of particular interest to multi-institutional projects for which a co-branded web location is important. An example is the NOVIC Website, which contains an organic variety trial database in which viewers can browse trial reports by location and crop from around the U.S. The Carrot Improvement for Organic Agriculture project includes a carrot variety browser that categorizes carrots by color and nematode resistance characteristics.

Videos produced by OREI and ORG project group members are available on the eOrganic YouTube channel and on the eXtension website. The following videos are examples of those published by members of OREI and ORG projects:

- A Whole Farm Approach to Incorporating Pasture Raised Organic Poultry and a Novel Cereal Grain (Naked Oats) into a Multi-year Organic Rotation, John Anderson, Kathy Bielek, The Ohio State University.
- Identifying and Scouting for Late Blight on Organic Farms, Abby Seaman, Cornell University.
- Weed Control in Organic Spring Cereals, Lauren Kolb, University of Maine.
- Addressing Critical Pest Management Challenges in Organic Cucurbit Production, Jason Grauer, Myra Manning, Lindsay Wyatt, Cornell University

eOrganic also provides OREI and ORG groups with web conferencing and online group workspaces to facilitate online project management. In 2015, an OREI group hosted a national web conference that brought together over ten local groups involved in organic grain production, which fostered local and national collaboration.

Additional Resources about eOrganic

Stone, A., D. Treadwell, A. Formiga, J. McQueen, M. Wander, J. Riddle, H. Darby and D. Heleba. 2012. eOrganic: The Organic Agriculture Community of Practice for eXtension. HortTechnology October 2012. Vol 22, No. 5 583-588. Available at http://horttech.ashspublications.org/content/22/5/583.abstract?related-urls=yes&legid=horttech;22/5/583

Formiga A., A. Stone, D. Heleba, J. McQueen, M. Coe. 2014. Evaluation of the eOrganic Webinar Program. Journal of Extension. V. 52, No. 4, August 2014. Available at http://www.joe.org/joe/2014august/a5.php

Learn more about including eOrganic in a grant at http://eorganic.info/proposal.

APPENDIX I.

Rationale for Recommendations Regarding OREI and ORG

In this Appendix, each of the Recommendations presented in the Final Report is shown in italics, followed by rationale in plain text.

To accomplish the goal of strengthening the OREI and ORG programs at USDA, it will require the significant expansion of USDA funding for organic research and development programs. USDA research funding for organic systems comprises only a fraction of one percent of the total spending for agricultural research. The spending on organic agriculture research must greatly increase in order to aid producers in meeting the growing demand for organic food production. In addition, it would be a tremendous benefit to the ORG program to have a specific authorization and mandatory funding.

The OREI and the ORG have begun to fill a historically unmet need for substantive research and science-based practical information and tools for organic farming systems. OREI and ORG have already yielded some important new tools for producers, and laid vital groundwork for future advances, including research data, new and improved research methods, advanced plant breeding lines, and other "intermediary" outcomes. Adequate program funding over the long term is essential to realizing the full potential for advances in sustainable and profitable organic systems that this body of knowledge represents.

In addition, the current research agenda for organic agriculture, as documented by NOSB (annually), OFRF (Sooby, 2007; Jerkins and Ory, 2016), and other governmental and non-governmental sources as well as the OREI and ORG RFAs themselves, considerably exceeds the programs' current capacity. Each year, the OREI program receives far more high quality and innovative proposals than it can select at the current program funding level of $20 million per year. Increased funding for OREI would both attract a larger number of high quality, innovative proposals, and allow funding of a greater scope of cutting edge sustainable organic research endeavors. In addition, making ORG funding mandatory through a specific authorization under the 2018 Farm Bill would provide security and continuity to this program.

Because of the known and potential environmental, climate, and food security benefits of sustainable, diversified, organic farming and ranching systems, investment of USDA research dollars should be increased in order to implement the following recommendations.

Increase research on underfunded and emerging priority areas.

- *Continue to address ongoing and emerging organic research priorities, including those identified by the NOP National Organic Standards Board (updated annually), and OFRF (Jerkins and Ory, 2016).*
  - *Examples of ongoing priorities include soil health and fertility, weed management, pest and disease management, and marketing and economic issues.*
  - *Examples of emerging priorities include pollinators and pollinator habitat, functional agricultural biodiversity, food safety in organic systems, preventing GMO contamination in organic crops, and application of advanced data systems (GPS based field tracking, precision technology, etc.) to organic production.*
  - *Invite projects that integrate new NOP-compatible weed control technologies (mechanical, thermal, etc.) with cover crops, rotations, and organic no-till.*

OREI has made a considerable investment in addressing organic weed management and soil health and fertility and these issues remain top research priorities for farmers surveyed in 2015 by OFRF (Jerkins and Ory, 2016). The terms "soil", "cover crop", "crop rotation", and "crop-livestock integration" were not included in OREI RFA priority lists during 2011-2016. Soil health remains a foundational component of organic and sustainable farming, and its management is a complex matter that merits ongoing research and explicit inclusion as a priority for OREI funding.

