



IMPACTS OF OFRF GRANTS: 2006-2014

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EXECUTIVE SUMMARY

The Organic Farming Research Foundation (OFRF) is a non-profit organization founded in 1990 with the goal of advancing organic agriculture through scientific research. OFRF provides grants for organic farming research and education, with a particular focus on practical solutions to organic farming challenges. This report was conducted to review and analyze the past nine years of OFRF's grant making program, (2006-2014), with the goal of refocusing, strengthening and expanding the program for the future.



Organic farming and organic farming research have grown tremendously in recent years. When OFRF was founded in 1990, organic farming research was not a well-studied field of inquiry, and the US Department of Agriculture was more than a decade away from certifying organically grown products. Today there are more than 15,000 certified organic producers in the US, a growth of 250% since 2002, and organic farming research is now being conducted at universities around the world (USDA, 2015).

This growth validates OFRF's commitment to funding practical research and science-based solutions to production challenges faced by this rapidly growing agricultural sector.

This report offers a detailed review of OFRF-funded research and education projects initiated between 2006-2014. This report is an update to the 2006 report, "Investing in Organic Knowledge," and offers insights into the most recent period of OFRF grant making. This evaluation clearly indicates that OFRF investments have resulted in important advances in organic farming knowledge and practice, particularly for targeted crops and research areas. The report also identifies emerging research needs, and suggests how OFRF's grant program can be strengthened to fill knowledge gaps and better address farmers' priorities.

OFRF awarded 106 grants from 2006-2014, investing a total of \$1,452,517. The average one-year grant amounted to \$13,967.

While modest in size, OFRF grants have played a crucial role in advancing the careers of young scientists, many of whom have subsequently advanced to influential research, teaching and public-service careers in organic agriculture. Results from OFRF-supported research, which are freely available on the foundation's website, have added substantially to the body of scientific knowledge guiding modern organic farming practices.

In addition, the foundation's unique partnership with organic farmers has kept its research program current, relevant, and focused. OFRF regularly surveys organic farmers about their experiences, challenges and information needs, and uses farmer feedback to craft its research funding priorities.

OFRF funds projects based on scientific merit, combined with the potential to address identified organic farming challenges. Funding from 2006-2014 focused on insect pest management, plant breeding, disease management, and weed management - all major challenge areas for organic farmers. For example, OFRF-funded research has advanced the methodology and knowledge surrounding how to best solve the problem of soilborne disease, how to utilize beneficial organisms like bats and birds for pest control, and how growing new crops like goji berries can be economically advantageous. The most significant impacts of the projects from this period are advances in knowledge regarding crop breeding and disease management, two areas that have been prioritized for OFRF funding. Advances have also been made in insect management, and the creation of impactful educational resources and training programs.

Techniques and findings from OFRF-funded research have been widely implemented by organic farmers over the years, with information disseminated online, in sponsored publications, and at farming conferences and field days.

Many OFRF-funded projects address farming challenges confronting all cropping systems. However our analysis shows a greater historical focus on vegetable, fruit, and grain cropping systems, with a lesser focus on animal research, herbs, and tree nuts. It is recommended that future funding include more projects focused on livestock, animal research, pasture management and livestock health.

OFRF's diverse pool of research project directors includes university professors, postdoctoral researchers, extension agents, non-profit organizations, and farmers. The most common OFRF grant recipients are university professors. However, OFRF grants have proved particularly influential on the careers of graduate students and early-career scientists.

Grant recipients have used initial OFRF awards to leverage significant additional funding from state and federal agencies. For example, a research project led by Dr. Carol Shennan and Dr. Joji Muramoto at UC Santa Cruz to examine organic management of soilborne diseases in strawberry production, initiated with \$28,000 in OFRF grants, eventually led to \$2.8 million in additional USDA funding. Funding innovative work at the early stages becomes enhanced and very impactful when researchers are able to grow their programs and continue the work at a larger scale.

One unique facet of OFRF grant projects is close collaboration with farmers as research directors and participants. Projects with strong farmer collaboration tend to be grounded in the real-world challenges faced by producers. Farmer involvement translates into strong projects, which often produce results that are quickly adopted by the industry. Continuing to include farmers in a diverse pool of research project directors, along with students, academics and extension personnel, is a priority for future OFRF funding.

OFRF grants are most commonly awarded in the western U.S., where organic farming has seen the most growth. The foundation has also made progress in strengthening funding in other parts of the country. From 2006-2014, OFRF funded projects in 25 states and increased the number of projects funded in the southern U.S. OFRF will continue to support projects throughout the nation and in-

crease outreach to underserved regions where organic farming has experienced slower growth.

Overall, OFRF grant funding has advanced scientific knowledge and improved the practices, ecological sustainability and economic prosperity of organic farming. These successes support our goal of researchers and farmers working collaboratively to support the improvement and widespread adoption of organic agriculture. This longstanding collaboration has created a strong network of scientists and farmers who share research results and innovate together to craft solutions to organic farming challenges.

This report recommends continued support for insect, disease, and weed management research efforts as well as special attention to research needs related to post-harvest handling and food safety, pasture management, crop rotations, and livestock disease.

OFRF is already improving its grant-making program based on current and past recommendations. OFRF has created an online application system for the 2016 grant cycle to streamline the application process. In the 2016 call for proposals, OFRF is directing future funding toward emerging areas of need, such as soil health and drought management. OFRF is also conducting strategic outreach to encourage proposals from a diverse group of applicants including graduate students, farmers, and extension agents.

OFRF is committed to supporting the research needed to meet the current challenges of organic farming, and to help organic farming continue its rapid growth. Through these efforts, OFRF is creating a more resilient and sustainable agricultural system that values healthy environments and healthy people.

FULL REPORT: IMPACTS OF OFRF GRANTS

INTRODUCTION

OFRF is a leading grant maker for organic agriculture research and education, funding innovative research and education projects that lead to new production solutions for farmers and a stronger community among organic farmers. Since its founding, OFRF has funded 314 research projects with the aim of directly addressing the needs of organic farmers and ranchers. OFRF is one of the first non-profit organizations to award grants dedicated to organic farming research, making important scientific contributions to organic knowledge and practice since 1990.

This report is an analysis and review of OFRF grants made from 2006-2014, and serves as an update to a previous report from 2006, *Investing in Organic Knowledge: Impacts of the First 13 Years of the Organic Farming Research Foundation's Grantmaking Program* (Sooby, 2006). The OFRF Board of Directors requires periodic re-evaluation of the foundation's grant-making program to ensure its impact and continued relevance to the current needs of farmers and ranchers.

Opportunities for organic farming research funding have expanded dramatically since 1990, with the USDA Organic Agriculture Research and Extension Initiative (OREI), USDA Sustainable Agriculture Research & Education (SARE), and Ceres Trust now offering substantial funding opportunities for organic research. This report is an effort to define the unique and historic role of OFRF funding, and determine how we can best position the foundation to work in con-

cert with these partner organizations and continue to fund impactful and innovative research.

For the period of 2006-2014, OFRF-funded projects have covered a wide range of topics and had positive impacts on organic farming. From research projects examining new varieties and organic seed breeding to educational projects that link beginning farmers with mentors, OFRF grants have helped produce important tools and informational sources for organic farmers.

OFRF GRANT MAKING PROCESS

Project proposals are solicited by OFRF with a request for proposals (RFP). These RFPs encompassed both research and education projects until 2014, when the foundation's board of directors decided to focus primarily on research projects, while making requirements for education and outreach stronger. OFRF receives contributions from individuals, other non-profit organizations and government agencies to provide funds for the grant-making program. Applications are received by OFRF staff and reviewed for completeness. Complete proposals are forwarded to the board of directors for review. Projects are reviewed based on merit of the research questions, qualifications of the research team, and potential impact on organic agriculture. Preference is given to proposals that include farmer participation.

Competitiveness of the program has varied from year to year, based on the number of proposals received and funds available. Board members make final decisions on which projects are funded. Grants are awarded for one year with the option of reapplication for continued funding. Each grant recipient is responsible for reporting project results in a final report. OFRF staff evaluates final reports for completeness and attainment of the proposed research objectives. Detailed information on all OFRF-funded research projects is available online in the OFRF Grant Research Database (<http://www.ofrf.org/research/database>) with links to publications and resources useful to farmers.

METHODS USED FOR THIS REPORT

To generate this report, quantitative data were collected to perform a descriptive analysis of the grant program, and qualitative data were collected from a series of interviews to gain a nuanced understanding of the impacts of the program.

For the descriptive analysis, project proposals and final research reports for each grant were analyzed. Data collected included information regarding amount of the award, the project directors, farmer involvement in the research, type of research questions, and ways in which results were shared with target audiences.

A total of 106 grants were made during the period of 2006-2014. One grant was excluded from the analysis because it was a donor-directed grant. For the donor-directed grant, OFRF served as fiscal administrator but the grant did not go through OFRF's grant review and selection process.

DESCRIPTIVE ANALYSIS

Total funding awarded

From 2006-2014, OFRF awarded \$1,452,517 in grant funding for research and education projects. Each year there was a spring and fall grant cycle, except for 2006 which offered only a spring grant cycle. Total amounts awarded for each grant cycle were variable, ranging from \$230,590 in the fall of 2008 to \$14,000 in the fall of 2014 (Figure 1). On average, OFRF grant awards totaled \$85,442 for each grant cycle.

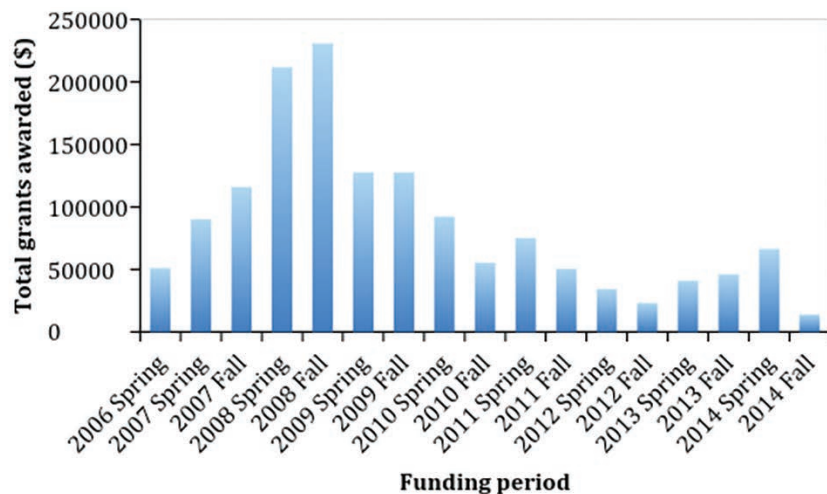


Figure 1. Total grant amounts awarded from spring 2006 to fall 2014

NUMBER OF GRANTS

OFRF made a total of 106 grant awards from fall 2006 to fall 2014. These awards ranged from a minimum of \$2,152 to a maximum of \$57,597 for individual awards for a single grant cycle (Figure 2). The average award per year for a given project was \$13,967. Twenty-two projects were funded for two or more years, and 63 projects were funded for only one year, for a total of 85 unique projects funded by OFRF from 2006-2014.

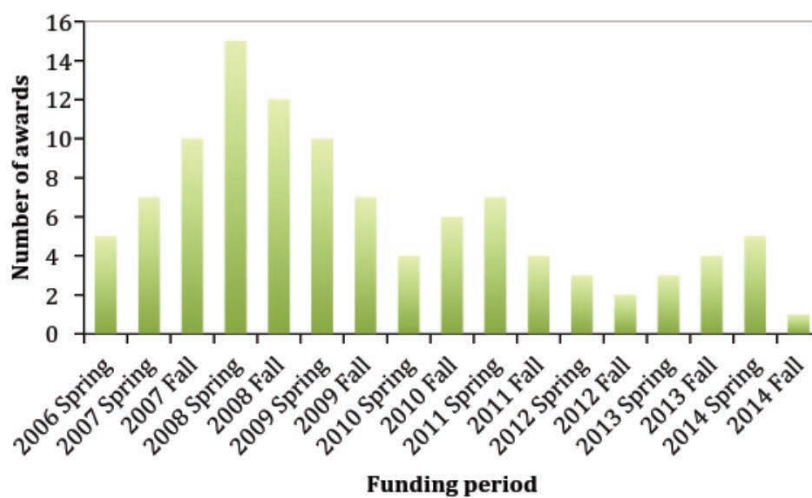


Figure 2. Number of awards made for each funding cycle.

TYPE OF GRANT

OFRF awarded both research and education grants. Of the 85 unique projects, 23 were education projects and 62 were research projects (Figure 3). While most of the research projects had strong outreach and education components, 11 were purely research efforts with little or no outreach.

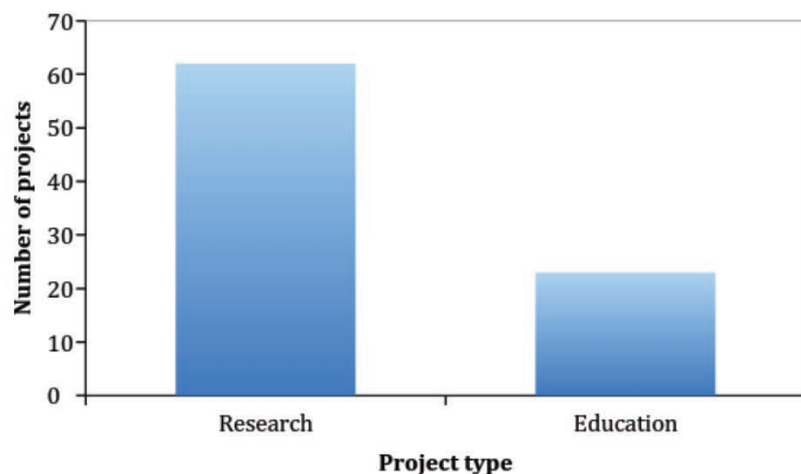


Figure 3. Number of research and education projects funded from 2006-2014.

GEOGRAPHIC LOCATION OF PROJECTS

The number of U.S. organic producers and organic acres varies greatly by region, with organic production concentrated in the western and north central regions (Table 1). The southern region currently has the fewest organic operators and the fewest organic acres of the USDA's four geographic regions (USDA ERS, 2013).

The 85 grant projects funded by OFRF during the study period took place in 25 states¹ as well as two projects in Canada and one project in Mexico (Table 2). Analysis of the project locations based



Figure 4. Map showing the four different regions as defined by USDA SARE.

on geographical region was based on the regional delineations set by the USDA Sustainable Agriculture Research & Education (SARE) program (Figure 4; USDA SARE, 2012). The western region received the largest number of research grants from OFRF, yet OFRF grant funding to the north central, northeast, and southern regions has increased substantially compared with funding from 1995-2005 (Figure 6).

¹Complete list of all states with OFRF projects: Arkansas, California, Colorado, Florida, Georgia, Idaho, Indiana, Iowa, Kansas, Massachusetts, Michigan, Minnesota, Montana, New Hampshire, New York, North Carolina, North Dakota, Ohio, Oregon, Pennsylvania, Vermont, Virginia, Washington, West Virginia, and Wisconsin.



Figure 5. U.S. states with the highest organic product sales. (Source: USDA, 2015).

Organic farms sold a total of \$5.5 billion in organic products in 2014, with much of this value concentrated in the top five organic-producing states of California, Washington, Pennsylvania, Oregon, and Wisconsin (USDA, 2015; Figure 5). Western states make up the majority of organic sales, and OFRF funding has historically focused on the West, the region with the most organic farms and the highest organic value. However, OFRF has the dual goals of supporting regions

where there is a need for organic growth, like the South, and regions with robust organic agriculture and high research needs.

