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US Federal Organic Research Activity is Expanding

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Abstract

The United States Department of Agriculture/Agricultural Research Service is the agency responsible for the federal effort in agricultural research. A recent survey of the ~2340 USDA/ARS scientists revealed that approximately 8% of the scientists were interested in working on research topics for organic agriculture. At the time of the survey only about 4% had worked in or were working on projects useful to certified organic industries. The survey identified several obstacles hindering work in organic agriculture. Some obstacles such as low funding levels were not unique to organic research while other obstacles were. A recent USDA/ARS workshop on organic agriculture helped to identify and alleviate some of those issues.

Introduction

The growth of organic agriculture as an industry has mandated an equivalent growth in organic agriculture research. Local, state, and national research institutions are beginning research programs in organic agriculture and the resulting publications are beginning to emerge. A literature search in the CABI database revealed that, in the five years from 2000 to 2004, nearly 4 times as many (2168) publications on organic agriculture were published as compared to the five years from 1990 to 1994 (558). The interest of the US federal government is also increasing and more scientists from the US Department of Agriculture/Agricultural Research Service (USDA/ARS) are conducting research on organic agriculture than ever before. This paper provides a glimpse of organic agriculture research currently underway at the Federal level.

Early pioneers in organic agricultural research were mostly growers and researchers working with Non-Governmental Organizations (NGOs). The lack of funding for state and federal research was in part due to the lack of economic impact and political clout of the organic sector during its early years. Organizations like the Organic Farming Research Foundation (OFRF) were created to fill the vacuum that existed due to the lack of institutional support for organic farming research (5). As the political and economic clout of the organic sector has grown, so has the involvement of government research organizations. Consequently more state institutions are implementing organic research and extension programs. Approximately 44 states now have some evidence of organic research activity supported by state resources (9). Although some universities and cooperative extension agencies have just recently begun to serve the research needs of the organic industry, others, like the University of California at Santa Cruz, have been conducting organic agricultural research for decades. Their record is exceptionally impressive considering that they are not a Land Grant University and thus

have limited resources available to them for agricultural research in comparison to the Land Grants.

Organic Agricultural Research at the Federal Level

Three agencies within the USDA are responsible for the national effort in organic agricultural research. Cooperative State Research Education and Extension Service (CSREES; csrees.usda.gov) is responsible for competitive funding programs within the Department. Until recently there were no funds designated specifically for organic agriculture research, although there were several programs from which scientists received funds for conducting organic agriculture research. The Sustainable Agriculture Research and Education program (SARE; sare.org) and individual programs within the National Research Initiative (NRI; csrees.usda.gov/funding/nri/nri.html) have funded organic research projects. However, in 2000 the first program explicitly aimed at funding research on organic agriculture was established. The Organic Transitions Program is part of the Integrated Pest Management Integrated Competitive Grants authorization in the 1998 farm bill (AREERA). A second program, the Organic Research and Extension Initiative (OREI) was authorized in the 2002 farm bill. Grants from OREI were funded for the first time in 2004 as part of the Integrated Organic Program (IOP), which combined both authorizations into a single program. To date these two programs have awarded approximately \$8.5 million dollars for organic research projects. Although funds are provided to state, private, and other federal organizations, this program directs the funds toward issues that are significant at the national level. Part of this research focus was influenced by the research agenda developed by the Scientific Congress on Organic Agriculture Research (7). While CSREES runs granting programs in organic agriculture research, this agency does not conduct research.

The Economic Research Service (ERS; ers.usda.gov) is responsible for research on agricultural economics. Members of the ERS published have published important analyses of market and economic trends in the organic industry. They have led the way in our understanding of growth in the US organic industry.

The Agricultural Research Service (ARS) is the national agricultural research organization in the US, and is comprised of approximately 2340 scientists. The agency is divided into eight administrative areas that are based on regional proximity. There are over 20 National Programs with 1373 individual projects organized in the themes: (i) Animal Production, Product Value and Safety; (ii) Natural Resources and Sustainable Agricultural Systems; and (iii) Crop Production and Product Value and Safety. The National programs are run by National Program Leaders (NPL) who prioritize the national research agenda within those programs. There is no specific national program for organic agriculture and therefore until recently there was no documentation of which scientists were conducting organic research or the extent of the USDA commitment to organic research.