Given the serious tradeoffs between soil quality and adequate weed control to protect crop yields (documented in multiple OREI and ORG projects), organic weed management may require an integrated approach of prevention and control. While the soil-saving practices of crop rotation, cover cropping, minimum till, and crop-livestock integration can help mitigate some weed problems, additional direct-control measures may be needed to protect organic crop yields. In addition to high-residue cultivators, some new innovative techniques that entail little or no soil disturbance include weed pullers, directed hot water sprays (safer than flaming in high residue conditions), air-propelled abrasive grits (OREI 2014-05376), and NOP-allowable herbicides based on essential oils and plant allelochemicals. Meanwhile, OREI and ORG funded breeding and cultivar evaluation have begun to identify and develop crop genotypes with greater competitiveness or allelopathy toward weeds, and/or better tolerance to the presence of weeds. Integration of physical control tactics and improved plant genetics into high residue minimum till organic crop rotations could lead to high-yielding sustainable organic systems that also improve soil, conserve soil, sequester C, and reduce net GHG impacts.

Successful marketing and economic viability remain essential to the sustainability of organic farming, yet "economic benefits of organic systems" has not been listed as a separate annual RFA priority for OREI since 2009. Results of the 2015 organic farmer survey underscore the importance of marketing issues and economic sustainability for organic systems (Jerkins and Ory, 2016). Although the legislative goals include marketing and economics, and several priorities listed on the FY2016 RFA touch on economic issues, we encourage USDA NIFA to explore whether the deletion of the "economic benefits" item from annual RFA priorities has led to a decrease in applications and/or awards with a strong marketing and economic analysis component.

Functional agricultural biodiversity (FAB) is a science-based and site specific approach to designing biodiverse farming systems in which components interact positively and synergistically to provide crop pollination, biological pest control, improved water quality, and other ecosystem services. The FAB approach is more likely to yield net benefits than a more general "the more the better" approach to farm diversification, which can lead to negative biological interactions among components, as well as logistical challenges in enterprise management. FAB was the topic of planning project OREI 2011-02005 (Western region functional agricultural biodiversity, Oregon State University), which assembled a strong team and developed robust research hypotheses. Although the full proposal was not funded, planning team activities led to a review of biodiversity aspects of state agricultural conservation programs in CA, OR, and ID; and contributed to new NOP guidance on biodiversity and conservation.

FAB may well be an important cutting edge for successful diversified organic systems, and merits consideration as a priority topic in OREI and ORG RFAs. OREI included two projects in its 2015 awards that take a functional biodiversity approach to selection of cover crop mixtures (Pennsylvania State University) and the benefits and risks of wild bird populations on the farm (Washington State University).

Within the scope of functional biodiversity, pollinators and pollinator habitat merit attention because of the emerging global pollinator crisis. Organic and other producers are directly affected, and sustainable, biodiverse, organic systems may provide part of the solution by expanding safe habitats for honeybees and native pollinators. In OFRF's 2015 survey, nearly half of organic farmers cited pollinator health as a high research priority (Jerkins and Ory, 2016).

Many mid- to large-scale conventional commodity crop farmers utilize advanced data collection and field monitoring systems to support precision application of nutrients and other inputs and management practices, tailored to variations in soil type and conditions, weed and pest populations. New farmer-friendly sensor and data management technologies make these "big data" applications more accessible to smaller, more diversified producers. Although this issue has not yet emerged in farmer surveys, the potential for advanced data management technologies to enhance management efficiency in organic farming systems remains largely unexplored.

- *Continue to fund projects on a wide range of agronomic and specialty crops; invite and fund proposals for commodities that were under-represented in OREI and ORG awards between 2002-2014, including rice, cotton, tree nuts, herbs, and cut flowers.*

Rice, cotton, tree nuts, culinary and medicinal herbs, and cut flowers are major agricultural commodities in US commerce, yet only one OREI or ORG project addressed each of the first four, and no projects addressed cut flowers from 2002-2014. Although organic sales of each of these commodities represents only 0.3 – 1.7% of total US organic sales (USDA, 2015), and few organic farmers reported producing rice, cotton, or tree nuts in 2015 (Jerkins and Ory, 2016), this

may indicate that significant barriers remain to economically viable organic production of these crops, and thus point to a need for more research in order to open new business opportunities in these crops for organic producers.