	Western	Southern	North central	Northeast
Number of operations (%)	4,578 (36%)	971 (8%)	4,118 (32%)	2,996 (24%)
Number of organic acres (%)	3,084,153 (59%)	397,904 (8%)	1,218,058 (23%)	518,997 (10%)

Table 1. The number of organic pasture and cropland operations and acres by region in 2011 (Source: USDA ERS, 2013)

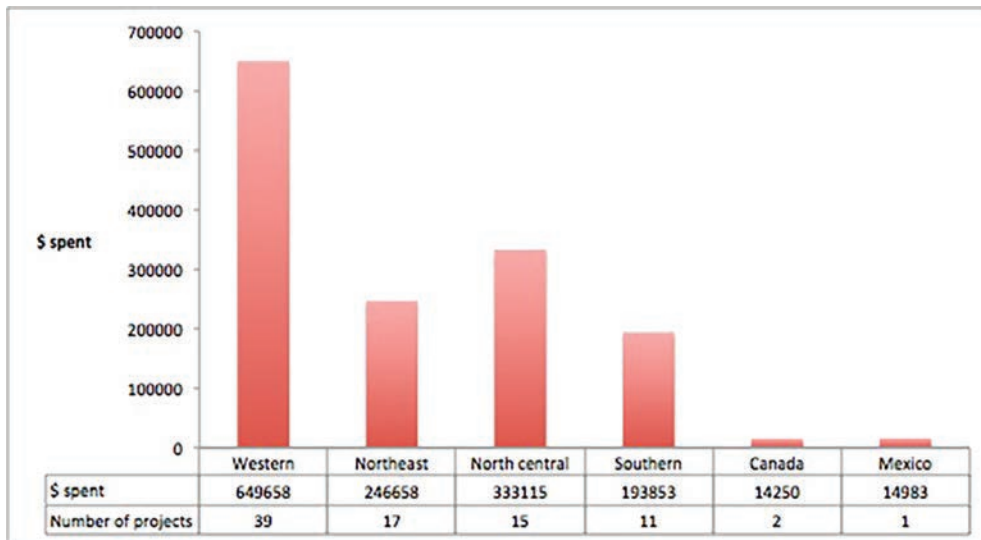


Figure 6. Number of projects and amount funded in each region.

WESTERN REGION

Forty-six percent of OFRF-funded projects over the study period took place in the western region.² Research in the West is concentrated in California and Washington, with several projects taking place in the Central Coast of California. Researchers from California have received OFRF funding to work on projects related to insect pest management, soil borne pathogens, food safety, and enhancement of biodiversity. An example of cutting-edge research in the western region comes from Dr. Carol Shennan at UC Santa Cruz on a project titled, “Integrated soil-borne disease and weed management for organic strawberries using anaerobic soil disinfestation, broccoli residue incorporation and mustard cake application.” This project found that anaerobic soil disinfection was an effective management tool for soil-borne pathogens and a viable alternative to toxic fumigants. Shennan’s research team continued their initial OFRF-funded study with a grant from the USDA’s National Institute for Agriculture’s (NIFA) Organic Research Education Initiative for \$2.6 million and the Western Sustainable Agriculture Research and Education Program for \$218,000. The ability to leverage OFRF grants to garner future funding creates additional value to the OFRF grant making program.

NORTHEAST REGION

Nineteen percent of OFRF-funded projects during the study period were focused in the northeastern states.³ Projects in the northeast focused on pest and disease control as well as educational projects aimed at increasing farmer-to-farmer learning. One important project, “On-farm management of cutworms in organic no-till corn” led by Jeff Moyer of the Rodale Institute, addressed the potentially devastating problem of corn yield losses from cutworm and found that habitat manipulation is a more effective and economical strategy than biological pesticide inputs for cutworm management. Three exciting educational projects were also conducted, including two projects titled “Searchable Library of Articles on Organic Growing” and “The Liberation of Odairy Archives” which both made organic agricultural information available online in a searchable format.

NORTH-CENTRAL REGION

The north-central region produced many projects related to plant breeding, pest-control, and crop diversification for several crops with a focus on corn, snap beans, and apples⁴. One example of crucial research comes from Frank Kutka and his project “Developing ‘Organic-Ready’ Maize Populations with Gametophytic Incompatibility.” Contamination from genetically modified (GMO) varieties is a major real-world farming problem, and this project explores the use of naturally occurring traits derived from South American popcorn and the ancient Mexican grain teosinte to create a screen against outcrossing (introducing unrelated genetic material into a breeding line) from transgenic, or genetically modified corn. “We need corn that organic farmers can grow without fear of GMO contamination,” Kutka said.

In addition to research, OFRF funded several innovative educational and training projects in the

²The region defined as the western region includes Alaska, American Samoa, Arizona, California, Micronesia, Guam, Hawaii, Idaho, Montana, N. Marianas Islands, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

³The northeastern states include Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Washington, D.C., and West Virginia.

⁴The north central states include Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.

north central region, including the “Bilingual farmer training and mentorship program” project in Iowa. This project trained mostly low-income, immigrants in organic practices and built a farmer-to-farmer mentorship program.

SOUTHERN REGION

The southern region is least represented in terms of organic production value nationally, and received the lowest percentage of OFRF grant funding (11%) over the study period. Projects in the southern region constituted 13 percent of the OFRF projects funded from 1990-2005, and there has been a slight decrease in this amount from 2006-2014. Because organic agriculture in the southern states has a less prominent presence than in other regions, there is opportunity for OFRF to increase funding and outreach in this region to encourage growth of the organic sector. There are several very exciting projects in the southern region funded by OFRF from 2006-2014. Two standout projects combined research with efforts to improve farm financial stability in the south: “Off-Season Organic Blackberry and Raspberry Production to Expand Markets and Sustain Farm Profitability” in Arkansas and “Organic cover crop seed production as a sustainable enterprise for the Southeast” in Georgia. Research that examines new crops and economic opportunities for farmers is a key step in strengthening organic agriculture in the southern region.

INTERNATIONAL PROJECTS

OFRF funded two projects in Canada and one project in Mexico over the period of 2006-2014. The Canadian Organic Growers implemented two educational projects that resulted in practical manuals for farmers: an organic crop production guide and an organic livestock guide (Figure 7). These guides were targeted at Canadian farmers, yet hold meaningful information applicable to farmers in many locations. Professor Stacy Philpot conducted the third international project, “Investigating the effects of shade canopy management on natural enemies, pests, plant damage, and yield in organic coffee plantations” in Mexico. This agroecology project combined environmental analysis with agricultural management for an interdisciplinary project with implications for on-farm management of natural enemies for pest control.

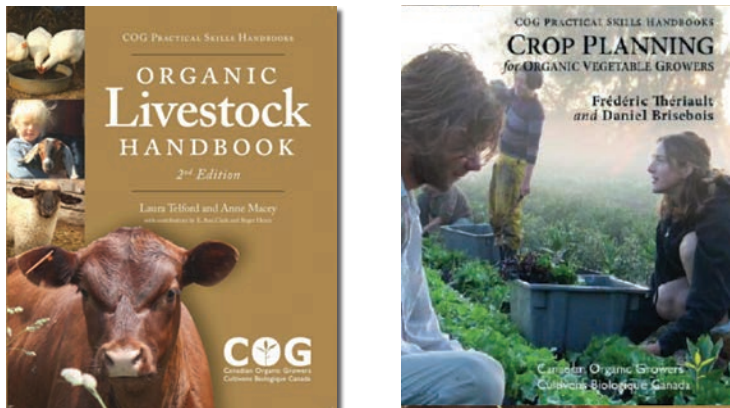


Figure 7a and b. Livestock and crop production manuals produced by Canadian Organic Growers.

TYPE OF RECIPIENTS

Diverse teams of applicants

OFRF's research and education partners are a diverse group including university professors, graduate and undergraduate students, farmers, and non-profit employees. Of the 85 unique projects funded during the study period, 53 had a member of the application team based at a university. Six projects included an applicant who worked for the USDA Natural Resources Conservation Service or Agricultural Research Service and six projects had applicants who worked for a local government agency. Thirty projects had team members based in non-profit organizations, and four projects had team members based in for-profit organizations. Twenty-four projects had individual farmers as part of the application teams, with three projects being led by farmers as the project director.

TYPES OF PROJECT DIRECTORS

University project directors

Project directors affiliated with universities make up the majority (59%) of project directors funded by OFRF. Project directors from universities consisted of associate or full professors, university extension agents, assistant professors, graduate students, and university researchers. Table 2 shows the number and percentages of the different types of university researchers funded as project directors through OFRF from 2006-2014. The most common type of university-based project director was an associate or full professor. There were no grants made to undergraduate students as the project director.

University position	Number (%)
Associate/full professor	19 (38%)
University extension agent	10 (20%)
Assistant professor	9 (18%)
Graduate student	6 (12%)
University researcher	5 (10%)
Postdoctoral scholar	1 (2%)

Table 2. Number of project directors with different university positions funded by OFRF.

Grants made to professors represented important contributions to their overall research programs and ongoing projects. Several professors were funded for multiple projects during the period of 2006-2014. For example, Professor James Nienhuis from the University of Wisconsin was funded for his project “Reducing risk associated with organic snap bean production in Wisconsin” in 2010, then funded again in 2012 for the related project “Snap Beans With Enhanced Nitrogen-Use Efficiency for Organic Production.” Nienhuis said that funding from OFRF was critical to his research, considering that funding from the commercial vegetable processing industry is difficult because there is little interest in nitrogen use efficiency because synthetic nitrogen is cheaply available. Grants made to professors commonly fund research that is carried out by graduate students, postdoctoral scholars, and undergraduate students.

NON-PROFIT ORGANIZATIONS

OFRF has given grant support to several non-profit organizations. Many of these grant projects are for educational projects. For example, OFRF funded five grants (2007 - 2011) to the Organic Seed Alliance totaling \$67,168, for projects include organic seed breeding guides for different crops. An introduction to organic seed breeding and crop-specific manuals for sweet corn, carrots, and tomatoes have been distributed to hundreds of farmers. In addition, OFRF has made multiple grants to the Rodale Institute, the Northeast Organic Farming Association, and the Xerces Society. Although individual OFRF project grants are relatively modest, continued support from OFRF over the years shows long-term commitment to the educational and research programs at these different organizations.

FARMER PROJECT DIRECTORS

From 2006-2014 OFRF funded three farmer-led projects. These included Oregon farmer Jonathan Spero’s four-year sweet corn breeding project “Create Two Open-Pollinated, Sugar-Enhanced Sweet Corn Varieties,” organic apple farmer Steve Tennes’ project “Integrating bats into organic pest management,” and organic garlic farmer Susan Fluegel’s project “Effectiveness and economic impact of weed control systems in organic garlic production.” These three projects demonstrated the creativity and innovation possible when farmers are in control of research experiments that they are passionate about. The projects have resulted in two new corn varieties, strengthened understanding of the role bats play in pest control, and insights into weed management.

FARMER INVOLVEMENT

A majority of OFRF-funded projects include farmers as collaborators with advisory roles in the research. Eighty-three projects listed farmers as having a role with the projects, with only three projects not involving farmers (Figure 8). The most common role for farmers was an advisory role, with 76 (89%) of projects listing farmers as project advisors. Many projects worked with farmers to develop research priorities and ensure that the projects were of value to farmers. Fifty-five projects (65%) stated that farmers were involved with on-farm research. In many cases,

this meant that research was conducted on private organic farmland with the assistance and planning of the farmer. Forty-one projects (48%) listed farmers as part of the application team – this could be as project directors or as cooperators. Farmers were less involved with results dissemination, with only 33 projects involving farmers in the outreach process. The strong participation of farmers in the research as collaborators and project leaders is a unique and important distinction of OFRF-funded projects.

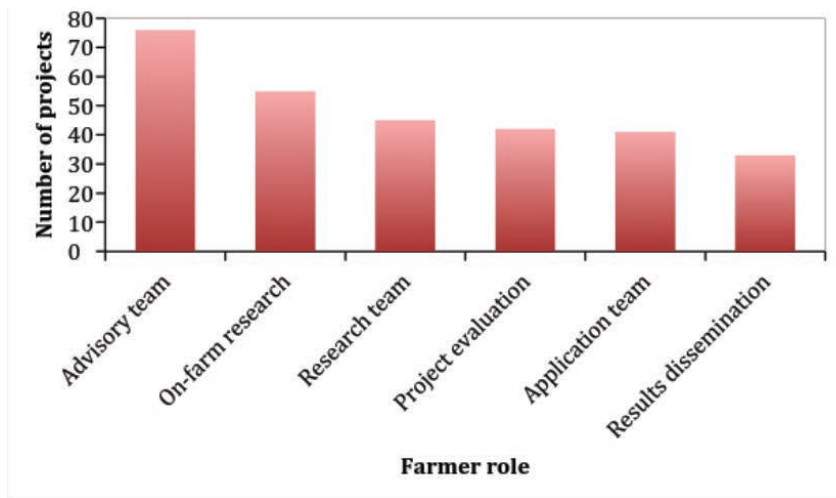


Figure 8. Farmer involvement in OFRF grant projects.

RESEARCH TOPICS

OFRF grants from 2006-2014 have spanned a great number of topics related to different crop and livestock types. Projects related to vegetable production are the most common, followed by projects that relate to all crops in general and fruit (Figure 9). Studies that addressed all crops in general were not studying a specific crop system, but rather a management challenge relevant to all crops.

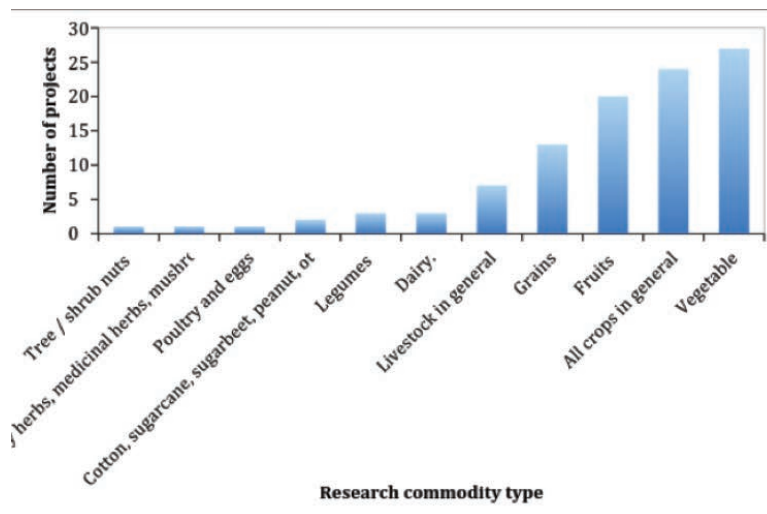


Figure 9. Number of projects on different crops.

RESEARCHERS HAVE DONE WORK ON THE FOLLOWING CROPS:

alfalfa	corn	ornamentals	spelt
apples	cotton,	papaya	spinach
barley	cucumber	pears	squash
beets	eggplant	pepper	strawberries
blackberries	garlic	potato	sweet corn
blueberries	goji berries	quinoa	tomato
broccoli	grapes	raspberries	watermelon
Brussels sprouts	hops	rice	wheat
canola	kale	soybean	
carrots	lettuce	snap beans	
coffee	melon	sorghum	

Research topics related to production practices primarily focus on crop pest management, crop breeding, and the quality of crops (Figure 10). Other prominent research areas include crop disease management, soil nutrient management, and weed management. Many projects spanned multiple research topics. For example, many of the plant breeding projects also examined the quality and yield of the crops.