Until the late 1970s the USDA/ARS had no official policy toward organic agriculture but this sector was most often neglected and at times demeaned by USDA administrators (5). The first attempt by the ARS at a national organic research agenda was made in the late 1970s. In 1979 the USDA/ARS began an extensive assessment of organic farming in the US by the "USDA Study Team on Organic Farming" which published what is still one of the most comprehensive analyses of organic agriculture in the US conducted by government agencies (5). The resulting publication from this study team called for the establishment of a permanent resources coordinator on organic agriculture (10). These recommendations were initially taken seriously but in 1982 the full-time organic farming coordinator position that

was recommended and established was abolished. Although some scientists continued to work in organic systems, the organic nature of their work was not emphasized and they didn't report the organic nature of their work in the project reports.

Nine years ago, an informative survey of the Current Research Information System (CRIS) database was conducted by Mark Lipson of OFRF (5). He reported that less than one-tenth of one percent of the USDA's research portfolio consisted of "strong organic projects." He recommended that the level of commitment should be raised to the level of the industry market share. This survey was done with the best available data and provided valuable insight into the current research being conducted. However, because of the structure of CRIS project documentation systems, very little of the scientist's research can be documented there. Additionally because of the lack of support for organic research in the agency, some scientists did not explicitly state that their research was done in organic systems. In order to try to better understand who was working in organic systems or who would be interested in doing so, I was asked by the USDA National Program Staff (NPS) to survey USDA/ARS scientists in 2001 (3). All supervisors were asked to forward a request for scientists working or interested in organic research to contact the NPS. All respondents were asked if they knew of other ARS scientists interested or working in organic research.

A total of 188 USDA/ARS scientists responded that they were interested in organic agriculture research. Many of them hadn't yet had the opportunity to work in organic systems but were eager to. Of the 188 who responded, 89 stated that they work in organic research. All 188 scientists received a survey to evaluate the nature of the work they do and/or the obstacles they face in conducting organic research. Some of results from this survey are reported here.

Of the 89 scientists who indicated that they conduct organic research, four scientists reported that 100% of their research was directly applicable to organic agriculture. However, only one appropriated project within the ARS is dedicated to work in organic systems (Cover Cropping Practices to Improve Weed and Fertility Management in Organic Production Systems). This new project, established in 2001, has a single scientist located in the Crop Improvement and Protection Research Unit at Salinas, CA. There were 15 scientists who reported that at least 50% of their research was explicitly organic. Nevertheless, the commitment of other scientists' time varied, with the average scientist spending about 18.5% of their time and presumably resources working on organic research projects. At the time of the survey, there was only one location that had certified land that they owned (Salinas, CA with 22 acres certified) (Fig. 3). In addition, Beltsville, MD (Fig. 1) had 30 certifiable acres, and Fort Pierce, FL was developing 10 acres on 80-year lease (Fig. 2). Thus, most ARS scientists conduct their organic research in collaboration with established organic growers or NGOs. For example, scientists in Morris, MN have developed a long-term relationship with an NGO, Barnes-Aastad Soil and Water Conservation Research Association, where they have initiated a long-term systems trial that includes 3.8 acres that, while not certified, are managed according to organic regulations (Fig. 4).



Fig. 1. USDA/ARS Organic Research Farming Systems Trial in Beltsville, MD. Dr. Michel Cavigelli, a soil scientist with the Sustainable Agricultural Systems Laboratory, manages this farming systems trial, which was initiated in 1993. The trial emphasizes organic production systems and the replicated plots are big enough to use standard-sized farm equipment. The research team compares organic and conventional production systems by evaluating crop performance, soil fertility, soil quality, weed population dynamics, nutrient cycling, soil biological activity, and other measures of agronomic performance among the five cropping systems.



Fig. 2. Paper mulch being evaluated as an alternative to plastic mulch at Rosie's Organic Farm, Gainesville, FL. Dr. Erin Roskopf of the Subtropical Plant Pathology Research Unit in Fort Pierce, FL is evaluating biodegradable paper mulches as an alternative to plastic mulches for weed control in organic and conventional systems. Like many ARS scientists, Dr. Roskopf collaborates with organic growers to test promising technologies on the growers' land. In addition, Dr. Roskopf and her colleagues are working to certify 10 acres of land for which the USDA/ARS holds a long-term lease.