Although they appear to comprise a small percentage of organic sales (USDA, 2015), herbs and cut flowers comprise significant parts of production and business plans for many smaller, diversified, direct-marketing organic farms. For example, over half of survey respondents from the Northeast and South produced herbs, while one in three farmers from these regions produced flowers (Jerkins and Ory, 2016). Herbs and flowers also provide important ecosystem services for these farms by providing diverse food sources and habitat for natural enemies of crop pests and for pollinators.

The substantial numbers of awards for organic production, variety evaluation, and breeding of corn, soybean, wheat, other grains, and forages has helped to address the urgent need for organic feed grains and forage for certified organic livestock and poultry operations. In addition, these projects have helped open new market opportunities for organic bread wheat (e.g., OREI 2009-01366, University of Maine) and specialty grains (OREI 2011-01994, Cornell University) for human consumption. Yet, serious production and economic viability challenges remain for organic grain enterprises.

In FY 2015, NIFA funded proposals to continue work on bread wheat production (OREI, University of Maine), grain crop rotations and fertility management (OREI, USDA-ARS Beltsville, MD), optimizing cover crops for organic grain production (OREI, Pennsylvania State University), forage production for dairy (OREI, University of Tennessee; and OREI planning grant University of New Hampshire), rice breeding and IPM (OREI, Texas A&M University), nitrogen management in organic grains (ORG, Iowa State University), and GHG mitigation in organic grain and forage production (ORG, Pennsylvania State University). We look forward to continued progress toward meeting the challenges of organic grain and forage production through future OREI and ORG funded projects.

- *Continue to prioritize development of public crop cultivars for organic systems throughout the US, continue to support farmer-participatory plant breeding and organic seed production networks, and provide an option for long-term funding.*
    - *Continue to address organic breeding priorities such as regional adaptation, nutrient use efficiency, durable (multigene) disease and pest resistance, weed-competitiveness, performance in resource-conserving systems such as organic minimum-till, and market traits such as flavor, nutritional value, and grain milling quality.*
    - *Address remaining gaps, such as vegetable crop varieties for the southern region.*

Plant breeding and public cultivar development have emerged as top priorities for a sustainable agriculture and food system, and OREI and ORG funded plant breeding projects, including several strong farmer-participatory breeding networks, have been among the greatest successes of these programs. After seventy years of selection in the context of input-intensive conventional farming systems with high levels of soluble nutrient availability and synthetic crop protection chemicals, many of today's crop varieties are not well suited to organic and sustainable production systems. In addition, there has been an alarming decline over the past few decades in the number of public plant breeders trained and skilled in classical field-based methods of crop breeding, selection, and cultivar development. Thus, our team is most appreciative that OREI and ORG have made a substantial investment in this vital area, and that practical outcomes (new cultivars available to farmers) have begun to accrue. We are especially encouraged to see that commitment reflected again in the FY 2015 OREI awards, which include experiential learning-based breeding of vegetables and dry beans (University of California, Davis), farmer-participatory cover crop breeding (USDA-ARS Beltsville), a breeding component in organic rice IPM (Texas A&M University), a tomato breeding planning grant (Purdue University), and a three-day Student Organic Seed Symposium to educate future organic plant breeders (University of Wisconsin).

Breeding and selecting crops *on organic farms* as well as *for organic priority traits* may go far toward overcoming the yield gap between conventional and organic systems. For example, one corn breeding project (OREI 2014-05340) has developed several advanced breeding lines that have N use efficiency and N fixation capacities (thus enhancing performance in organic systems and reducing the need for high levels of soluble soil N with their attendant environmental risks), high protein and methionine content (thus addressing organic poultry farmers' needs for methionine sources), and yields commensurate with other Corn Belt hybrids. Plant breeding for organic minimum-till systems with high biomass cover crops and diversified rotations may lead to new cultivars that can perform reliably and profitably in these most resource-conserving and GHG-mitigating systems.

Because plant breeding is a long-term endeavor (often requiring seven to ten years from initial crosses to finished cultivar ready for release), we were glad to see that the Northern Vegetable Improvement Collaborative (Oregon State University) and the corn breeding project (USDA ARS) received additional OREI funding in 2014, allowing these teams to reach their goals of releasing new cultivars in the next few years. In order to allow sustained funding for other organic plant breeding teams, we encourage the OREI program to consider reinstating the long term funding category in OREI, with options for funding renewals contingent on satisfactory progress toward breeding goals.