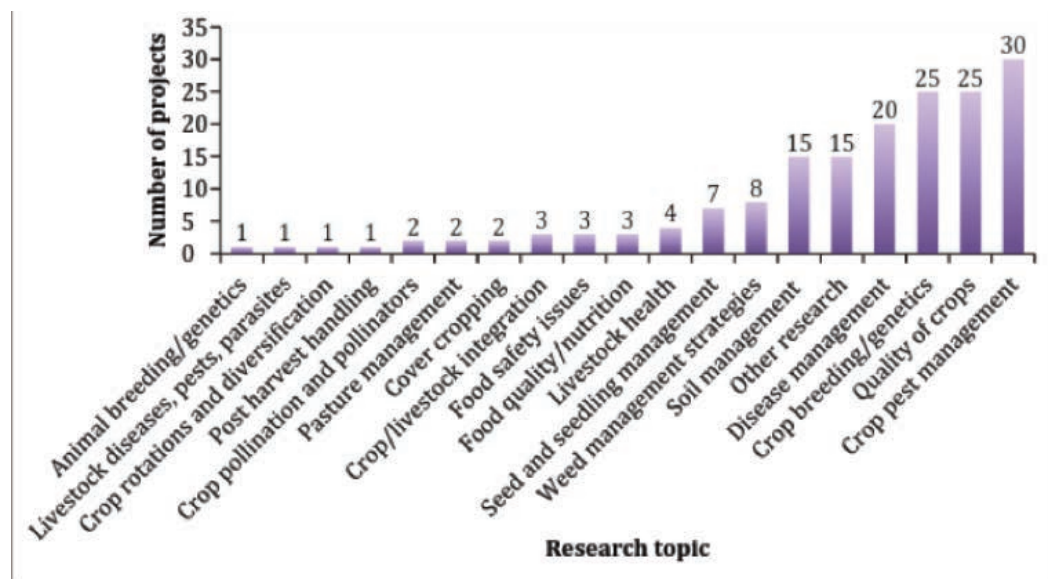


Figure 10. Number of projects for different research topics.

2007 NATIONAL ORGANIC RESEARCH AGENDA (NORA) PRIORITY AREAS

In 2007, OFRF produced a report called the National Organic Research Agenda (NORA), which set a number of research priorities for organic agriculture. These priorities were set based on listening sessions and a national survey of organic farmers. The NORA proposed four main areas of high priority for research:

- soil microbiology, fertility, and quality
- systems approaches to pest management
- organic livestock and poultry production systems, and
- breeding and genetics.

Of the 85 projects OFRF funded during the study period (2006-2014), 74% (63 projects) addressed one of the NORA priority areas (Figure 11). Twelve projects addressed more than one NORA priority area. Forty-eight percent of projects addressed an issue related to weed, insect pests, or disease management. Of the projects addressing a pest management issue, the majority focused on managing insect pests. Twenty-seven percent of projects addressed an issue related to breeding and genetics, with 22 projects focused on plant breeding and one project on animal breeding. More than 17% of projects addressed issues related to soil microbiology, fertility, and quality, with most projects focused on nutrient management. Six percent of projects studied livestock and poultry, and of those few projects, most were focused on animal health and nutrition.

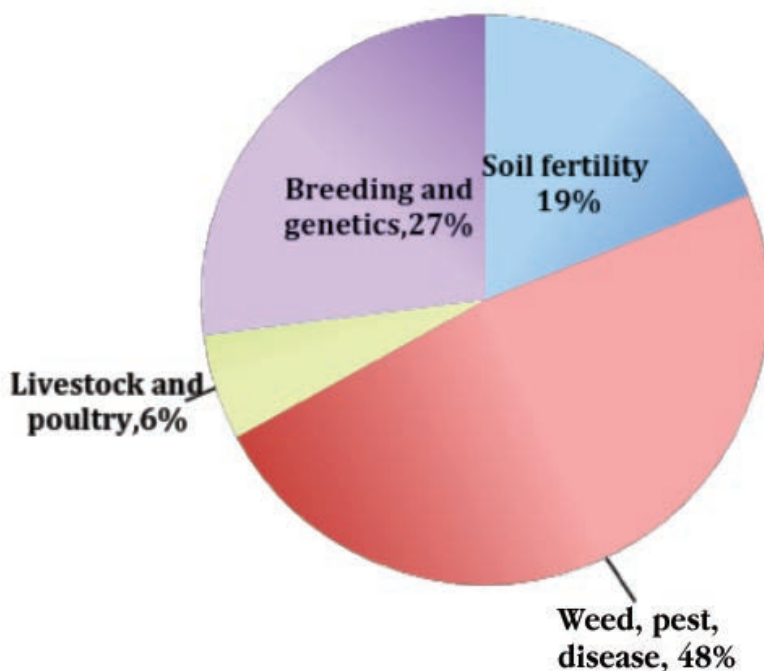


Figure 11. The percentage of projects addressing the different NORA priority areas.

Aligning OFRF’s grant-making program with NORA priority areas allows the foundation to target research topics of most interest to farmers, and encourage cutting-edge research and early-career scientists who often cannot qualify for other types of research funding. One area where this approach has fallen short is in the funding of livestock-related research. While livestock and poultry management are listed as NORA priorities, relatively few OFRF-funded projects addressed those issues. Therefore, moving forward, it may be worthwhile for OFRF to increase the number of grants addressing these issues, or perhaps to issue a livestock and poultry-specific RFP.

SOCIAL AND ECONOMIC PROJECT COMPONENTS

Thirty-nine projects (46%) had research or education objectives rooted in social or economic research. Several projects included more than one social or economic research component, such as having both farmer-to-farmer learning and marketing as part of the same project. Seventeen projects created an educational resource such as a toolkit or manual, and 16 projects involved economic analysis. Other projects focused on marketing, socio-economic analysis, and policy analysis (Figure 12).

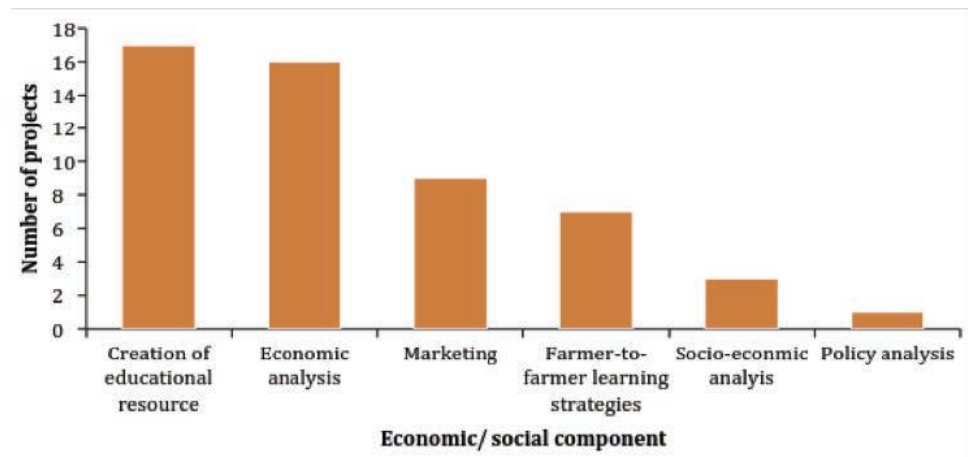


Figure 12. Number of projects with an economic or social component.

ENVIRONMENTAL PROJECT COMPONENTS

All projects funded during the study period were evaluated based on whether they addressed an environmental conservation issue or enhanced ecosystem services. Less than 25% of projects had components that evaluated environmental issues (Table 3). Considering the pressing environmental issues of soil health and potential effects of climate change on agriculture, for example, OFRF may consider prioritizing projects with environmental components in the future.

Table 3. Number of projects that addresses environmental issues.

Number of Projects	Environmental issue addressed
0	Carbon sequestration/ climate change
0	Energy and water conservation
2	Soil conservation
6	Protecting species and habitats
8	Pollination and native pollinators
12	Ecosystem services

RESULTS DISSEMINATION AND OUTREACH

Outreach and sharing results was a priority for nearly all of the projects. The grantees disseminated results to diverse audiences including farmers, scientists, extension agents, government agencies, educators, the public, and food processors (Figure 13). Farmers were the most important target audience, with 78 projects (92%) stating that they targeted farmers with their outreach efforts.

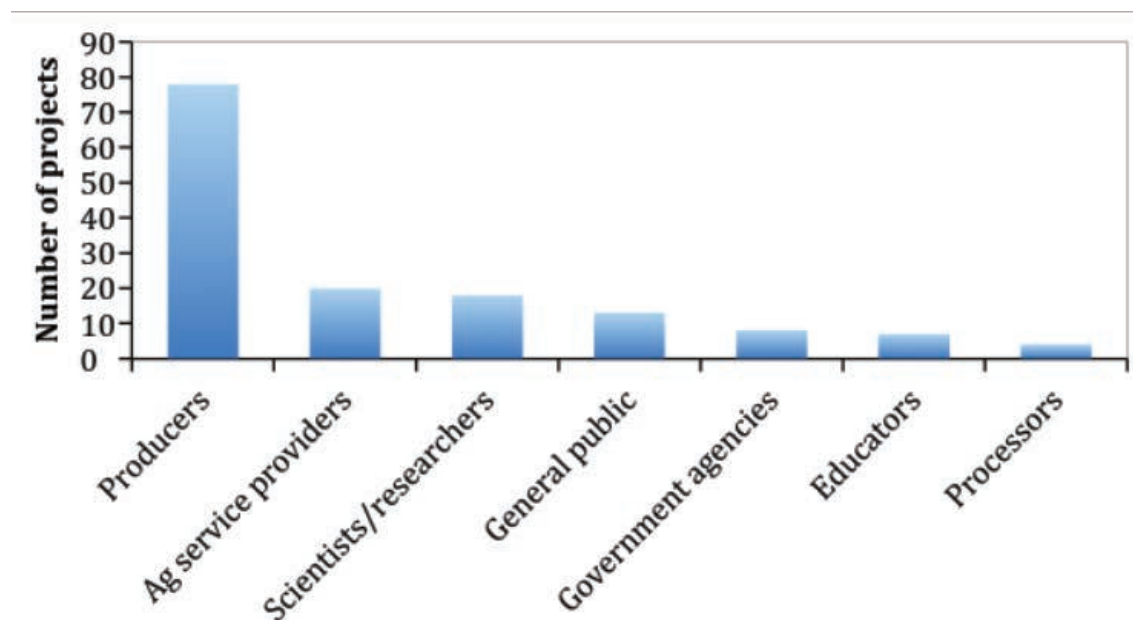


Figure 13. The type of audience targeted by outreach and education materials.

DISSEMINATION PRODUCTS

The project teams communicated research results through a variety of pathways including written materials, conference presentations and workshops, farm field days, and various online outlets such as eOrganic, project websites, e-mail lists, and videos on youtube.com (Figure 14). Most projects utilized multiple outreach channels and created strong outreach materials for diverse audiences. The most common dissemination channels were conference presentations, written materials such as handouts, and farmer field days.

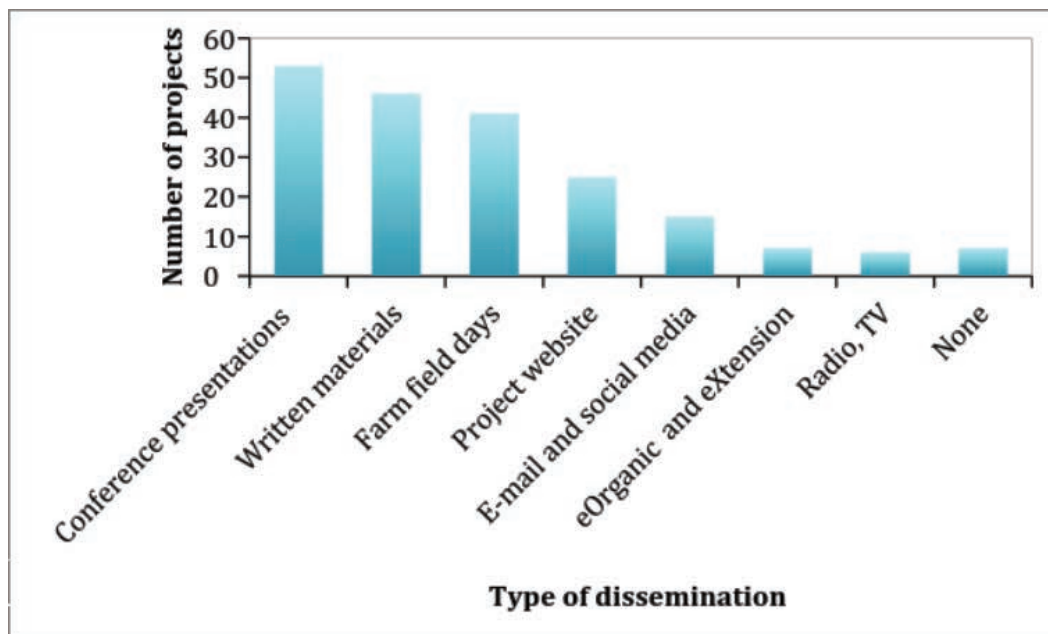


Figure 14. Type and frequency of dissemination method.

IMPACTS REPORTED

For the final report to OFRE, grantees are asked to describe the useful tools, information and resources created and delivered to farmers. Grantees are not asked directly to evaluate and report on the impacts their projects had, or whether farmers are using the results of the project. However, to fully assess whether project outcomes are met, it would be beneficial to perform longer-term follow up to see how the results are being used. Future final report requirements may include a section for the grantee to reflect on the impacts of the project.

Few of the grantees evaluated the impacts of their projects. Many projects have the potential to improve or expand organic agriculture, enhance profitability for farmers, improve environmental conservation, improve communication among farmers, or provide a practical tool or product to be used by farmers. These impacts are rarely measured or reported in the final reports, likely due to the short-term nature of these grants. Seventy-one percent of grantees did not report on the

impacts of their projects. Of the projects that did list impacts, most of the final reports stated that projects had improved farming operations. Educational projects were more consistent in reporting impacts and following up with farmer participants about changes in practices, utilizing project resources, and maintaining mentorship relationships. For example, a grant made to the Northwest Coalition for Alternatives to Pesticides under the direction of Jennifer Miller, “Expanding farmer-to-farmer learning for Idaho’s organic farmers,” developed farmer-led meetings to exchange knowledge about organic production and marketing techniques. Participants were tracked after the meetings, and they kept in contact with one another, and many adopted new practices as a result. Another project, a farmer-training grant awarded to Adelante Mujeres, followed up with participants and found that trainees experienced increased household income.

OFRF PROJECT IMPACTS

The following section examines the impacts of OFRF-funded projects on the careers of individual investigators and farmers, as well as contributions to organic farming knowledge. The information on these impacts was collected through phone interviews with the project directors of several research and education projects and their farmer collaborators.

IMPACTS ON RECIPIENTS

Graduate Students

OFRF research grants awarded to graduate students greatly influenced their research programs and career development. Graduate students who received OFRF funding reported gaining experience applying for grants, designing their own projects, and gaining confidence in carrying out research. Many graduate-student grant recipients have gone on to pursue organic farming research as postdoctoral scholars, professors, and professional researchers.

As a master’s degree student at North Carolina State University, Suzanne O’Connell was awarded an OFRF grant to study tomato grafting for soil borne disease resistance for the project “Grafting Tomatoes on disease resistant rootstocks for small-scale organic production systems” in 2007 (Figure 15). She credits the experience of having an OFRF grant with a positive impact on her career. “The grant influenced my career direction,” O’Connell said. “The grant helped me have a positive experience doing research in my master’s project and encouraged me to get my PhD. Applying for the grant, being successful, and working with farmers made the work real and inspired my career in a positive way. I have maintained this thread of research in organic systems now as a professor at the University of Georgia.”