Fig. 3. Organic Weed Management Systems Trial, Salinas, CA. Dr. Eric Brennan and colleagues are evaluating cover crop variety and seeding rates on a variety of agronomic, horticultural, and economic aspects in an organic vegetable production system on a portion of the 22 acres certified in Salinas, CA. Dr. Eric Brennan's research program (Cover Cropping Practices to Improve Weed and Fertility Management in Organic Production Systems) is the first and only USDA/ARS project specified to work in organic systems.



Fig. 4. USDA/ARS Farming Systems Plots, Morris, MN. In 2002, Dr. David Archer and his colleagues established 96 organically managed plots out of the 192 plots in this long-term farming systems trial. This represents 3.8 acres that could be certified organic. The experiment is comparing tillage, rotations, and fertilization in plots managed organically and conventionally. The plots in the foreground are a tofu variety of soybeans (Vital), conventional tillage on the left, strip tillage on the right. This work is being done in conjunction with an NGO, Barnes-Aastad Soil and Water Conservation Research Association.

Although the scientists work in a wide range of disciplines (Table 1), less than 2% work in animal systems. National Programs in the Animal Production, Product Value and Safety National Program could potentially offer a great deal more that would directly impact organic agriculture. The remaining 98% of research was split evenly between national programs in Natural Resources and Sustainable Agricultural Systems and Crop Production and Product Value and Safety. Interestingly, 12 scientists were working on organic systems as alternatives to methyl bromide as part of National Program 308.

Table 1. The number of USDA/ARS scientists and locations conducting organic research.

State	Location	Number of scientists	Disciplines represented
Arkansas	Booneville	1	Agronomy
California	Davis	1	Plant pathology
	Parlier	4	Entomology, plant pathology, soil science
	Salinas	2	Horticulture, plant pathology
	Shafter	1	Entomology
Colorado	Fort Collins	1	Soil science
Florida	Fort Pierce	2	Microbiology, plant pathology
	Gainesville	2	Entomology
	Miami	1	Chemistry
Georgia	Athens	1	Microbiology
	Dawson	2	Food technology, plant physiology
	Tifton	4	Entomology, plant pathology
Iowa	Ames	5	Agronomy, entomology, soil science, plant pathology
Idaho	Kimberly	1	Soil science
Kansas	Manhattan	2	Entomology
Maryland	Beltsville	14	Agronomy, chemistry, genetics, microbiology, plant physiology, soil science, weed science, zoology
Minnesota	Morris	5	Agronomy, plant physiology, soil science
	St. Paul	1	Soil science
Missouri	Columbia	2	Chemistry, microbiology
Mississippi	Oxford	1	Agronomy
	Mississippi State	1	Entomology
	Poplarville	1	Entomology
North Dakota	Mandan	1	Soil science
Nebraska	Lincoln	2	Soil science
New York	Ithaca	1	Ecology
Oklahoma	Lane	3	Agronomy, entomology, plant physiology
Oregon	Corvallis	4	Entomologist, plant pathology
Pennsylvania	Wyndmoor	3	Chemistry, microbiology
South	Florence	1	Genetics

Carolina			
Texas	Weslaco	2	Soil science
Utah	Logan	1	Entomology
Washington	Prosser	1	Plant physiology
	Pullman	1	Soil science
	Wapato	6	Entomology
	Wenatchee	2	Plant pathology, plant physiology
West Virginia	Beaver	3	Plant physiology, soil science
	Kearneysville	3	Entomology, soil science

Obstacles to Organic Research in the USDA/ARS

As part of the survey, ARS scientists were asked what obstacles prevented or hindered their work in organic agriculture. This was an open-ended question to which 171 of the 188 scientists interested in organic agriculture responded. Many of the scientists had multiple responses. The obstacles fell into six categories, five of which were easily defined. The main categories of obstacles were related to: (i) resource issues; (ii) scientific issues; (iii) agency acceptance; (iv) cooperators; and (v) regulatory issues. Additionally, 22 respondents reported issues that didn't fall into one of these categories and 8% said they had no obstacles.