- *Increase funding for organic livestock and poultry production; invite and fund proposals for under-represented commodities, especially beef, pork, and turkey.*

Animal products comprised more than one-third of total US organic sales in 2014 (USDA, 2015), yet livestock and poultry projects accounted for only about 7% of OREI and ORG funding between 2002 and 2014, compared to 74% for organic crops and 17% for projects addressing both crops and livestock, or general topics. The greatest research investment in organic animal agriculture focused on dairy, which also represents about 20% of total US organic sales (USDA, 2015). Thus, more research investment in organic livestock and poultry production seems warranted.

Beef, pork, and turkey play major roles in American agricultural commerce and diets, yet there were only two projects for beef, two for pork, and no projects for turkey.. In 2015, more organic producers raised and sold organic beef than any other animal product, including dairy; and more than one in four producers in the Northeast raised hogs (Jerkins and Ory, 2016). Additional research and extension for organic livestock and poultry production merits high priority, and could open substantial economic opportunity for organic producers to meet demand for organic meat and other animal products.

Continued funding for research into organic grain and forage production will also play a vital role in supporting organic livestock enterprises. Overcoming existing hurdles to profitable organic grain production would not only help organic grain producers themselves but could also clear a major barrier to the expansion of organic dairy, poultry, egg, pork, and other livestock enterprises.

- *Invite and fund proposals to identify traits and develop new and improved livestock and poultry breeds for organic production, with emphasis on disease and parasite resistance, overall ability to thrive in lower-input systems, performance on pasture and rotational grazing systems, and other priorities for organic systems.*
    - *Provide an option for long-term livestock breeding projects.*

Breeding of livestock and poultry for organic production systems, including pasture based and rotational grazing systems, is vital to the long term success and sustainability of organic farming and ranching. For the past several years, OREI RFAs have included the following priority:

> *"Catalog, characterize and/or select animal genotypes and breeds adapted to organic systems. This would include, but is not restricted to: identification of and selection for pest and disease resistance; health and performance under organic pasture and feed regimens; and performance in small, mixed or innovative farming operations."*

Yet, none of the OREI and ORG projects through 2015 entailed actual livestock breeding. This may reflect a lack of proposals in the area of animal genetics; however a more direct priority statement such as: *"Breed, evaluate, and select animal genotypes and breeds adapted to organic systems. This would include … "* might make it clearer to potential applicants that livestock breeding is a priority for OREI funding. We also encourage OREI to make a long term funding option available for animal breeding projects similar to plant breeding.

The need and opportunity are great. For example, project reports from a team working on organic management of gastro-intestinal parasites in sheep (OREI 2005-04426 and OREI 2010-01884, USDA-ARS, Booneville, AR) indicate great potential for breeding for parasite resistance, which could overcome the greatest barrier to organic small ruminant production. As of the 2015 awards, this promising lead has not been followed up with a sheep breeding project through OREI or ORG.

- *Invite and fund proposals for meta-analysis of past OREI and ORG research on complex issues such as soil health, integrated organic weed management, and C sequestration and GHG mitigation in organic systems.*
    - *Encourage applicants to include conferences, symposia, teleconferences, or other opportunities for researcher and producer representatives of project teams to share data and perspectives, and exchange ideas on the topic of meta-analysis.*

Results to date from studies of C sequestration and net GHG impact of various organic, minimum till, and conventional systems have been complex, inconsistent, and difficult to interpret in a way that can lead to sound guidelines for producers seeking to optimize their environmental stewardship. Similarly, outcomes from projects seeking to co-manage weeds, soil quality, and crop yield through reduced tillage, high biomass cover crops, diversified rotations, and other strategies have had mixed results, sometimes including tradeoffs between soil health and profitability of the cropping system. Outcomes of these studies depend on a wide array of factors, including climate, rainfall, soil type and condition, and past management history as well as the details of the experimental farming systems and protocols undergoing comparative evaluation. With soil health and organic weed management remaining high on farmers' priority list (Jerkins and Ory, 2016), an in-depth review or meta-analysis of the past 14 years of OREI and ORG funded research on

these issues may be needed to better understand underlying processes and causal factors, refine hypothesis for future research, and lay the groundwork for developing practical guidelines for different regions and production systems.

In addition to meta-analysis of research data itself, a conference, series of meetings, or other opportunities for scientist and producer participants in past or ongoing OREI and ORG projects on the target issue to share findings, ideas and perspectives could enhance and complement the data meta-analysis in developing new approaches, hypotheses, or strategies for future research.

Different project teams working on different aspects of a complex issue may each have parts of the solution that, if implemented together in an integrated system, might give a much better outcome than any one alone. Bringing project teams together through in-person or teleconference meetings can help overcome the limitations of projects with a narrower focus, allowing several projects that each focus on one or a few components of a complex issue to address that issue collectively in a holistic manner. OREI funded symposia and other meetings can provide opportunities for such synergism amongst project teams, and thus reduce the need for each project to tackle all angles of a complex issue like weed management in a "holistic" approach that attempts to "do everything" and thereby get spread too thin.