Figure 15. Grower Stefan Hartmann and graduate students Cary Rivard and Suzanne O’Connell standing in the research trial.

In 2013, PhD student Lucas Niebert from the University of Oregon received a grant for his project, “Managing Indigenous Seed-Inhabiting Microbes for Biological Control Against Fusarium Pathogens in Corn.” This project was part of his PhD dissertation. “Options for funding organic research are limited, and this grant allowed me to develop contact with the organic farming community in Oregon,” Niebert said. “The OFRF grant allowed me to develop my own research program and gain confidence in project management. This research would not have been possible without the grant from OFRF. It has helped give me the confidence to apply for other fellowships.”

Researcher Jared Zystro, now at the Organic Seed Alliance, first began his research as a graduate student at the University of Wisconsin. He described how OFRF funding was formative in his experience of conducting research and applying for grants. “As a grad student, the funding from OFRF was the first grant I had ever had funded,” Zystro said. “I learned a lot from that process and the feedback from OFRF staff. Getting this funding was huge for me. OFRF allowed us to increase the scale and have a track record for applying for larger grants.”

OFRF grants have also helped graduate students publish academic articles and make presentations about their work. These publication and outreach activities have bolstered the careers of these students, many of whom have gone on to continue organic farming research as professors or professional researchers. For example, Suzanne O’Connell wrote her Master’s thesis as well as two academic journal articles with the team that worked on her OFRF project. The research experience, experience applying for grants, and the freedom to create one’s own project are important to the careers of graduate student grant recipients.

University faculty

OFRF grants have been influential in helping university professors and researchers develop their research programs as well as change research directions towards organic agriculture research.

For Curt Rom, professor at the University of Arkansas, an OFRF grant had a profound impact on his career and research identity (Figure 16). “I am grateful to all of the people who support OFRF because they can make magic happen for people like me,” Rom said. “I got \$5,000 from OFRF to look at organic spray alternatives. At the time, experimental stations and universities were not embracing organic. This first initial grant has completely transformed who I am as a scientist. I was the apple and peach guy, now I am the sustainable, organic, local foods guy. It completely changed my view, who I am, direction, focus, and career.” Rom’s organic research has become a powerful teaching tool that he uses for his class, the Principles of Horticulture. He uses the research site as a destination for hands-on learning field trips, and he stated that hundreds of students have seen the trials and learned about the experiment.

OFRF grants often have important impacts on the careers of university researchers, especially at the start of their careers. “The OFRF funding is a good fit for early-career faculty or researchers working on more fringe ideas with limited support from commodity groups,” said Matthew Grieshop, professor at Michigan State University. Grieshop emphasized the importance of OFRF support for early career development and starting organic farming research programs.

Grants awarded to professors often support graduate and undergraduate student research as well as teaching and traineeships. For example, the 2010 grant award to Prof. James Nienhuis of the University of Wisconsin for the project “Reducing Risk Associated with Organic Snap Bean Production in Wisconsin” resulted in ongoing research, and led to continued OFRF funding for a Master’s thesis in 2014 for graduate student Benjamin Hughey titled, “Evaluation of nitrogen -use efficiency in a snap bean population.”



Figure 16. Professor Curt Rom.

Non-profit recipients

OFRF funding has been instrumental in supporting projects by non-profit researchers and outreach specialists throughout the country. OFRF has funded projects at non-profit organizations including the Organic Seed Alliance, Alabama Sustainable Agriculture Network, Rodale Institute, Xerces Society, and the Northwest Coalition for Alternatives to Pesticides.

Karen Wynne, of the Alabama Sustainable Agriculture Network (ASAN), said an OFRF grant helped build a strong foundation and support for outreach activities at ASAN. “There is an ongoing effort to build a network of small farmers, advocates, and educators,” Wynn said. “We have a more cohesive group working together for 12 years to build the concept of sustainable agriculture in Alabama. We represent farmers that are usually ignored. This work facilitated relationships among growers, which is really valuable.” The grant to ASAN helped build a mentorship program, and organized farm tours to demonstrate new practices (Figure 17). The program resulted in farmers adopting new practices and assisted farmers wishing to transition to organic agriculture. “At the start of the grant there were four certified organic farmers in Alabama, and now there are about 20,” Wynne said. “We have more wholesale opportunities and more motivation to get certified. As a result of the mentorship farmers adopted different production practices such as crop rotations, types of cover crops, new cultural practices and rotational grazing and grass finishing for beef.”



Figure 17. A farmer-to-farmer educational tour of a hoop house as part of the ASAN outreach project.

Jared Zystro, who was involved with a grant to the Organic Seed alliance to create organic seed breeding guides, said that the guides contribute to a major goal of the organization. “Farmers will maintain seed and create a seed system that is diverse, with many stakeholders, and is resistant to changing climate and responds to the needs of farmers,” Zystro said.

Jennifer Miller from the Northwest Center for Alternatives to Pesticide (NCAP) was a project director along with the farmer collaborators for the project “Expanding Farmer-to-Farmer Learning for Idaho’s Organic Farmers.” The project held two farmer-to-farmer exchanges and training in order to establish sharing and a community of practice among the organic farmers in the state of Idaho. The success of the first exchange led to five subsequent events - and NCAP is currently planning the seventh year of organic farming meetings. These meetings have become extremely important to organic farmers in Idaho. “The biggest impact of the project was creating a sense of

community with organic farmers, especially in Southern Idaho, Miller said. “This meeting has become a re-energizing time for growers where they get to share ideas. We continue to hear back the incredible value of these meetings to the farmers. It is highly valuable that farmers do not need to go out of state to get high quality organic education.” The project has not only created a sense of community, but also spurred adoption of new organic practices and innovations that have helped organic farmers thrive. For example, farmers have adopted new post-harvest handling techniques related to food safety, increased habitat for beneficial insects and pollinators, and have improved their nutrient budgeting, as a result of the exchanges.

Farmer project directors

One of the great opportunities offered by OFRF grants is for organic farmers to pursue research projects as principal investigators. Farmer-led projects allow farmers to design their own research questions and conduct research that will directly benefit their operations. These farmer-led projects are of great value, especially for trialing new crop varieties for organic production, seed breeding, and experimenting with new conservation practices.

Organic farmer Jonathan Spero of Lupine Knoll Farm in Oregon completed his four-year



Figure 18. Farmer researcher Jonathan Spero.

seed-breeding project “Create open pollinated, sugary enhanced sweet corn varieties,” in 2015 (Figure 18). This plant-breeding project set out to develop new sweet corn varieties especially suitable for organic production methods. Spero’s sweet-corn breeding project was supported by a four-year research grant from OFRF. The project has resulted in development of two new varieties of sweet corn: Top Hat and Tuxana. These varieties are both open-pollinated and sugary-enhanced, meaning that they allow farmers to save seeds and eaters to enjoy delicious organically-grown sweet corn. For the first time, these two varieties

are being grown for commercial sale in 2015. “My work is resulting in new varieties, creating new options for organic farmers,” Spero said. The hard work and dedication of this multi-year project has resulted in new sweet corn varieties that will be important for organic farmers who need seeds especially suited for organic farming. Spero’s research serves as an example of successful farmer-led research, and his goal is to show other farmers that on-farm seed breeding is possible. “My planned contribution is to show how anyone can make real improvements in corn or in any open pollinated vegetable variety,” Spero said. Spero stated that he loves doing sweet corn breeding research and that improving vegetable varieties is an opportunity for small farmers to make a real and long-lasting difference.

FARMER COLLABORATION

All of the researchers and education project investigators interviewed reported excellent experiences working with farmer collaborators, and many listed the farmer collaboration as a highlight of their project experience. Researchers often stated that the involvement and partnership with farmers grounded the research, and helped focus projects on real farming challenges that are important to farmers.

The nature of farmer collaboration was diverse, with some projects being largely farmer driven and some projects having peripheral involvement from farmers as project advisors. The most successful projects, in terms of producing research results that are readily adoptable by farmers, are those projects with strong farmer collaborations. Jennifer Miller said that her outreach project achieved excellent participation and outcomes because of farmer involvement, “Farmers are the drivers of the project,” Miller said “The best resources are other farmers. The farmers identify topics and the farmer participants vote on what they want to discuss. A variety of needs are met for both vegetable crop growers and livestock growers. It is farmer driven as much as possible.”

University extension agent Doug Collins said that the farmer involvement on his project on organic fertility management was very important to its success. “Farmers played a huge role and it was a very successful collaboration,” Collins said. “The farmers had a high level of engagement and participation. It was an excellent experience working with farmers.”

Suzanne O’Connell said the collaboration with a farmer was the highlight of her graduate research. “The farmers had an equal role in everything we did,” O’Connell said. “The farmer helped define the project and was involved in all decisions. The farmer helped collect data, estimate economic costs, and present outreach presentations. It was a great collaboration and kept the research real.” She also stated that the OFRF funding was key in developing this partnership, “The OFRF grant allowed the farmers to be compensated for their time and knowledge,” she said. “Paying the farmers strengthened the collaboration because they felt valued. The farmer wasn’t a host, but a partner.”

Matthew Grieshop’s project was farmer-driven in that the farmers were seeking a solution for their specific pest problem. Grieshop worked together with the farmer collaborator to design the experiment, and found a middle ground in the design, balancing what was best for the farmer and what was best for the research. The project resulted in a management tool to control apple flea weevil on organic farms. At least six organic farms have adopted the management strategy on 350-400 acres, exerting a strong positive impact on the organic apple industry in Michigan, Grieshop said.

Lucas Nebert’s research involved working with two organic farms for field research and lab research involving DNA analysis. The farmers he works with are interested in understanding how seed treatments may be of value for disease protection. He hopes that future research projects will involve even more of a participatory format, with growers sending in seeds and getting them

analyzed – essentially growers designing their own projects. His project developed a methodology for figuring out the seed associated microorganisms and how they might be useful as a seed treatment. One of Nebert’s goals is for research data and methods to be free and open to the public, and he maintains a website to share his progress and data. He believes the most important part of collaborative farmer-researcher projects is developing a network, and hopes that OFRF can help build a network of growers interested in collaborating with scientists.

Non-profit organizations partnering with farmers on education and outreach projects found that the practical expertise of farmers melded well with the educational expertise of the organization. For example, Jennifer Miller of NCAP stated that the farmers brought the project idea and plan to NCAP, and that NCAP was able to execute their idea due to their background in organizing educational trainings. This partnership, where the project is farmer-driven and carried out as a joint venture, has been very successful in meeting the needs of farmers. Jared Zystro of the OSA said that partnerships between researchers and farmers are essential to participatory plant breeding. “Farmers participated from the beginning,” Zystro said. “We worked with farmers in the process, and that was a very valuable aspect of our breeding. We need to be able to see the projects on working farms. The farmer collaboration grounded the work and helped us see things you have to think about if you are a farmer/breeder. For example, farmers let us know how important it is to emphasize the initial planning process that goes into breeding. The farmer has to understand what resources are going to be needed, and what tasks will need to be completed at different times of the year.”

The deep exchange of ideas and expertise between farmers and researchers is a valuable and unique part of the OFRF grants – bringing benefits to the project results as well as the experience for the researchers and farmers.

EXPERIENCES OF FARMER COLLABORATORS

Beth Rasgorshek, an Idaho organic seed farmer who co-lead the education and outreach project: “Expanding Farmer-to-Farmer Learning for Idaho’s Organic Farmers,” has had a very rewarding experience participating in the project. She brought the idea of a farmer-to-farmer exchange to NCAP, and has been a leader in organizing organic farmer exchanges in Idaho. “There was a need for all the organic farmers to get together and support one another in our farm businesses and to move organic agriculture forward in our region,” Rasgorshek said. “Her goals were to bring organic farmers together to learn from one another. Beth has learned a great deal from the exchange (Figure 19). In particular she has become more confident in growing new crops because she has a network of other farmers she can turn to for advice. She said the project has been very successful in creating an organic farming community, an especially important as a resource for beginning farmers.



Figure 19. Farmer collaborator Beth Rasgorshek.

Stefan Hartman of Black River Organic Farm in North Carolina played an important role in the research project “Grafting tomatoes on disease resistant rootstocks for small-scale organic production systems.” The goal of this project was to overcome a bacterial wilt problem so severe on his farm that he had stopped growing open-field, fresh-market tomatoes. “Developing grafting procedures and cultivars has become a necessity for the continued survival of our farm,” Hartman said. Hartman was involved with the on-farm trials where he helped plan experiments, and harvested and recorded tomato yields and fruit numbers for side-by-side comparisons. The project provided useful results, showing that grafting was beneficial for dealing with the disease pressure and also created sturdier plants. “The project was a big success for me because I am still doing grafting and I was shown the technique as part of the project,” Hartman said. He is now using grafting mostly for heirloom tomatoes, and he said this technique has allowed him to grow tomatoes, which is good for his direct marketing. Although the project was challenging and time-intensive, he said there was a big pay-back because they got good results and a new management tool.

LEVERAGED RESOURCES

Since 1990, OFRF has provided key funding for unique organic research projects. For many of these projects, OFRF funding has enabled researchers to collect preliminary data and use those results to secure additional research funding. OFRF grants have been especially helpful for early-career scientists that may be less-competitive for federal grants helps researchers collect data and become more competitive for larger grants. OFRF provides feedback on grant proposals and final reports, supporting grantees to seek further funding and build on their OFRF projects. Overall, OFRF grants have been instrumental in leveraging millions of dollars in additional research funding.

This is the case because OFRF resources can be used as a proof-of-concept project to collect preliminary data that can be used to support future applications to larger grantors. For example, researcher Kevin Murphy said initial OFRF funding was vital to launching his research program on breeding new varieties of organic grain. “Without support from OFRF and the Clif Bar Family Foundation Seed Matters grant, we would not have obtained the additional funding needed to carry on long-term breeding and agronomy research for alternative crops,” Murphy said. “The additional funding includes a \$36,000 grant from the WSU Center for Sustaining Agriculture and Natural Resources and a \$1.6M grant from the USDA Organic Research and Extension Initiative.” These new funds greatly expanded Murphy’s ongoing work to develop nutritious and delicious organic hullless barley varieties, and to support kitchen trials by some of the nation’s top pastry chefs to ensure that the varieties also useful for baking. Jared Zystro emphasized the importance of OFRF funding in launching the organic sweet corn breeding program at the University of Wisconsin. “We began on a small scale, but OFRF allowed us to increase the scale and have a track record for applying for OREI,” Zystro said. “We included data from the OFRF grant in the OREI proposal, so it was a spring-board for a larger project. Then with the OREI funding, it institutionalized the organic sweet corn breeding at the University.”

Curt Rom credits an initial \$5,000 grant from OFRF with helping him create a large and exciting organic research program. “OFRF funded phase one of my work,” Rom said. “It let me provide evidence and information that I used as preliminary data to go to Southern SARE and apply for a larger grant. The OFRF grant turned into a grant for 4 years for \$450,000.”

Carol Miles reported that an OFRF research grant led the way to an additional \$300,000 in research support from Washington State and the USDA to continue her work on vegetable grafting.