Over 40% of the scientists who responded identified resource issues as a significant obstacle to their research in organic systems. One respondent summed up the situation, "We have no obstacles except for lack of time, funds, and personnel." The lack of resources is not a new phenomenon to agricultural research in general (8). The total US federal support for agricultural research is typically 2% of the nation's total expenditure for research and development (1). Many years the *increase* in the budget for the National Institutes of Health is greater than the *total* research budget for all research conducted by the ARS.

In addition to funding issues, which are common to all of agricultural research, there appear to be resource issues that are particular to organic production systems. Many research stations have farm equipment and land that could be used for organic production; however, the burden of cleaning pesticides and other substances that are not permitted in organic production from machinery often falls to the organic programs. Additionally, problems that arise from potential chemical contamination due to shared irrigation or run-off are usually the burden of organic programs to solve. This often leads new organic programs to buy their own equipment and develop independent infrastructure that new conventional-based programs usually do not need to do. To help mitigate these problems, organic researchers may place a greater emphasis on on-farm research, which in turn leads to a greater need to address problems with the grower-cooperators, as discussed below.

When scientists refer to the lack of time they are indicating that they do not have mandates to work in organic agriculture 100% of the time. Generally ARS field personnel are not trained in organic production methods. Most ARS scientists must then balance work in other farming systems with work in organic systems and learn how to manage organic land. Additionally many scientists expressed that they have little time to dedicate to organic systems since they already are fully occupied with their work in conventional systems.

Issues with cooperators represented 28% of the obstacles identified and some of these obstacles relate directly to grower numbers. One common

comment was "Organic growers just don't come to us for help." Many scientists expressed the sentiment that the number of organic growers was low relative to conventional growers so they can't find cooperators or grower land on which to work or there isn't a demand for their help.

In addition to the lack of contact between researchers and growers, concerns with the grower-scientists collaboration were expressed. Some expressed a potential lack of commitment by growers to complete the research once it is started. More than one scientist indicated that growers quit experiments in the middle of an experiment, wasting the scientist's investment. This is a problem that growers and scientists face in any cooperative research project due to different imperatives (4). However, this problem can be minimized by choosing the appropriate research-management model. Moreover, including growers from the beginning of the research planning process as equal partners helps to alleviate this problem.

In addition to difficulty finding organic growers, scientists had difficulty finding scientific cooperators interested in organic agriculture or associated agriculture industries for support. It appears that the perception of the quality of organic research is not the issue, since only a small percentage (1%) identified legitimacy as an issue. Previously, this was a major issue preventing scientists from working in organic agriculture (5). This difficulty may be because the scientists are already over-worked, or because of the smaller pool of scientists available for teamwork in organic systems.

Approximately 20% of the scientists that responded identified scientific issues as major obstacles. For example, the need for huge land resources for replicated experimental plots was given as a scientific issue since these are not available. Additionally, experimental design for organic research was recognized as an obstacle. In particular the size of plots needed to do research in the replicated designs in vogue for single-component analysis is impractical.

In fact, a change in the over-all approach to research may be needed in order to adequately study complex organic systems. According to Drinkwater (2) systems research evaluates how complex systems function as a whole in contrast to component research, which evaluates cause-effect relationships of individual components of the system. Systems research is often discussed as an integral approach to advancing organic agriculture due to the systems-level functions that are thought to be operating (6). Many ARS scientists recognized the need for more complex statistical methods for analyzing their work, but these methods have not yet been standardized and are sometimes not well accepted.

Scientists are still struggling with how to truly do interdisciplinary research instead of multidisciplinary research and many don't understand the conceptual difference (11). The distinction between these two is significant for organic agriculture. Multidisciplinary research has several scientists from different disciplines working on the same project. Multidisciplinary research is often essentially single component research replicated for each discipline on the same research plot with little interaction among the disciplines. On the other hand, interdisciplinary research begins to approach systems research because the disciplines interact and share approaches and analyses. Notwithstanding these difficulties, over 60% of the ARS scientists working in organic research say that they are already taking a systems approach to their research.