- Continue to require that practices to be tested as the primary experimental hypothesis or system be compliant with current NOP rules. In addition make alignment of experimental organic treatments with principles of sustainable agriculture a criterion for proposal review.

We appreciate NIFA for including clear requirements in OREI and ORG RFAs for research to focus on experimental practices and systems that comply with NOP rules and are implemented on certified organic land. We also understand the need for certain projects to utilize non-organic practices in "control" treatments to compare organic versus conventional systems. In addition, the vast majority of OREI and ORG projects to date have utilized experimental systems or treatments that reflect the spirit as well as the letter of NOP organic definition and rules. However, a small number of projects tested "organic" systems with poor nutrient management or inadequate cropping system diversity. Results from such studies are of limited utility to organic producers and can be misleading. Review panels should be instructed to evaluate the sustainability of proposed organic systems, strategies, or tactics, as well as their full compliance with NOP standards including non-use of NOP-prohibited materials.

Balance funding for smaller proposals with simple goals and on-the-ground methods, with larger, more complex, and multi-institutional projects.

- *Continue to fund conferences, symposia, and planning projects to bring farmers, researchers, and other stakeholders together to disseminate and share OREI and other organic research outcomes, as well as ideas and perspectives on future research.*
  - *Encourage proposals for symposia on challenging issues like co-management of weeds and soil quality, organic minimum till, GHG estimation and mitigation, poultry nutrition, parasite management in small ruminants, and effective alternatives to materials that may be removed from the NOP National List.*
  - *Announce planning grant awards early enough in the annual funding cycle to allow teams time to develop and submit full proposals in the next funding year.*
  - *Periodically adjust the $50,000 funding cap for conference and planning grants for changes in cost of living (currency inflation).*

OREI funded conferences such as the Organic Agricultural Research Symposia, and others focused on specific topics including organic fruit production and organic seed systems, have served two vital purposes: dissemination of key outcomes of other OREI, ORG, and relevant research endeavors; and an opportunity for producers, researchers, service providers, and other stakeholders to exchange information, ideas, and perspectives; discuss research outcomes; re-evaluate research priorities; and propose new approaches to production challenges. Symposia that convene participants in past and current OREI and ORG projects on a specific challenge or topic (e.g., GHG estimation and mitigation) can be especially effective in helping the research and farming community develop new hypotheses or experimental protocols for future research.

Planning grants not only facilitate proposal development but can also accomplish significant practical outcomes regardless of the success of the full proposal. Examples include an organic bison planning project which led to improved herd management (OREI 2010-01916) and a functional agricultural biodiversity project which supported a review of several states' agricultural conservation programs (OREI 2011-02005). However, one leader of a successful planning grant commented on the short interval between announcement of the planning grant award and the deadline for the full proposal in the subsequent funding year, which could make it more difficult for teams to meet the deadline with a high quality proposal. Thus, we encourage NIFA to consider announcing OREI planning grant awards earlier in the funding cycle to allow teams sufficient time to develop and submit robust full REE proposals.

The $50,000 ceiling on planning grant and conference grant awards was set in 2009, the first year that OREI offered these grants. Although currency inflation has been relatively slow in recent years, the value of the dollar has shifted significantly since then, and we recommend that the maximum award for these valuable low budget grants be periodically adjusted to remain equivalent to $50K in 2009 dollars.

- *Fund smaller, targeted OREI projects (<$500 K) as well as larger, multi-issue, multi-disciplinary, and multi-institutional projects.*
  - *Retain the three-tier structure for REE projects adopted in the 2015 and 2016 OREI RFAs, and consider adopting a 20% funding set-aside for targeted projects.*
  - *Instruct proposal review panels to consider the efficacy of simple, well-designed, lower-budget, targeted projects, as well as the power of sophisticated methods and the scope of large, holistic projects that tackle multiple issues simultaneously. Panels should also weigh the costs and benefits of including many versus fewer partners, and not automatically prioritize the most "multi-institutional" projects.*

During their first several years, OREI and ORG funded small- to moderate-size REE projects ($30 – 750K), many of which were surprisingly cost-effective in providing farmer-ready practical outcomes as well as valuable intermediary results (research data, plant breeding lines, etc.). Since 2009, the OREI program has primarily funded larger projects, with 80% of funding going to projects with budgets of $1M or more. While these larger projects took a holistic perspective and have amassed a substantial body of research information, many have yielded only limited practical information, guidelines, tools, or other products that producers can apply to their farms with confidence. In part, this reflects the complex nature of the issues addressed: GHG emissions from whole farming systems, soil microbiology and nutrient dynamics, and integrated approaches to co-managing weeds, nutrients, and soil quality. However, some of these projects appeared to have lost some cost-efficacy by taking on too many issues at once, and/or trying to coordinate a large and unwieldy array of partner institutions. Several PIs commented on this issue during interviews with our team, and one observed that projects were "too large and diffuse" to lead to practical outcomes within the life of the grant.