Another project that used OFRF funding to leverage additional resources is “Integrated soil-borne disease and weed management for organic strawberries using anaerobic soil disinfestation, broccoli residue incorporation and mustard cake application” carried out by Carol Shennan from UC Santa Cruz. Initial funding from OFRF led to a \$2.6 million grant from the Organic Research Education Initiative for \$2.6 million, and \$218,000 from the Western Sustainable Agriculture Research and Education Program, allowing the research team to continue the research at a larger scale and for multiple years. As a result of this robust research program, many farmers now implement the organic soil disinfestation techniques they developed as a way to control disease.

PROJECTS MOST ACCESSED ON THE WEBSITE

Project information, summaries, and final reports for grants funded between 2007 and 2014 are available on the OFRF website. The project descriptions offer valuable information to researchers and farmers, and some project web pages have been visited by thousands of people. Table 4 shows a list of the top ten most-visited project pages and the corresponding number of page views from December 2013 to September 2015.

Table 4. Top ten most visited project web pages from December 2013 to September 2015.

Project title	Page views
Developing an organic commercial production system for the Goji berry	2369
Alabama Sustainable Agriculture Network Farmer-to-Farmer Program organic outreach	1568
Creating two open pollinated, sugary enhanced sweet corn varieties	720
Managing farm habitat for wild pollinators	714
Farmer-based evolutionary participatory plant breeding for organic quinoa, buckwheat and spelt	681
Effectiveness and economic impact of weed control systems in organic garlic production	600
Enhancing biological control of insect pests using flowering intercrops in wine grape agroecosystems	563
Deploying microbes as seed treatment for protection against soil-borne plant pathogens	420
Integrated soil-borne disease and weed management for organic strawberries using anaerobic soil	324
Participatory screening of broccoli varieties for organic systems in Western North Carolina	323

RECOMMENDATIONS

There are several ways in which the OFRF grant program can focus and grow in order to best support the needs of organic farmers. The review of our past grants shows we can strengthen where we make grants, diversify the types of grant recipients, and focus some of our efforts on research gaps. There are several gaps in the array of crops OFRF research projects have studied. In past years, most OFRF grant funding has gone towards vegetable and fruit crops (page 15). Going forward, OFRF can direct more attention toward commodities less studied such as nut production, culinary herbs, poultry and eggs, legumes, dairy, livestock, and grains. Research topics have focused on weed management, soil management, disease management, crop breeding, crop quality, and insect pest management. In future grant cycles, OFRF can broaden its efforts to include research on livestock diseases, crop rotation, post-harvest handling, pasture management, cover cropping, and food safety issues. Food safety issues may be of particular interest to farmers in coming years, as implementation of new Food Safety Modernization Act requirements may have production implications. Only 46% of OFRF-funded research projects included social or economic research components and only 25% of projects evaluated environmental issues. Some of the strongest OFRF-supported projects were interdisciplinary, and it may be beneficial to encourage projects that combine disciplines and expertise in order to approach agricultural challenges holistically.

The following specific recommendations are based on the overall review of the grant program as well as interviews with grantees.

MORE FARMER DIRECTED PROJECTS

Farmer-directed research projects directly explore farmers' challenges and needs. For a farmer to remove land from production to explore a new technique or perform an experiment represents a potential economic loss for the farmer. Grants to farmers remove that risk and allow farmers to creatively explore new solutions to their on-farm problems. Increased funding for individual farmers to conduct experiments with widespread impacts on the organic farming community will strengthen the OFRF grant program. In addition, farmers usually play an advisory role in OFRF-funded research projects. It would be advantageous to encourage applications where farmers are involved in multiple stages of the project, including the research and outreach components.

FUNDING FOR STUDENT RESEARCH

OFRF's past funding has focused on work carried out by university faculty as project directors. Funding for graduate students has a long-lasting impact on the career choices of the students, with many OFRF grantees subsequently pursuing careers focused on organic farming research. Increased funding for graduate students would likely have long-lasting impacts in supporting innovative research. OFRF could encourage this trend by making it clear on the application that

students are encouraged to apply as project directors. In addition, OFRF can expand outreach regarding our RFPs so more students, farmers, and extension agents are aware of the grant-making program and funding opportunities. Considering the great impact OFRF grants have made on early-career scientists, a shift towards greater funding of students and early-career professors may increase the impact on the development of organic farming research careers.

STRENGTHENING ORGANIC RESEARCH IN THE SOUTHERN REGION

OFRF funding is creating a more prominent organic presence in the southern U.S. by increasing research and outreach that encourages growth. As mentioned on page 13 of this report, project funding in the southern region is not as robust as in other regions. OFRF is committed to continuing our support of research and increasing the presence of organic agriculture in the South. To that end, OFRF could increase outreach regarding grant opportunities at southern universities and agricultural centers and increase educational and community-building activities to promote organic farming knowledge in the region.

PROMOTING COLLABORATION BETWEEN FARMERS AND RESEARCHERS

OFRF is unique in working directly with both researchers and organic farmers. In our 2015 Survey of Organic Farmers, we asked farmers to provide their contact information if they are interested in collaborating with researchers. There is the potential to use these farmer contacts to create a network of growers interested in collaborating with scientists, and to make this information available on our website.

FUNDING EDUCATION AND OUTREACH PROJECTS

OFRF education and outreach projects have been particularly useful and effective in making knowledge available to diverse groups of farmers. Education projects are some of the most commonly accessed resources on our website, such as the farmer-to-farmer training in Alabama and the guides for increasing pollination. These education projects provide direct benefits to farmers, and it is recommended that OFRF increase efforts to distribute educational materials and brochures related to organic research findings.

TOPICAL RESEARCH NEEDS

Researchers and project investigators were asked which research topics were most important for future OFRF funding. Among the responses, several recurrent themes emerged. Many researchers stressed the importance of research and outreach on organic marketing, transition to organic production, livestock, and weed management.

Organic marketing needs

Karen Wynne of Alabama Sustainable Agriculture Network emphasized the need for research and outreach linked to understanding organic marketing opportunities. “There is a need to connect research with marketing,” Wynne said. “In order for new practices to be adopted we need to make sure that they will result in a sale for the farmer.”

Transition to organic production needs

Jennifer Miller stated that there is a strong need for research targeting the needs of transitioning organic farmers. “We need projects that focus on how to help farmers transition,” Miller said. “This involves education and training to help reach that crowd. The growers need to understand market opportunities and get advising on what you have to do as a farmer.”

Livestock research

OFRF’s 2007 National Organic Research Agenda report included a detailed section on research goals for animal health, crop-livestock integration, and pasture management. Despite these described needs, little livestock research was funded by OFRF from 2006-2014 (See page 22). A priority of future OFRF funding will be to support basic and applied research on livestock management.

Weed management

Weeds are a major production challenge faced by all organic farmers. Farmer Stefan Hartman stated that after 30 years of organic farming, weeds are becoming more and more of a challenge on his farm. “Weeds are eating us (organic farmers) up and it is really hard to fight weeds,” Hartman said. “This is a reason some people give up because herbicides can be easier.” Addressing the needs of organic farmers related to weed management, especially in the south where there is tremendous weed pressure, is a research area that requires additional funding. OFRF funded eight projects dealing primarily with weed management from 2006-2014. Although these projects provided useful information, increasing the funding effort to address this ever-pressing challenge is a future funding priority.

Increased social and economic analysis

To comprehensively address farming challenges, interdisciplinary research that combines on-farm experimentation and economic and social analysis is required. In order for new techniques to be adopted, farmers need to know if they are economically feasible, and what barriers there may be to implementation. Social and economic research is integral to understanding the challenges faced by farmers, and the best ways to approach them. Additional funding for social and economic research projects, and inclusion of social and economic components within larger agronomic projects, is encouraged.

RECOMMENDATIONS FOR GRANT SELECTION

Future OFRF funding efforts should closely match the needs of organic farmers. OFRF's 2015 National Organic Research Agenda (NORA), an update of our 2007 NORA report, can serve as a guide for prioritizing research topics and funding. In past requests for proposals, OFRF has requested proposals on any topic as well as issuing more targeted calls for applications on priority topics. As a method for encouraging topics prioritized by farmers in the OFRF 2015 National Survey of Organic Farmers (which informs the NORA), OFRF may provide a list of farmer-identified research needs as part of future application instructions. This would allow applicants to better align their research goals with the identified needs of organic farmers.

Recommendations for the grant-making process

Project directors who provided feedback on OFRF grants and the grant-making process mentioned several aspects of the program they felt could be improved. Suggestions for greater award amounts, longer-term awards, and greater support for outreach activities were all themes that researchers have expressed both in this current report and the previous. OFRF is working to increase the financial support for the grant program with the aim of increasing funding and the number of awards given. In this section, a few of these suggestions are presented in more detail along with possible changes OFRF could make to address the suggestions.

Grant applications

Most of the project investigators interviewed reported that the OFRF application process is satisfactory in terms of difficulty and length. In response to feedback from applicants, OFRF is transitioning to an online application that will streamline the process for the applicant and for internal grant management. In addition, OFRF is committed to making funding decisions in a timely manner with a shorter review process and turn-around time.

Final reports

Many researchers were unable to complete their final reports by the due date. In addition, it was common for a grantee to submit a final report despite having unfinished project outreach activities. Several possibilities are available to improve this process. One possible change is to allow grantees to submit an interim report at the end of the grant year, and allow an extra six months to finish the final report. This would provide OFRF with a more complete understanding of the project effectiveness and avoid grantees commonly requesting extensions on the final report. Another possibility would be to give researchers more than one year to complete the project and final report, possibly allowing a project period to last 15 months.

Stronger outreach requirement

Although researchers commonly shared the results at conferences and field days, several OFRF-funded projects offered little education and outreach. Future grant applications can be improved by asking for detailed outreach plans and providing guidelines for what is expected in

terms of outreach. One researcher suggested having a requirement in the application process for a strong outreach component. The researcher stated it is important for research projects to produce usable products, giving the example that manuals and other educational materials can serve as long-lasting resources for farmers. In addition, OFRF could encourage research proposals to include funding requests for outreach activities and conference attendance.

Grant amounts

A recurrent response from past grantees is that the funding amount is not sufficient to produce in-depth research. One researcher stated, “The biggest problem I have with OFRF funding is that the funding limits are really too small to support in-depth research. For example a typical OFRF grant does not provide sufficient funds to support a graduate student for even one year. This makes me much less likely to compete for OFRF funds as I enter the middle portion of my career. This said, I could see helping graduate students or post-doctoral proposals.”

There are multiple ways OFRF can address this issue. OFRF could continue to provide grants of approximately \$15,000 with the understanding that these are meant to fund small projects. OFRF could also offer larger grant award amounts for projects that are of high priority. OFRF could also focus on funding particular applicant categories, such as graduate student projects and farmer projects instead of funding professors. A shift to student and early-career funding could allow for small grants to have larger impacts on research that may not be as easily funded by larger funding sources like state and federal agencies.

Grant time period

The short time period of the grant is an issue grantees commonly reported as being an impediment to in-depth research and project outcomes. One researcher stated, “OFRF only funds for one year. My publication wasn’t accepted because they wanted the study replicated for multiple years and I only had one year of data. The biggest lesson is to always propose multiple-year funding. It was a huge challenge to do enough work for it to be publishable during that time frame.” This sentiment was reinforced by another researcher who stated, “One of the challenges is that the OFRF grants are only for one year. For the year of our project, there was unusual pest pressure and weather. We collected baseline data, but you really need more longer-term research.”

OFRF commonly funds projects for multiple years. In these cases researchers reapply each year for continued project funding. Multiple-year funding is not guaranteed, but many applications indicate that they will apply for multiple years of support from OFRF.

One potential way to formalize this multi-year funding process would be to offer grantees the opportunity to state whether they would like a one- or two-year project period in the application. The OFRF board of directors could review the projects with the understanding that some may require multiple funding years to meet their goals. Having some projects funded for multiple years would allow researchers to both conduct research and carry out a strong outreach component while the grant is ongoing.

CONCLUSIONS

Grants awarded by OFRF from 2006-2014 have had important impacts on the organic farming sector through the development of new organic techniques, farmer education, and the creation of strong organic-farming networks. This report demonstrates that OFRF grants have made significant contributions to our understanding of disease management, insect pest management, weed management, crop breeding, economic valuation of organic operations, and ecological benefits of organic farming. In addition to outcomes with practical relevance on the farm, these collaborations between researcher, farmers, and non-profit organizations have created the space for rich exchanges regarding organic knowledge and community building.

As OFRF moves forward with the grant-making program, there is particular interest in directing future funding toward gaps left open by other organic research funders. A 2015 analysis of grants made by the USDA Organic Agriculture Research and Extension Initiative (OREI) evaluated trends of USDA funding, and also will inform OFRF future grant making. Understanding which research topic areas are important to farmers, and yet receive little attention from the USDA and similar grantors, will allow OFRF to strategically fund projects that will have far-reaching and needed impacts on the future of organic farming. By learning from the past grant experiences explored in this report, and making targeted changes, OFRF can amplify its beneficial influence on the future of organic farming. OFRF is committed to the continued funding of innovative organic farming research that will foster the widespread adoption and improvement of organic farming systems.

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APPENDIX I. SELECTED RESULTS OF FUNDED PROJECTS

OFRF funding for research and education projects has improved our understanding of how to grow organic crops efficiently and ecologically, and how to share that knowledge with and among farmers. Among other impacts, OFRF projects have resulted in scientific improvements in participatory plant breeding, soil and fertility management, and insect pest management. Hundreds of farmers have received pertinent research and training information through publications, presentations and workshops offered by OFRF's research partners. Practices and techniques developed by OFRF researchers, which are described below in detail, offer farmers practical information and tools to strengthen their operations' farming and marketing performance.

EDUCATION PROJECTS HIGHLY VALUED BY ORGANIC FARMERS

OFRF-funded education and outreach projects have had tremendous value for farmers throughout the country. These projects have ranged from the production of manuals and guides, to farmer-to-farmer exchanges and field days. Manuals serve as a permanent resource for farmers and have had a lasting impact. Face-to-face events hosted by OFRF grantees have helped create strong organic farming communities and networks. Below are a few highlights from the educational projects, followed by a list of all OFRF-funded education projects for the years 2006-2014.

Contamination Avoidance and Testing Protocols

This project, led by Holli Cederholm at the Organic Seed Growers and Trade Association, produced a manual entitled "Protecting Organic Seed Integrity: The Organic Farmer's Handbook to GE Avoidance and Testing." This manual provides best practices to avoid genetic contamination, and serves as a tool to help farmers, seed handlers, and seed companies maintain genetic purity in organic seed and food crops. Maintaining the integrity of organic seeds is of the highest priority to organic farmers. Compromised organic seed integrity could have broad impacts on the viability of organic farms and the credibility of organic products.

Co-managing biodiversity conservation and food safety on organic farms

Jo Ann Baumgartner led this project at the Wild Farm Alliance to create the organic farmer guide, Co-Managing Biodiversity Conservation and Food Safety on Organic Farms. This guide addresses cultural practices and issues that affect the compatibility of food safety and biodiversity conservation. Organic farmers are using the strategies presented in this manual to make management decisions that include conservation measures, and to effectively advocate for their farming practices with buyers and food-safety auditors. This guide and related resources have been used to educate Congress and the FDA about the critical need for co-management of food safety and conservation, resulting in a congressional mandate requiring the FDA to consider conservation when crafting the new food safety rules.