Because of the national presence of ARS across many climates and cropping systems, it is uniquely poised to ask questions about transferability of organic practices and knowledge from one environment and system to another. This transferability is an issue for scientists who believe that their research won't be broadly applicable if conducted on organic farms. Because organic growers use unique mixes of crops and approaches for their individual

farms and their approaches to farming have tended to be less formulaic than those of conventional production, the applicability of research conducted in one specialized farming system to other farming systems is questioned. Thus, scientists want to know if research conducted on one farm or location applies to other locations, and how to improve the breadth of that applicability. A coordinated research project organized at the national level could be conducted by the USDA/ARS to answer these questions.

Equal to scientific issues, agency-specific obstacles were identified by 20% of the respondents. These issues relate to the lack of support or approval of organic research given by administrators at all levels. The majority of the ARS scientists responding stated that organic agriculture had a low priority compared to conventional agriculture in their project goals. Others cited lack of local administrative support or support from the NPS. Another agency-related issue indicated the contrasting requirements of long-term and systems research and the evaluation system for scientists. Essentially, conducting long-term systems research may not benefit the scientist in the evaluation system. Systems research may take longer than component research and that is bad for early career scientists. In particular, one respondent noted that "A process-based approach is not beneficial to young scientists' careers because of risk and length of time to publication."

Regulatory issues are significant for at least 10% of the scientists who responded. Some scientists expressed that the definition of organic agriculture does not allow practices that would be more sustainable. One respondent noted: "They (regulators) put the definition ahead of alternative sustainable practices." It might be best for the definition of organic to evolve as the science of organic systems evolves. In addition, some scientists just don't understand the regulations or process of certification. Several scientists indicated that they just don't know if their research would fit within the rules.

Ideological differences still exist and scientists sometimes see the organic industry as a different kind of constituency than other grower groups with which they interact. An excellent illustration of this was the scientist who stated that he didn't want to work on organic agriculture because he might sound like an advocate for organic agriculture. He thought that by supporting organic agriculture through research he would be advocating for this production system over another. However, all scientists within the USDA/ARS work for particular sectors of agriculture at the exclusion of others. It is likely that this scientist could, for example, work on wheat without being concerned that he or she was advocating for wheat and thus implying that corn was not so good. Thus, scientists sometimes have different beliefs and actions with respect to organic agriculture that present unique obstacles to research.

Recent Progress on Obstacles

Recently the NPS and upper ARS administrators demonstrated renewed support for organic research in the agency. In addition to the support provided for the survey itself, NPS held an organic research workshop, which brought ARS scientists from around the country together to develop and exchange ideas on organic research projects and help develop an organic research action plan. The first USDA/ARS Workshop on Organic Agriculture was held in January 2005 in Austin, TX and was attended by 63 scientists. During the solicitation for this meeting, additional scientists indicated that they were interested in organic research, bringing the number of interested scientists to 196. Several significant results developed out of this meeting, including the development of an action plan. Moreover, important scientific contacts were made and research collaborations were established due to this meeting. One suggestion from the workshop was to reestablish a position at

the national level to coordinate all organic agriculture research in the USDA/ARS. This would transfer the onus of keeping the program going from individual scientists and move it to a strategic position. This would also demonstrate the intent of the agency to increase or emphasize organic agriculture in the near future and give an official level of legitimacy to research in this area.

Conclusions

The USDA/ARS is the premier federal agricultural research organization in the US. The renewed interest of this organization in organic agriculture research should both help resolve the scientific questions surrounding organic agriculture and meet grower needs. The agency has already taken several steps to help the scientists within the agency accomplish more in this area, and the removal of identified institutional barriers to organic research will demonstrate continued intent to support organic research. If taken, the recommendations from the ARS organic workshop should significantly aid scientists in their research efforts. These steps could increase the number of scientists in varied disciplines who are conducting organic research, which is necessary in order to conduct meaningful research in organic agriculture. Though many scientists are conducting research on a wide variety of crops using a range of disciplines already, research in organic animal production is clearly lacking.

Significant advancement of organic research in the ARS will require administrative coordination at the national level. Because of the national nature of the organization, questions fundamental to organic agriculture could be asked across all regions of the country to determine the general applicability of principles developed from one location to another. Because ARS projects are funded in multi-year cycles, the organization should be able to organize long-term projects that are difficult to execute in institutions relying on grant funding. The development of regional organic research centers was one idea suggested at the ARS National Organic Workshop that could facilitate coordinated research at both the local and national levels.

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