In 2014, OREI implemented a two-tier system to invite both large and smaller REE proposals, and expanded to a three-tier structure in 2015 and 2016, including multi-regional ($1 – 2M), regional ($500 K – 1M) and targeted (up to $500K) proposals. "Smaller, mid-size, and minority-serving institutions" were specifically encouraged to submit targeted proposals. However, with the exception of conference and planning grants, FY2015 awards did not include any projects in the targeted tier, and all went to 1862 LGUs or ARS research teams.

While it is necessary for research to take a *holistic perspective* to yield relevant outcomes for an inherently holistic system such as organic agriculture, it is quite reasonable and practical for a project to tackle a single issue or component *within a holistic context*. For example, new, soil-saving weed control tactics (e.g., air-propelled abrasive grits, OREI 2014-05376), new NOP-compatible biological disease controls (e.g., alternatives to antibiotics for fire blight, OREI 2011-01965 and ORG 2013-03968), or a simple crop rotation tactic (e.g., rye before soybean to reduce soybean aphids, ORG 2004-05204), can serve as important and appropriate components of organic systems approaches to crop protection. For targeted proposals, the RFA can include language encouraging applicants to place the narrower topic of study within the wider context of holistic organic systems.

Targeted proposals can address one or a few aspects of a larger, more complex issue; for example, a project focused on optimizing cover crop mixes for a specific region or farming system can provide valuable data to help address the larger challenge of co-managing soil health, weed populations, and crop nutrition and yield. A second targeted project might evaluate crop varieties for ability to utilize N from cover crop residues, a third might test mechanical no-till cover crop termination methods, etc. OREI funded conferences or symposia can then offer an opportunity for collaboration among representative participants from multiple small and larger projects addressing aspects of this issue to gain a more holistic perspective, and to develop new strategies or hypotheses that no one team would have developed alone.

Project review panels should be instructed to consider the merits of small, simple, targeted projects as well as large, holistic ones. Scientific merit, relevancy to organic research priorities, NOP compliance, and cost-efficacy of both experimental procedures themselves and proposed on-farm applications, should take precedence over whether research methodology is high-tech or cutting-edge. Panels should also consider the costs in time, and project resources of coordinating multiple institutional partners in a project, as well as the benefits gained from the different skills or perspectives offered by those partners.

The current three-tier structure could provide a means to realize and evaluate the potential benefits of both smaller and larger projects for different research goals and topics, but only if a significant percentage of OREI awards are in the targeted category. Thus, we encourage NIFA to consider setting aside a percentage (perhaps 20%) of OREI funding for the targeted tier of up to $500K.

Increase research funding to underserved entities, regions, and constituencies

- *Continue to invite and fund proposals from underserved regions (the South) and constituencies (Native American and other ethnic minorities), 1890 LGUs and other smaller universities and colleges, and non-governmental organizations engaged in organic agriculture research, education and outreach.*
- *Instruct review panels to evaluate and select proposals on the basis of scientific merit, relevancy to organic producer and processor priorities, NOP compliance, and cost efficacy, rather than size, endowment, and infrastructure of the applicant institution.*

For the past several years, RFAs have encouraged *"proposals addressing management of diseases, nematodes, weeds, and insect pests in the Southern Region,"* and this led to six successful proposals from the South in FY 2015, with $6.45 M total funding (37% of the nationwide funding total). We want to acknowledge and thank NIFA for addressing past under-representation of the Southern region in OREI, and look forward to continued funding of research efforts to address the particular challenges of organic farming in the South.

Recent RFAs have also encouraged applicants to, *". . . develop partnerships that include collaboration with: small- or mid-sized, accredited colleges and universities; 1890 Land-Grant Institutions, 1994 Land-Grant Institutions, Hispanic-serving institutions, and/or other institutions that serve high-risk, under-served, or hard-to-reach audiences; Non-Governmental Organizations (NGOs) that are engaged in organic agriculture research, education, and outreach."* Our analysis indicated that, throughout the history of OREI and ORG, some applicants have formed strong partnerships with sustainable agriculture NGOs and farmers' organizations as well as 1890 LGU and other colleges. However, because partners are not consistently listed in project abstracts on the CRIS database, we could not quantify the extent or efficacy of such partnerships.