Educating women farmers about certified organic production

Melissa Matthewson led this educational project based at the Southern Oregon Research and Experiment Station, as part of the Oregon State University (OSU) Extension Small Farms program. This project sponsored four on-farm field days hosted by and for women, organic and transitioning farmers. This project was developed based on input from the League of Women Farmers. Eighty women farmers attended four field days held on three certified organic farms and one transitioning farm. Project coordinators gathered information from these farmers about the issues they were having on their farms, and documented the educational resources they said that they needed. One of the participants in the field day reported its strong positive impacts, stating, “I learned a lot from the class on organic soil fertility and certification. I have already adjusted some of my land practices and have shared the information from the class about certification with others in my community. I think that many women are intimidated by the more technical aspects of farming. Offering a class to women created a collaborative and supportive learning and networking environment and the focus on organic certification brought women of varied ages and farm types who are ready for the next step. I feel very supported as I move forward in the next steps with my farm and for me this support helps me to ensure that our endeavor will be successful.”

Organic Participatory Plant Breeding Toolkit: Tools and training in participatory breeding projects for researchers and organic farmers

OFRF awarded two grants to the Organic Seed Alliance in 2010 to create educational materials related to organic seed breeding. One grant resulted in four manuals, including an introduction to organic seed breeding and crop-specific manuals for sweet corn, carrots, and tomatoes. These manuals have since been distributed to hundreds of farmers. “To increase organic farmers’ success, we must increase the number of varieties bred for organic systems,” said project director Micaela Colley. “One of our goals is to empower organic farmers to breed their own crop varieties. The methods described in these manuals can immediately be adopted by farmers to improve their skills in plant breeding, and, ultimately, improve their operations through seed varieties that are well-suited to their farms.”

Sustainable Organic Farming and Marketing Project

This project, led by Bridget Cooke at the Oregon-based non-profit Adelante Mujeres, was a training program to teach organic farming practices to low-income immigrant Spanish-speaking farmers, and aid them in marketing. Participants committed to 22 weeks of training followed by on-the-ground support for all aspects of growing and marketing. In addition to classroom instruction and skills development, participants learned how to conduct a feasibility study, write a farm plan including all relevant business aspects, and how to harvest and prepare produce for market. The project also provided information for low-income immigrant Spanish-speaking farm workers on the benefits of organic practice. Some participants are now selling their produce at the

Forest Grove Farmer's Market, and in 2009 had average sales of \$130 per week, an increase of \$60 per week from the year before.

Additional education and outreach projects

- *Pollinator conservation strategies for organic seed producers*
- *Searchable Library of Articles on Organic Growing*
- *Organic Livestock Handbook*
- *Expanding farmer-to-farmer learning for Idaho's organic farmers*
- *Four Organic Breeding Guides - An Introduction to Organic Breeding, and Organic Breeding for Sweet Corn, Carrots, and Tomato*
- *Alabama Sustainable Agriculture Network Farmer-to-Farmer Program organic outreach*
- *Increasing the adoption of organic farming practices through NRCS training*
- *Developing web resources for organic production in high tunnels*
- *Crop planning for the organic market garden: a practical skills handbook*
- *Bilingual organic farmer training and mentorship program*
- *Organic apple conference calls: providing expert organic production advice for Upper Midwest growers*
- *2007 Organic Farm Performance in Minnesota Report*
- *Production guides for organic carrot, lettuce, and beet/chard seed*
- *Tilth Producers of Washington Farm Walk Program*
- *Managing farm habitat for wild pollinators*
- *Organic farming curriculum project*
- *Updating and translating ALBA's Small Farmer Education Program*
- *An organic farmers' guide to value-added production*
- *Prioritizing research, education and regulatory pest management needs of organic potato farmers through participatory strategic planning*

RESEARCH PROJECTS IMPROVE ORGANIC AGRICULTURAL KNOWLEDGE

OFRF-funded projects have contributed greatly to the state of knowledge involved with organic agriculture. Projects have been instrumental in developing new pest control methods and new or-

ganic seed varieties, and helping farmers better manage their soil. In this section, we go into detail about some significant achievements, and provide the titles for additional projects.

ORGANIC PLANT BREEDING PROJECTS

OFRF awarded 15 grants from 2010-2013 in partnership with the Clif Bar Family Foundation's Seed Matters research grant program. These grants funded multi-year projects, a necessity for seed-breeding research, which requires continuity to progress from selective breeding to stabilization and commercialization of new organic seed varieties. In addition to seed-breeding research, OFRF-funded educational projects produced essential, hands-on print and video guides for organic seed breeding. These cutting-edge seed breeding research projects are providing organic farmers with tools and information they need to grow and flourish, including new organic-friendly seeds and cultivars. Examples include three new sweet corn varieties developed by OFRF research partners and now available on the commercial market – “Who Gets Kissed?,” “Tuxana” and “Top Hat.” Farmer demand for these sweet corn varieties is so high that seed distributors quickly sold out the first year's release.

CROP BREEDING RESEARCH HIGHLIGHTS

Developing “Organic-Ready” Maize Populations with Gametophytic Incompatibility

Contamination from genetically modified (GMO) varieties is a real-world farming challenge being addressed by Frank Kutka in his Clif Bar Seed Matters and OFRF-funded research project. Kutka's research explores the use of naturally occurring traits derived from South American popcorn and the ancient Mexican grain teosinte. These traits create a screen against outcrossing (introducing unrelated genetic material into a breeding line) from transgenic, or genetically modified corn. “We need corn that organic farmers can grow without fear of GMO contamination,” Kutka said. Seed from the resulting lines and populations will be released to the public along with publications in the Maize Genetics Cooperation Newsletter in order to prevent their being patented. The seed has been sent to three agricultural institutes for further breeding and production, and seeds will be commercially available in 2016.

Snap Beans with Enhanced Nitrogen-Use Efficiency for Organic Production

Professor James Nienhuis of the University of Wisconsin is conducting ongoing research to develop organic snap bean cultivars with enhanced nitrogen-use efficiency. The current snap bean cultivar used in the industry does not fix nitrogen, and requires supplemental nitrogen applications. Nitrogen applications have resulted in groundwater pollution problems throughout the state of Wisconsin. Commercialization of a nitrogen-fixing cultivar, which will occur following Dr. Nienhuis's final farm trial in 2015, has the potential to decrease nitrogen use in this industry and protect water quality. Funding from OFRF and Clif Bar Seed Matters has been critical to Dr. Nienhuis's research program, because funding from the commercial vegetable processing industry is difficult considering the lack of interest in nitrogen-use efficiency as long as synthetic nitrogen is cheaply available.

Breeding day-neutral strawberry cultivars for organic production in the Pacific Northwest

This project led by Patrick Moore at Washington State University at Puyallup, WA, was a three-year breeding effort to develop strawberry varieties that produce fruit over a 4-5 month period in the Pacific Northwest. The study also evaluated which cultivars produce the most flavorful and highest-yielding fruit. The study found that among the ten cultivars evaluated, 'Aromas' and 'Seascape' had the highest yield and the 'Albion' was rated the highest for flavor (Figure 20). Results of this study were shared in oral presentations, a workshop, a field day, an educational booklet and poster presentations reaching more than 100 people.



Figure 20. Strawberries.

Establishing breeding populations for organic broccoli, sweet corn, and red kale varieties

Micaela Colley of the Organic Seed Alliance led this project with four organic farmers and three professional plant breeders to refine organic breeding populations in three crops: a curly red kale, an early maturing broccoli, and a sugary enhanced sweet corn. This approach is called organic participatory plant breeding (PPB), and is a decentralized model in which organic farmer-breeders work in collaboration with university, nonprofit and private-industry plant breeders to improve plant genetics for organic systems. This approach can supply organic producers and processors with the crops and desired traits that they need. This project refined three breeding populations through mass selection, single plant selections, and progeny selection to create sub-populations for subsequent breeding activities.

Additional plant breeding projects

- *Participatory screening of broccoli varieties for organic systems in Western North Carolina: Phase II-On-farm Trials*
- *Organic Food Barley: Developing nutritious and delicious varieties for the Pacific Northwest*
- *Create Two Open-Pollinated, Sugar-Enhanced Sweet Corn Varieties*
- *Farmer-based evolutionary participatory plant breeding for organic quinoa, buckwheat and spelt*
- *Trialing and seed increase of promising new vegetable varieties for organic systems*
- *Evaluation of day-neutral strawberries in organic systems in Washington*
- *Participatory plant breeding to improve sweet corn for organic farmers*
- *Organic certified seed potato production in the Midwest*
- *Development of corn borer-resistant corn for organic farming systems*

Food quality and organic production projects

Understanding how to best produce high-yielding and nutritious organic food is a major goal for farmers, and a topic that OFRF research projects have addressed for carrots, peppers, wheat, and milk. This has not been a major funding priority for OFRF, although it is an area of particular relevance to consumers.

FOOD QUALITY RESEARCH HIGHLIGHTS

Effect of Organic Fertilizer Selection on Phytohormones, B-carotene Levels, Growth, and Yield of Carrots and Peppers

Professor Jessica Davis' team is utilizing laboratory analysis to quantify the concentration of various phytohormones in organic fertilizers including fish emulsion, kelp, compost and farm-grown cyanobacteria solutions. This project, which is ongoing, will also test the fertilizers on field crops of carrots and peppers, and assess fertilizer impact on growth, yield and nutrient levels in produce. The Colorado researchers will also produce a cost/benefit analysis of on-farm production of cyanobacteria fertilizer and publish the data, allowing organic farmers more opportunity to optimize economic returns. "Our intent is to empower farmers to close the circle of soil fertility, reduce their carbon footprint, reduce costs, and increase self-sufficiency," Davis said.

Integrating cultivar, soil and environment to develop regional value-added wheat crops with enhanced nutrient value

Kevin Murphy and collaborators conducted this research to determine the relationship among grain yield, mineral concentration and soil fertility for wheat at three diverse environments in Western Washington State (Figure 21). Murphy and his team evaluated grain yield and concentrations of calcium (Ca), copper (Cu), iron (Fe), magnesium (Mg), manganese (Mn), phosphorus (P) and zinc (Zn) in 18 spring wheat cultivars on organic farms. The researchers found that wheat varieties differed greatly in their mineral and protein content, and that these differences are useful for farmers in determining which varieties are best suited for their particular needs. Murphy stated that farmers will be able to use the results from this study to help determine which variety or varieties of wheat to plant to optimize grain yield and mineral nutrient concentration based on their own soil characteristics, and to market this wheat to local bakers as a value-added product with enhanced nutritional value.



Figure 21. Farmers and researchers at a field day in 2008 at Nash's Organic Produce in Sequim, WA.

The funding of disease-management projects has had significant impacts in the ability of organic farmers to control soilborne pathogens and crop diseases. OFRF research partners have developed innovative approaches to coping with soilborne disease, including new soil treatments such as anaerobic soil disinfestation (ASD) and the use of techniques including vegetable grafting onto disease resistant rootstocks. In both the ASD and vegetable grafting research, OFRF funded early-stage pilot projects for what have now become large-scale research endeavors.

DISEASE MANAGEMENT RESEARCH HIGHLIGHTS

Managing Indigenous Seed-Inhabiting Microbes for Biological Control Against Fusarium Pathogens in Corn

Doctoral student Lucas Nebert received an OFRF/Seed Matters grant to conduct his study to investigate using microorganisms as biological control agents against the fungus *Fusarium* in corn. This novel research has the potential to offer organic corn farmers a new method for protecting their crops from pathogens, with future possible applications for many other crops. His project has developed a methodology for analyzing seed-associated microorganisms and how they might be useful as a seed treatment. One of Nebert's goals is for the research data and methods to be free and open to the public, and he maintains a website to share his progress and data.

Grafting Vegetables for Soil-Borne Disease Resistance

Carol Miles, Vegetable Extension Specialist from Washington State University, was project director for the 2011 project "Grafting Vegetables for Soil-Borne Disease Resistance." This project examined the impact of grafting as a disease-control technology. The study found that in cases of high and medium risk for soilborne diseases, there were definite advantages for vegetable grafting for disease control. However, this is a technology that is just starting to be adopted in the US. "US producers are chemically dependent," Miles said. "The idea of using grafting, especially on annual crops, is not widely considered because it is completely accepted to spray, fumigate, and tarp to control disease pests." Although it may be the case that many growers are hesitant to try something new, Miles believes that early adopters will have an early edge. "Other people will start doing it once they see that it works well," Miles said. 2015 is the first year that grafted eggplant has been commercially planted (Figure 22).

Figure 22. Graduate student researcher Sahar Dabirian and the farm manager Thomas Bleazard checking the graft union on the grafted eggplant.



Integrated soil-borne disease and weed management for organic strawberries using anaerobic soil disinfestation, broccoli residue incorporation, and mustard cake application

As part of an ongoing effort to improve organic strawberry production systems, a researcher team led by Carol Shennan and Joji Muramoto at UCSC received special fruit grant funding from OFRF in 2010 to study anaerobic soil disinfestation (ASD) to reduce strawberry disease levels in the soil (Figure 23). ASD is a non-chemical alternative to hazardous fumigants, and it works by creating a growth of microorganisms that in turn create an anoxic environment that kills soilborne disease. An economic analysis of the different treatments showed that a rotation of broccoli—ASD + mustard cake—strawberries—lettuce had the highest net returns due to good yields of strawberry and lettuce, even with the highest treatment costs. The \$28,000 grant from OFRF that initiated the soil disinfestation study in 2009 has since leveraged another \$2.8 million in funding from government grants, allowing the study to expand and continue.



Figure 23. Dr. Carol Shennan.

ADDITIONAL DISEASE MANAGEMENT PROJECTS

- *Deploying microbes as seed treatment for protection against soilborne plant pathogens*
- *Biological mediation of apple replant disease in organic apple orchards*
- *Suppression of Pythium damping off with compost and vermicompost*
- *Evaluating the efficacy, interest, and legitimacy of farm-specific biological control inoculants for the control of soilborne diseases by organic farmers*
- *Grafting tomatoes on disease resistant rootstocks for small-scale organic production systems*

INSECT PEST MANAGEMENT PROJECTS

Insect pest management is the most commonly funded topic area for OFRF grant projects. These grants have made impacts in the knowledge of how organic systems can best control pests using a variety of mechanisms, from predatory beneficial organisms to use of organic insecticide products. A major strength of these projects is that they often evaluate the efficacy of several insect management techniques, and are able to provide recommendations for the most effective and economic pest-management approach. In addition, these projects take a systems approach to solving pest problems, such as creating habitat for natural enemies that both increases farm diversity and protects against insect pests.

INSECT PEST MANAGEMENT RESEARCH HIGHLIGHTS

Fungi, predatory mites and guardian plants for thrips IPM in organic greenhouse ornamentals

Vermont entomologist and extension specialist Margaret Skinner evaluated an integrated pest management (IPM) approach that combined predatory mites, insect-killing fungi, and marigolds to control thrips. Thrips are one of the most problematic pests of organic greenhouse production nationally and a common reason why growers suspend organic practices in greenhouse ornamentals, fearing crop loss from this persistent virus-transmitting pest. The study found that a treatment combining a granular fungal treatment and predatory mites with marigold “guardian plants” appeared to suppress thrips more effectively than marigolds with predatory mites alone. This represents a low-cost, organic approach that can be used to control thrips in a greenhouse environment.

Integrating bats into organic pest management

Farmer Steve Tennes of Country Mill Farms in Michigan led a three-year project examining how bats can contribute to the control of codling moth, one of the most destructive pests for apples and pears in the U.S. (Figure 24). Tennes conducted his research on seven apple orchards, examining the species of bats present on project farms, the composition of their diets, their pest management contribution and the best location for artificial bat habitat. Tennes and his collaborators concluded that the native species of bats in Michigan provide a minor contribution to controlling apple pests and that establishment of bat houses near water sources may contribute to the control of insects and is generally recommended as a conservation practice.



Figure 24. Farmer researcher Steve Tennes with a bat box.

On-farm management of cutworms in organic no-till corn

Jeffrey Moyer, former Director of Farm Operations at the Rodale Institute Experimental Farm (and now Executive Director of the Rodale Institute), conducted this project to identify effective management strategies for cutworm in organic no-till planted corn. This study showed that cutworm predation is always changing due to the timing of cutworm larvae populations, vetch bloom, and corn planting. Additionally, it was revealed that cutworm predation may not be as big of a problem in organic no-till corn as previously thought. Moyer found that the most effective control of cutworms was shown to be system and landscape management, rather than OMRI-approved biocontrols.

Insect management tools for organic cranberry production in the Pacific Northwest

Crop consultant Deborah Henderson sought in this project to identify suitable tools for management of three key cranberry insect pests - blackheaded fireworm, cranberry girdler and black vine weevil - and developed an integrated pest management (IPM) program for these pests. Pests are the main concern for organic Western cranberry growers, as many survive mild winters. The results of this project include pest management recommendations for each of these three pests.

ADDITIONAL INSECT PEST MANAGEMENT PROJECTS

- *Development of a Holistic Management Plan for the Apple Flea Weevil*
- *Integrating Biological Control for the Key Pests Diamondback Moth (*Plutella xylostella*) and Cabbage Aphid (*Brevicoryne brassicae*) in Organic Brussels Sprouts*
- *Enhancing insect-pest management in organic systems using genotypically diverse cultivar mixtures*
- *Enhancing biological control of insect pests using flowering intercrops in wine grape agroecosystems*
- *Investigating the use of buckwheat strips to attract beneficial insects for the management of Colorado potato beetle*
- *Integrating biological control with trap crop management in California organic strawberries*
- *Biological control of root lesion nematodes with *Pasteuria* spp.*
- *Investigating the effects of shade canopy management on natural enemies, pests, plant damage, and yield in organic coffee plantations*
- *Harnessing aphid alarm pheromone to rid broccoli heads of aphids*

WEED MANAGEMENT PROJECTS

Weed management is a major concern for all organic farmers. OFRF-funded projects have had positive impacts by evaluating the effectiveness of different weed management programs as well as new weed control techniques, like the use of compost extract. One great contribution of these projects is that they often combine weed management research with economic analysis, letting farmers know which weed control strategies will work best and be cost effective. OFRF contributions in this topic area are strong, yet this is an area where the foundation can strengthen funding to greater address the needs of farmers.

WEED MANAGEMENT RESEARCH HIGHLIGHTS

Effects of Compost Extracts on Organic Seed Germination and Reduction of Weed Seed Expression

Led by Dr. Gladis Zinati at the Rodale Institute, this project looked at whether compost extracts could reduce weed-seed germination. The study found that different types of compost vary in their ability to suppress weeds, and also in the undesirable effect of suppressing crop-seed germination. “The funding I received from OFRF was integral to test the concept of compost extract as a tool for weed suppression,” Zinati said. “The results showed that certain chemical and biological compositions could reduce percent germination of certain weeds but not all of them.”

Finding cost-effective weed and nutrient management practices in organic pear orchards

University of California Cooperative Extension agent Chuck Ingels conducted research on two serious challenges to organic orchards: weed and nutrient management. The study looked at the effects of in-row mowing, landscape fabric mulch, wood chip mulch, and organic herbicide on long-term suppression of weeds on the leaf water potential of trees at a Bosc pear farm. Ingels found that feather meal and nitrogen applications were the most effective nutrient management system. The most cost-effective weed control method was in-row mowing with a side-mounted mower.

Effectiveness and economic impact of weed control systems in organic garlic production

To help organic farmers choose suitable weed control, Idaho farmer Susan Fluegel and her partners at Grey Duck Garlic Farm evaluated the effectiveness of four different weeding methods on two varieties of organic hardneck garlic - German Red and Georgian Crystal. To determine the effectiveness of each combination of pre- and post-planting weeding methods, Susan evaluated weeding time, weed coverage, garlic bulb weight (total yield), garlic bulb size, and the economic feasibility for all weed-control methods. Susan found that solarization, though effective against weeds, decreased the size of garlic bulbs by 5.5 percent and decreased yield by 10 percent compared to garlic in stale seedbeds. On average, there was no difference in time or garlic yield in hand versus flame weeding, though flame weeding was three times more expensive. Overall, a combination of a stale seedbed and then hand weeding is the most effective weed control method for garlic.

ADDITIONAL WEED MANAGEMENT PROJECTS

- *Weeds your way: strategies for organic managing weeds in central New York state*
- *Agroecosystem approach: managing annual and perennial weeds in organic, minimum-till vegetable production*
- *Methods to breed field corn that competes better with weeds on organic farms*

SOIL AND NUTRIENT MANAGEMENT PROJECTS

Soil and fertility management are two of the most common topics funded by OFRF. Our research partners are making great progress in determining the types of nutrient budgets, fertilization systems and products best suited for organic crops. One important lesson from soil research is that every farm has a unique set of requirements and conditions, and organic farms in particular are unique in their soil characteristics.

SOIL AND NUTRIENT MANAGEMENT RESEARCH HIGHLIGHTS

Measuring Active Carbon to Predict Seasonal Nitrate Mineralization on Organic Farms

Extension agent Doug Collins conducted this project to characterize nitrogen mineralization on organic broccoli farms in Washington State. Collins found that every farm is different in the amount of nitrogen needed. Fertilizer guides are written for conventional farms, and they do not account for nitrogen mineralization in organic agriculture. Collins is now able to tell organic farmers that their soil is different, and they can use less fertilizer. “For example, a conventional farm has a rate of 50 lb/acre of nitrogen mineralization and an organic farm has a rate of 81-140 lb/acre of nitrogen mineralization,” Collins said. The understanding that organic farms mineralize nitrogen at different rates than conventional farms has implications for the amount of fertilization needed and the way organic farmers budget nitrogen. The next phase of Collins’ research will provide recommendations for how much nitrogen to use for broccoli – a high nitrogen crop

Evaluation of alternative nitrogen sources for California rice systems

The objectives of this study were to (1) to determine the effectiveness of organic fertilizer N mineralization in meeting rice crop nitrogen demand, as reflected by plant nitrogen uptake, and improved grain yield; (2) to determine nitrogen mineralization rates of organic fertilizers; and (3) to compare the returns on investment in pelletized organic materials with those of poultry litter. This study produced important practical information for farmers, showing that pelletized fertilizer has higher and more predictable nitrogen availability and produced higher rice yields than poultry litter. Additionally, pelletized fertilizers had higher returns on investment, ranging from 57-76 percent, whereas poultry litter had returns of only 18-19 percent. This information serves as important guidance for growers wishing to maximize fertility in a cost-effective manner.

Optimizing mulch and fertilizer use in organic blueberries

Eric Hanson at Michigan State conducted this three-year project funded in partnership with Stretch Island Fruit Company. Hanson examined the impact of fertilizer and mulch types, on nitrogen availability in the soil and plant health, in organic blueberry systems. Hanson evaluated composted manures, feather meal, commercial organic fertilizers and organic mulch materials (bark, wood chips, straw, leaves, peat). The results showed that compost is a useful source of nitrogen for blueberries and that surface mulches effectively suppress weeds.

Fish extracts for integrated disease, insect, and fertility management in organic blueberries in the Southeastern U.S.

Harald Scherm of the University of Georgia examined how foliar applications of fish extracts could contribute to disease, insect, and nutrient management in organic blueberries. This project explored the use of four different fish extracts. The extracts were sprayed on the blueberry leaves with backpack sprayers at a rate equivalent to 60-75 gal/acre. These products contribute consistently to leaf disease suppression and nutrition and can have added benefits on leaf beetle suppression. The study found that there were no major differences among the treatment products in terms of protecting against leaf spot, leaf rust, and leaf beetle; damage was inconsistent across trials for all products. Significantly higher levels of potassium were found after the application of some of the fish extract treatments, leading to a possible nutritional benefit.

Effectiveness of agroecological management in improving soil quality in California vineyards

Agroecology professor at UC Berkeley Miguel Altieri, graduate students Albie Miles, Houston Wilson, Paul Rose, and researcher Clara Nicholls worked on this project to assess the effectiveness of specific agroecological management strategies (e.g., winter and summer cover crops and native plant hedgerow corridors) on the improvement of soil quality and the enhancement of functional biodiversity for pest regulation in California vineyard agroecosystems. The overall goal of the research was to further define the requisite landscape structure, cover crop species composition and the management of such plants needed to stimulate soil biological activity, enhance and sustain soil quality, and sponsor cost-effective ecological management of key wine grape pests. The study compared seven vineyards with varying management practices and identified cover crop diversification as a key strategy to promote the internal regulation of important arthropod pests and the maintenance of soil fertility, without the use of synthetically compounded materials.

CONSERVATION BIOLOGY PROJECTS

The intersection between environmental protection and organic farming is strong, with the agroecological view that a healthy farm ecosystem will be diverse and protective of natural resources. Conservation biology projects examine this intersection, especially how promoting ecological health can in turn promote ecosystem services like pest control from beneficial organisms. OFRF-funded projects focused on conservation biology have demonstrated how birds and diverse habitat are important for pest reduction.

CONSERVATION BIOLOGY RESEARCH HIGHLIGHTS

Integrating songbird conservation and insect pest management in organic California vineyards



Figure 25. Researcher Julie Jedlicka with a bird box.

Julie Jedlicka, PhD student at UC Santa Cruz led this project as part of her doctoral dissertation (Figure 25). Her objective was to test whether biocontrol of moth, leafhopper and sharpshooter pests was enhanced through conservation of insect-eating birds via the establishment of songbird nest boxes. “It felt good to be able to provide the grower with this resource,” Jedlicka said. Songbird nesting sites have decreased due to disruption of woodland and savannah habitat. Creating nesting boxes for songbirds in vineyards provides habitat for native birds,

such as the Western Bluebird, as well as providing a biocontrol for insect pests. Western Bluebird abundance increased by a factor of nine in nest box treatment areas throughout the breeding season. Additionally, there was a significant decrease in larvae both immediately adjacent to occupied nest boxes (average 83% larvae removal) and at randomly selected points (average 58% larvae removal) throughout the nest box treatment areas of the vineyard.

Determining habitat requirements for natural enemies of crop pests

PhD student Rebecca Chaplin-Kramer from UC Berkeley conducted her research project working with growers in the Salinas Valley and surrounding areas to understand how landscape factors around the farm contribute to natural pest control. She examined how syrphid flies act in controlling cabbage aphids in broccoli crops. The results of this project demonstrate that natural habitat does indeed provide a pest control service to farms. This research has established that farms having a substantial amount (>50%) of natural habitat in the surrounding landscape have essentially double the biological pest control found on farms with less than 15% nearby natural habitat. The potential for habitat around the farm to benefit pests as well as the natural enemies of those pests, is an important consideration in understanding the impact of habitat complexity on pest control services.

COVER CROP PROJECTS

COVER CROP RESEARCH HIGHLIGHTS

Organic Cover Crop Seed Production as a Sustainable Enterprise for the Southeast

Extension agent Ray Hicks from Screven County, Georgia, led this project to evaluate the performance and economic viability of cover crop seed production. Organic cover crop seeds



Figure 26. Georgia farmer Re-linda Walker in organic crimson clover field (Photo by Julia Gaskin).

are not widely available in Georgia, and there is little organic seed production in the southeastern United States (Figure 26). Hicks and his collaborators evaluated different cover crop varieties for seed yields, seed quality, profitability, and special equipment adaptations or infrastructure needed. This project evaluated the profitability of certified organic crimson clover seed and annual rye seed production, finding that both clover and rye organic cover crop seed production could be profitable in the Southeast.

Identification of superior cover crop varieties for organic seed production in the Maritime Northwest

John Navazio of the Organic Seed Alliance led the research on this project to evaluate different varieties of five cover crop species including buckwheat, oats, hairy vetch, red clover, and field peas. Cover crops were evaluated for their ability to 1) produce a vigorous, strong cover to protect the soil and discourage weed growth; 2) produce a superior mature seed set in a timely fashion at the end of the season; and 3) produce a superior seed harvest of viable seed. This project reinforced the importance of selecting the best performing variety for the purpose of seed production, as variety choice was found to affect yield, seed quality, and in some cases the ability to successfully mature and harvest a seed crop. The grower benefited from access to a new population of buckwheat that was created by mixing the best varieties. This new population reliably matures in his climate and is higher yielding than the population he was previously using.

ECONOMIC EVALUATION PROJECTS

Research projects with economic components have been effective in quantifying the costs and economic potential of new and alternative crops like goji berry, hops, and berries. These projects are important in demonstrating that there are markets for diversified cropping systems and the production of new crops.

Several research projects had economic components, although most had a predominantly agronomic focus. The projects that combined economic evaluation with the investigation of new practices provided important and practical information regarding the adoptability of new farming practices. For example, “Organic Cover Crop Seed Production as a Sustainable Enterprise for the Southeast,” highlighted in the cover crop research section above, included a detailed analysis of the economic viability of producing different varieties of cover crop seed in a specific region. Projects with economic components, even if the economic section of the project was a minor part of the research, offer a richer interdisciplinary insight into the economic potential for different farming practices. This economic information is extremely important in informing farmers about the potential economic risks and benefits of switching to new crops or production techniques.

ECONOMIC EVALUATION RESEARCH HIGHLIGHTS

Adapting organic apple practices for Great Lakes region organic hops production

Matthew Grieshop, Assistant Professor of Organic Pest Management at Michigan State University, conducted research investigating the cost and feasibility of growing hops in the Midwest as well as identifying hops varieties best suited for conditions in the Upper Midwest. The study found that the first year establishment of a hopyard using materials adapted from high density tree fruit cost approximately \$7,317, and that the Chinook, Pride of Ringwood, and Galena varieties are less frequently attacked by mite pests, compared to the other hops varieties.

Developing an organic commercial production system for the Goji berry

This project, led by Norma Wilson in Lovettsville, Virginia, was to develop organic propagation and cultural recommendations for the Goji berry. Goji Berry (*Lycium barbarum* or *Lycium chinense*) is a specialty crop ideal for small farmers because of smaller land usage, reduced labor requirements, and greater income per acre planted (Figure 27). She collected data on the time it takes to root Goji berry from cutting and grow as a transplant, in addition to the varieties of field pests, both animals and insects. One of her main findings was that the time of doing the cutting greatly affects the survival rate. Cuttings taken in June had the highest survival rate and those cut in August had the lowest survival rate. This research is important in showing that the timing of cuttings should be based on the specific climatic conditions at individual farms.



Figure 27. Goji Berries.

Off-season organic blackberry and raspberry production to expand markets and sustain farm profitability

This project was developed by Dr. Curt Rom at the University of Arkansas to investigate production issues for organic primocane blackberries and the economics of extending the season of blackberries and raspberries by using high tunnels. Dr. Rom found that growing blackberries and raspberries in high tunnels increases yields, berry size, extends the growing season, and performed better in poor weather conditions. However, berries grown in tunnels need additional frost protection, as they bloom earlier in the year when frost may still be a risk. This research served as the foundation for Dr. Rom's research and teaching program on organic and sustainable horticulture.