Finally, although recent RFAs have encouraged 1890 LGU and other smaller institutions of higher learning to apply especially for targeted projects, full REE awards in 2014 and 2015 remained dominated by 1862 LGUs, with the exception of one award to a NGO (National Center for Appropriate Technology, OREI 2014-05354) and three to ARS. We also noted that a full proposal arising from a planning grant on organic bison submitted by a Native American tribe who had assembled a strong research team and had already implemented improved sustainable herd management during the planning process, was not funded. Two possible reasons for this lack of awards to smaller institutions and minority applicants could be a dearth of strong proposals from these applicants, or inadvertent bias on the part of review panels toward large, well-endowed 1862 LGUs with strong track records in organic research as well as the infrastructure to conduct sophisticated laboratory or field station experiments, measurements, and analyses. Our suggested instructions to review panels are intended to guard against possible biases of this kind.

- *Eliminate the match requirement for all applicants for OREI and ORG funding, to make the programs more accessible to NGOs and other entities.*

While projects whose lead institutions (funded entities), or one or more major partners are colleges and universities are currently exempt from the 1:1 matching requirement in OREI and ORG proposals, we strongly encourage NIFA to eliminate this requirement for all OREI and ORG applications. Recent RFA language allowing the exemption for projects that include a college or university as a substantial partner took a big step toward removing a major (often insurmountable) barrier to NGOs and other non-university entities applying for OREI and ORG funding as the lead institution. If it is within NIFA authority under current Farm Bill legislation to take the next step by eliminating the requirement for all applicants, we strongly encourage NIFA to do so. Some of the most innovative and farmer-relevant proposals can come from NGOs engaged in organic and sustainable agriculture endeavors, and such applicants should be encouraged to participate in the capacity of lead institution, either alone or in partnership with a university.

Increase producer engagement

- *Continue to encourage the engagement of producers in all phases of a project from goal setting and proposal development through planning, execution, outreach, and evaluation.*
- *Encourage projects to link producer participants with one another and with project scientists in learning networks; provide guidance on how this might be achieved while ensuring confidentiality of any sensitive producer information (such as business data).*

We appreciate the clear language in OREI RFAs regarding stakeholder engagement, exemplified in the 2016 RFA, page 7:

> *NIFA strongly encourages applicants to consult with organic producers and/or processors before developing project applications. Producers and/or processors should play an important role in developing project goals and objectives; in implementing the plan; and in evaluating and disseminating project results and outcomes. Projects must involve work that is viewed by stakeholders as both necessary and important.*

Many OREI and some ORG projects exemplify this kind of producer engagement, and some have developed highly

effective producer-scientist networks that enhanced the level of innovation, scientific soundness of on-farm research, and farmer relevance of project outcomes. However, some project proposals seemed to promise a greater degree of active farmer engagement than was evident from project final reports and other products. Two projects that engaged large numbers of growers did not link the producers to one another, so that farmer participants did not know or have an opportunity to meet with other producers on the team. One of these projects proposed development of a "learning community" of at least 60 producers working with scientists on the team to address a high priority research question for farmers in the region. Yet, interviews with four farmers at the end of the first year of the project revealed that their only contact with the research team was with two or three scientists who visited their farms to collect soil and plant samples; as of April of 2016 they had not even received 2015 sample analysis results for their own farms. When one of these farmers asked why they have not been put in touch with other producers on the project, he was informed that this information was being kept confidential. While it is understandable that some information shared by producers, such as economic, marketing, and business management data, may be of a sensitive nature that should be kept confidential, it seems counterproductive to keep project participants isolated from one another entirely.

It may be helpful for NIFA to develop guidance language on how to strike a balance between keeping certain aspects of participant farming operations confidential and fostering the often highly productive interaction of producer participants with one another and with scientists on the project. When such interaction is absent, and especially when farmers do not receive data taken from their own farms, a tremendous opportunity for mutual learning and networking is lost.

Improve project reporting, dissemination, outreach, and access to project outcomes

- *Require and facilitate consistent and up-to-date reporting for all projects on the CRIS database:*
  - *Require final project report to provide a clear and prominently displayed summary of key project outcomes, including new crop varieties, new NOP-compatible pest controls, decision tools, manuals, information sheets, videos, and other farmer-ready products (with web links or other sources through which farmers and service providers can access each), as well as intermediary research findings and emerging research questions intended for the scientific community.*
  - *Require a complete listing, in project proposal and/or final report, of all major project partners, to allow producers and other stakeholders to identify and access partners in projects of interest, and allow the public to assess engagement of NGOs, 1890 and 1994 LGUs, and other entities in OREI and ORG research.*
- *Remove redundancy among successive annual reports, but retain unique material in earlier progress reports that is not included in later reports.*
- *Develop a searchable database, similar to that already available on line for the SARE program, through which producers and other end users can readily access OREI and ORG project summaries and outcomes by commodity, region, or topic.*
- *Continue to utilize OREI funded conferences and symposia as a dissemination venue for both intermediary research outcomes and farmer-ready project products and information.*
- *Ensure ongoing funding of the eOrganic communities of practice to facilitate OREI and ORG project outreach via the eXtension website. Continue to encourage (but not require) project teams to utilize eOrganic for development and delivery of project products.*
- *Explore ways to restore and make available valuable products and outcomes from past OREI and ORG projects that are currently inaccessible.*