Persistence of Florida's small-scale organic farms in the face of growing demand for organic products

Graduate student Lindsay Fernandez-Salvador led this project examining the market conditions that enable small-scale organic farms to persist, and the characteristics that explain the success

or lack of success of small organic farms. Fernandez-Salvador performed semi-structured interviews with 32 of Florida's 75 certified organic farmers, and collected and analyzed organic market data from USDA's Economic Research Service and the Organic Trade Association. She analyzed market chain data from 50 "players" in Florida's organic industry including packers, processors, distributors and retailers. She found the two most important threats to farm persistence were increasing costs of organic inputs and interstate and international competition. The most important factors contributing to farm persistence were increasing consumer demand for organic products and price premiums. Of those small farms found to be highly successful, the formation of a social-business contract was the most important contribution to their success. Farms that adopted industrial methods of production and marketing, such as input substitution and vertical market chain integration, struggled the most.

ANIMAL PROJECTS

OFRF funded only one research project focused on animal production during the study period - a project on feed for organic dairy cows. Animal production research is a priority area where OFRF has the potential to make an impact with future funding efforts.

ANIMAL RESEARCH

Molasses as an alternative energy feed source for organic dairies

Kathy Soder of the USDA Agricultural Research Service was awarded an OFRF grant to study the possibility of using molasses as a feed source for organic dairy cows (Figure 28). This is an interesting possibility because organic dairies are faced with the challenge of sourcing and purchasing organic feed grains. With short supplies, escalating feed prices, and recently falling organic milk prices, farmers are searching for alternative energy sources for lactating dairy cows. In the feeding trial, the organic lactating herd at the University of New Hampshire was supplemented with either molasses or corn meal. It was found that molasses performed similarly to cornmeal at low levels of supplementation, and that both molasses and corn supplements performed only marginally better than an all-pasture diet. The results of this research will be used to develop feeding recommendations for molasses supplementation for organic dairy farmers, consultants and industry professionals.



Figure 28. Continuous culture fermentation units at the USDA-ARS Facility, University Park, PA.

APPENDIX 2. COMPLETE LIST OF PROJECTS FUNDED FROM 2006-2014.

FUNDING CYCLE	PI	TITLE	TOTAL AMOUNT FUNDED
2014 Fall	Jessica Davis	Effect of Organic Fertilizer Selection on Phytohormones, B-carotene Levels, Growth, and Yield of Carrots and Peppers	\$14,000.00
2014 Spring	Frank Kutka	Developing “Organic-Ready” Maize Populations with Gametophytic Incompatibility Year 4	\$11,800.00
2014 Spring	Eric Carr	Deploying microbes as seed treatment for protection against soilborne plant pathogens	\$14,932.00
2014 Spring	Jonathan Spero	Create Two Open-Pollinated, Sugar-Enhanced Sweet Corn Varieties: Year 4	\$9,490.00
2014 Spring	Jeanine Davis	Participatory screening of broccoli varieties for organic systems in Western North Carolina: Phase II-On-farm Trials Year 3	\$14,945.00
2014 Spring	Kevin Murphy	Organic Food Barley: Developing nutritious and delicious varieties for the Pacific Northwest	\$15,000.00
2013 Fall	Fred Forsburg	Can Organic Garlic Seed Stock Be Created Disease-Free From the Production of Garlic Bulbils?	\$8,906.00
2013 Fall	Sam Fuller	Organic Seed Production and Improvement Training Program for Vermont	\$9,195.00
2013 Fall	James Nienhuis	Snap Beans with Enhanced Nitrogen-Use Efficiency for Organic Production-Year 2	\$14,989.00

2013 Fall	Lucas Nebert	Managing Indigenous Seed-Inhabiting Microbes for Biological Control Against Fusarium Pathogens in Corn	\$13,000.00
2013 Spring	Gladis Zinati	Effects of Compost Extracts on Organic Seed Germination and Reduction of Weed Seed Expression	\$14,376.00
2013 Spring	Jeanine Davis	Participatory screening of broccoli varieties for organic systems in Western North Carolina Year 2	\$14,734.00
2013 Spring	Frank Kutka	Developing "Organic-Ready" Maize Populations with Gametophytic Incompatibility Year 3	\$11,900.00
2012 Fall	James Nienhuis	Snap Beans with Enhanced Nitrogen-Use Efficiency for Organic Production	\$14,224.00
2012 Fall	Jonathan Spero	Create Two Open-Pollinated, Sugar-Enhanced Sweet Corn Varieties: Year Three	\$8,870.00
2012 Spring	Frank J. Kutka	Developing "Organic-Ready" Maize Populations with Ga1s Gametophytic Incompatibility; Year 2	\$12,000.00
2012 Spring	Laura Parker/Holli Cederholm	Contamination Avoidance and Testing Protocols	\$10,966.00
2012 Spring	Patrick Moore	Breeding day-neutral strawberry cultivars for organic production in the Pacific Northwest	\$11,200.00
2011 Fall	Douglas P. Collins	Measuring Active Carbon to Predict Seasonal Nitrate Mineralization on Organic Farms	\$14,996.00
2011 Fall	Eric Mader	Pollinator conservation strategies for organic seed producers	\$12,500.00
2011 Fall	Jeanine Davis	Participatory screening of broccoli varieties for organic systems in Western North Carolina	\$14,734.00

2011 Fall	Jonathan Spero	Creating two open pollinated, sugary enhanced sweet corn varieties	\$8,410.00
2011 Spring	Carol A. Miles	Grafting Vegetables for Soil-Borne Disease Resistance	\$12,984.00
2011 Spring	Frank J. Kutka	Developing "Organic-Ready" Maize Populations with Ga1s Gametophytic Incompatibility	\$11,500.00
2011 Spring	Jack Kittredge	Searchable Library of Articles on Organic Growing	\$6,000.00
2011 Spring	Jared Zystro	Organic Participatory Plant Breeding Toolkit: Tools and training in participatory breeding	
projects for researchers and organic farmers	\$12,021.00		
2011 Spring	Kristine Swaren/Laura Telford	Organic Livestock Handbook	\$7,125.00
2011 Spring	Matthew Grieshop	Development of a Holistic Management Plan for the Apple Flea Weevil	\$10,229.00
2011 Spring	Sean Swezey/Diego Nieto	Integrating Biological Control for the Key Pests Diamond-back Moth (<i>Plutella xylostella</i>) and Cabbage Aphid (<i>Brevicoryne brassicae</i>) in Organic Brussels Sprouts, year 2	\$14,990.00
2010 Fall	James Nienhuis	Reducing risk associated with organic snap bean production in Wisconsin	\$11,129.00
2010 Fall	Jennifer Miller	Expanding farmer-to-farmer learning for Idaho's organic farmers	\$5,100.00
2010 Fall	Jonathan Spero	Creating two open pollinated, sugary enhanced sweet corn varieties	\$8,060.00
2010 Fall	Kevin Murphy	Farmer-based evolutionary participatory plant breeding for organic quinoa, buckwheat and spelt	\$14,177.00

2010 Fall	Micaela R. Colley	Four Organic Breeding Guides - An Introduction to Organic Breeding, and Organic Breeding for Sweet Corn, Carrots, and Tomato	\$14,815.00
2010 Fall	Ray Hicks	Organic Cover Crop Seed Production as a Sustainable Enterprise for the Southeast year 2	\$2,152.00
2010 Spring	John F. Tooker	Enhancing insect-pest management in organic systems using genotypically diverse cultivar mixtures	\$13,638.00
2010 Spring	Sean Swezey	Integrating biological control for the key pests diamondback moth and cabbage aphid in organic brussels sprouts	\$14,324.00
2010 Spring	Jo Ann Baumgartner	Co-managing biodiversity conservation and food safety on organic farms	15000
2010 Spring	Carol Shennan	Integrated soil-borne disease and weed management for organic strawberries using anaerobic soil disinfestation, broccoli residue incorporation, and mustard cake application	\$49,132.00
2009 Fall	Chuck Ingels	Finding cost-effective weed and nutrient management practices in organic pear orchards	\$27,624.00
2009 Fall	Ed Maltby	The liberation of Odairy archives	\$12,000.00
2009 Fall	John Navazio	Identification of superior cover crop varieties for organic seed production in the Maritime Northwest	\$14,488.00
2009 Fall	Karen Wynne	Alabama Sustainable Agriculture Network Farmer-to-Farmer Program organic outreach	\$7,680.00

2009 Fall	Kathy Soder	Molasses as an alternative energy feed source for organic dairies	\$15,000.00
2009 Fall	Margaret Skinner	Fungi, predatory mites and guardian plants for thrips IPM in organic greenhouse ornamentals, year 2	\$14,997.00
2009 Fall	Steve Tennes	Integrating bats into organic pest management	\$35,873.00
2009 Spring	Lori Hoagland	Biological mediation of apple replant disease in organic apple orchards	\$35,122.00
2009 Spring	Martin Kleinschmit / Katie Starkweather	Increasing the adoption of organic farming practices through NRCS training	\$15,000.00
2009 Spring	Matthew Grieshop	Adapting organic apple practices for Great Lakes region organic hops production	\$8,140.00
2009 Spring	Melissa Matthewson	Educating women farmers about certified organic production	\$8,466.00
2009 Spring	Michael Mazourek	Trialing and seed increase of promising new vegetable varieties for organic systems	\$14,953.00
2009 Spring	Miguel A. Altieri	Enhancing biological control of insect pests using flowering intercrops in wine grape agroecosystems, year 2	\$14,730.00
2009 Spring	Norma Wilson	Developing an organic commercial production system for the Goji berry	\$7,924.00
2009 Spring	Ray Hicks	Organic cover crop seed production as a sustainable enterprise for the Southeast	\$2,536.00
2009 Spring	Robert Hadad	Investigating the use of buckwheat strips to attract beneficial insects for the management of Colorado potato beetle, year 2	\$5,868.00

2009 Spring	Stacy M. Philpott	Investigating the effects of shade canopy management on natural enemies, pests, plant damage, and yield in organic coffee plantations	\$14,983.00
2008 Fall	Bruce Linquist	Evaluation of alternative nitrogen sources for California rice systems	\$13,817.00
2008 Fall	Eric Hanson	Optimizing mulch and fertilizer use in organic blueberries	\$57,597.00
2008 Fall	Harald Scherm	Fish extracts for integrated disease, insect, and fertility management in organic blueberries in the Southeastern U.S.	\$39,295.00
2008 Fall	Jeffrey Moyer	On-farm management of cutworms in organic no-till corn, year 2	\$15,000.00
2008 Fall	Julie Jedlicka	Integrating songbird conservation and insect pest management in organic California vineyards	\$15,000.00
2008 Fall	Kimberly Williams	Developing web resources for organic production in high tunnels	\$8,271.00
2008 Fall	Kristine Swaren	Crop planning for the organic market garden: a practical skills handbook	\$7,125.00
2008 Fall	Linda Barnes	Bilingual organic farmer training and mentorship program	\$10,500.00
2008 Fall	Patrick Moore	Evaluation of day-neutral strawberries in organic systems in Washington	\$38,640.00
2008 Fall	Phillip Fujiyoshi	Harnessing aphid alarm pheromone to rid broccoli heads of aphids	\$2,550.00
2008 Fall	Scott Hoffman Black	Managing farm habitat for wild pollinators	\$8,000.00
2008 Fall	William Tracy	Participatory plant breeding to improve sweet corn for organic farmers	\$14,795.00

2008 Spring	Amy Charkowski	Organic certified seed potato production in the Midwest year 2	\$14,884.00
2008 Spring	Brent McCown, DiPietro, L	Organic apple conference calls: providing expert organic production advice for Upper Midwest growers	\$9,978.00
2008 Spring	Bridget Cooke	Sustainable Organic Farming and Marketing Project	\$8,000.00
2008 Spring	Curt Rom	Off-season organic blackberry and raspberry production to expand markets and sustain farm profitability	\$38,209.00
2008 Spring	Dave Christensen	Development of corn border-resistant corn for organic farming systems, year 3	\$14,555.00
2008 Spring	Deborah Henderson	Insect management tools for organic cranberry production in the Pacific Northwest	\$27,475.00
2008 Spring	Eric B. Nelson	Suppression of Pythium damping off with compost and vermicompost year 2	\$10,180.00
2008 Spring	Lindsay Fernandez-Salvador	Persistence of Florida's small-scale organic farms in the face of growing demand for organic products	\$7,304.00
2008 Spring	Margaret Skinner	Fungi, predatory mites and guardian plants for thrips IPM in organic greenhouse ornamentals	\$14,968.00
2008 Spring	Meg Moynihan	2007 Organic Farm Performance in Minnesota Report	\$6,725.00
2008 Spring	Micaela R. Colley	Production guides for organic carrot, lettuce, and beet/chard seed	\$13,614.00
2008 Spring	Miguel A. Altieri	Effectiveness of agroecological management in improving soil quality in California vineyards	\$14,980.00
2008 Spring	Nancy Allen	Tilth Producers of Washington Farm Walk Program	\$6,100.00

2008 Spring	Sean Swezey	Integrating biological control with trap crop management in California organic strawberries year 2	\$14,471.00
2008 Spring	Susan Fluegel	Effectiveness and economic impact of weed control systems in organic garlic production	\$10,362.00
2007 Fall	Alice Rolls	Organic farming curriculum project	\$13,400.00
2007 Fall	Gary Peterson	Updating and translating ALBA's Small Farmer Education Program	\$12,758.00
2007 Fall	George Kuepper	An organic farmers' guide to value-added production	\$8,800.00
2007 Fall	James Kotcon	Biological control of root lesion nematodes with <i>Pasteuria</i> spp.	\$13,937.00
2007 Fall	Jeffrey Moyer	On-farm management of cutworms in organic no-till corn	\$15,000.00
2007 Fall	Jennifer Miller	Prioritizing research, education and regulatory pest management needs of organic potato farmers through participatory strategic planning	\$12,240.00
2007 Fall	Kevin Murphy	Integrating cultivar, soil and environment to develop regional value-added wheat crops with enhanced nutrient value	\$11,500.00
2007 Fall	Matthew Harbur/Brian Baker (final report by Elizabeth Dyck and Baker)	Weeds your way: strategies for organic managing weeds in central New York state	\$11,664.00
2007 Fall	Robert Hadad	Investigating the use of buckwheat strips for the management of Colorado potato beetle in potato production and as an attractant of native pollinators for vine crops	\$5,547.00
2007 Fall	Suzanne O'Connell	Grafting tomatoes on disease resistant rootstocks for small-scale organic production systems	\$11,174.00

2007 Spring	Amy Charkowski	Organic certified seed potato production in the midwest	\$14,600.00
2007 Spring	Dave Christensen	Development of corn border-resistant corn for organic farming systems: year 2	\$14,970.00
2007 Spring	Edward DePeters	Healthy components in organic milk: oligosaccharides, vitamins and omega-3 fatty acids make organic milk unique in healthy diets	\$15,000.00
2007 Spring	Eric B. Nelson	Suppression of Pythium damping off with compost and vermicompost year 1	\$10,019.00
2007 Spring	Micaela R. Colley	Establishing breeding populations for organic broccoli, sweet corn, and red kale varieties	\$11,834.00
2007 Spring	Rebecca Chaplin-Kramer	Determining habitat requirements for natural enemies of crop pests	\$8,770.00
2007 Spring	Sean Swezey	Integrating biological control with trap crop management in California organic strawberries year 1	\$14,848.00
2006 Spring	Brian McSpadden Gardener	Evaluating the efficacy, interest, and legitimacy of farm-specific biological control inoculants for the control of soilborne diseases by organic farmers	\$9,584.00
2006 Spring	Dave Christensen	Development of corn border-resistant corn for organic farming systems	\$8,350.00
2006 Spring	Frank H. Stonaker	Evaluation of screened high tunnels for production of organic vegetables in Colorado	\$14,942.00
2006 Spring	Helen Atthowe	Agroecosystem approach: managing annual and perennial weeds in organic, minimum-till vegetable production	\$6,258.00



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