For many projects, our team encountered difficulties in identifying, accessing, and reviewing practical outcomes and products for producers from the project abstracts available on the CRIS database. Projects varied widely in the quality, thoroughness, and organization of their final reports. While a minority of CRIS reports clearly stated outcomes and provided web links or other sources for decision tools and other valuable informational outputs, most others either gave only sketchy reports on outcomes, or "buried" clues to key outcomes (with or without direct links or sources) in the middle of lengthy, detailed reports on project methodology and outreach activities. We often spent considerable time combing through reports in order to ascertain what the project actually accomplished, both in terms of practical information and tools for organic producers and processors and in terms of research data that scientists could use to guide their own research and outreach endeavors.

The establishment of the eOrganic community of practice and website, and publication of proceedings of several OREI funded organic farming research symposia significantly improved accessibility of key outcomes for projects initiated since FY2009. However, only about half of OREI and ORG projects during the 2009-14 period have utilized eOrganic and/or reported through the OREI-funded symposia. A few other projects established their own websites, which also facilitated access. Some effort is still needed to track down products and outcomes.

When our team first conducted the review of projects via the CRIS database (early in 2015), we found that some projects submitted multiple, lengthy annual reports with much redundant material, making it even more time-consuming to identify and assess project accomplishments. By the end of the year, many projects had updated their reports, but earlier progress reports were deleted from the CRIS database. In some cases, this resulted in the loss of interesting and significant outcomes that had been reported in earlier but not later reports.

Requiring all OREI and ORG project teams to submit reports in a timely fashion, and to include a prominently displayed, succinct summary of all significant project outcomes that producers, service providers, researchers, or other stakeholders might want to access, with links to decision tools and other project products, would greatly facilitate both assessment and dissemination of OREI and ORG project outcomes.

In addition, while many project reports included reference to project partners, including organic farming NGOs, smaller universities and colleges, 1890 LGU, and farmers' organizations, the reporting on active partners and partnerships was highly inconsistent, and no reports included a list of project partners. Therefore, while OREI RFAs in recent years have encouraged applicants to partner with these other kinds of entities, it was impossible for our team to assess the degree and efficacy of such partnering through the CRIS abstracts. A simple list of major project partners would address this issue, and would take less than half a page for most projects.

Farmer interviewees have cited the SARE program's searchable web site that allows the user to access all SARE funded projects to date, and to retrieve project reports and SARE publications by topic, crop or livestock species, or other search parameters. Establishing such a database for specific to the OREI and ORG funded projects would, in effect, provide a "one-stop shop" online through which producers and other end-users can readily access practical outcomes, tools, and products from OREI and ORG by commodity, research issue, farming system, or region.

While eOrganic has indeed proven valuable in many ways, at least one interviewee (a project PI) raised a concern that his team had been required to use, and pay for (as part of the project budget), the eOrganic service when the research had not yet developed farmer-ready outcomes. Thus, we want to register our concurrence with current OREI RFA language that encourages but does not require use of eOrganic. In addition, it is important to ensure that eOrganic receives sufficient funding to continue to expand and update its offerings for the organic farming sector, and at the same time not to place the burden of funding eOrganic too heavily on the budgets of other OREI and ORG projects. Our team would like to encourage NIFA to explore ways to ensure the long term financial sustainability of this valuable outreach venue.

Finally, a significant minority of OREI and ORG projects, especially among those funded during the first five or six years of the programs, appear to have generated valuable information that has unfortunately not been archived and disseminated in durable form, and appears to have been lost, or at least become inaccessible to producers and the general public. One prominent example is the New Agriculture Network established in the North Central region, through which several OREI projects disseminated findings and facilitated highly effective farmer-researcher exchanges. Prominent among these is *Partnering for Organic Agriculture in the Midwest* (OREI 2005-04473, Michigan State University), which facilitated biweekly teleconferences between producers and researchers, the content of which was not recorded in durable and accessible form. Efforts to retrieve project findings throughout the history of OREI and ORG, and make them available through the above-mentioned user-friendly searchable database or one-stop-shop, would be a tremendous service to the organic farming and research communities.