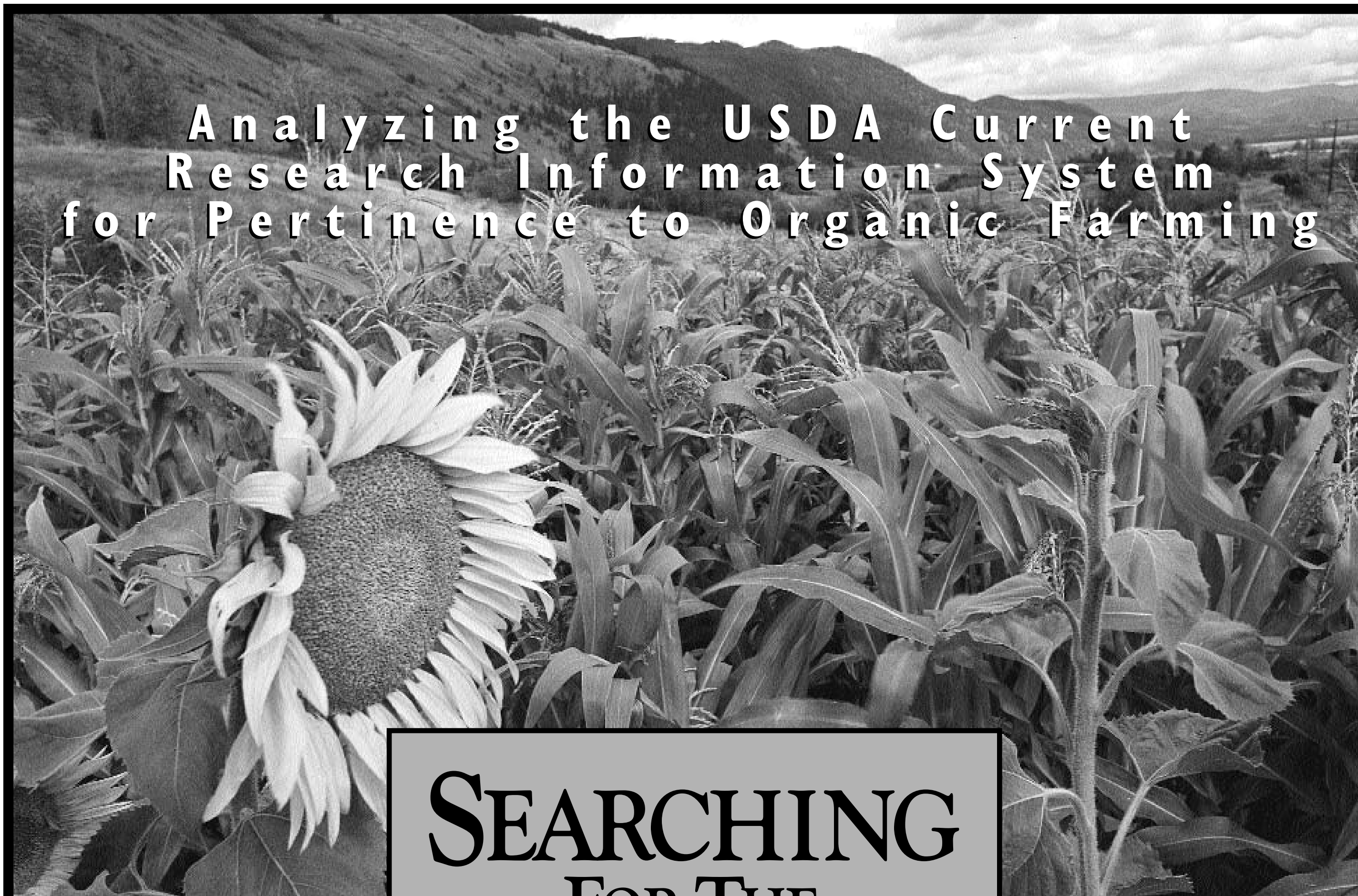
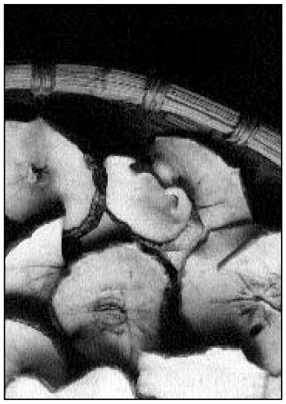
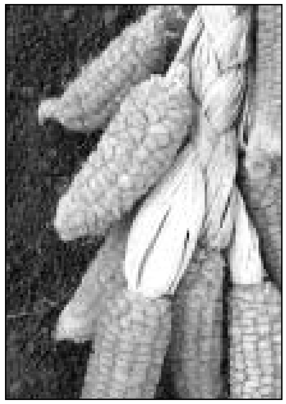
Analyzing the USDA Current Research Information System for Pertinence to Organic Farming



Searching for the "O-Word"

Help Support Research In Organic Farming

The Organic Farming Research Foundation was founded by certified organic farmers in September, 1990. Our purpose is *to foster the improvement and widespread adoption of organic farming practices.* We describe our mission as: *to sponsor research related to organic farming; to disseminate research results to organic farmers and to growers interested in adopting organic production systems; and to educate the public and decision-makers about organic farming issues.*

Contributions to OFRF are tax-deductible as allowed by law. Since 1990 we have raised over $1,000,000 in support of our organic farming research and information dissemination programs. To date OFRF has awarded sixty-nine on-farm research and education grants. We award new grants in the spring and fall of each year. We publish our *Information Bulletin* three times each year. OFRF also conducts a survey of the nation's certified organic farmers and hosts a national leadership business and regulatory conference on the term "organic" every other year. Contributions supporting our general program and special projects have been received from organic farmers, family foundations, businesses active in the organic products industry, and individuals concerned about the state of America's agricultural system.

We welcome contributions of any size. It's the sum of the thousands of donations (large and small) that has helped the Organic Farming Research Foundation become an acknowledged leader in providing the public with research and marketplace information on the term "organic". Please make a donation to OFRF today. For more information on any component of OFRF's general program or to receive a complimentary copy of our *Information Bulletin*, please write us.

ORGANIC FARMING RESEARCH FOUNDATION
P.O. BOX 440 SANTA CRUZ, CALIFORNIA 95061
831-426-6606 (ph) 831-426-6670 (fax) research@OFRF.org (email)

SEARCHING FOR THE "O-WORD"

Analyzing the USDA Current Research Information System for Pertinence to Organic Farming

by

Mark Lipson

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design and photography by Kenneth McCormick

printed on recycled paper

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Notwithstanding the best efforts of all those who contributed to this project, all mistakes and erroneous statements within this publication are the sole responsibility of the author.

NATIONAL ORGANIC RESEARCH POLICY ANALYSIS PROJECT STAFF

Mark Lipson is the Policy Program Coordinator for the Organic Farming Research Foundation and the principal author of this report. He also is a working organic farmer as a partner in the Molino Creek Farming Collective of Davenport, California. Mark serves as the Chair of the California Organic Foods Advisory Board. **Bob Scowcroft** is the Executive Director of OFRF, and provided supervision of the entire project. **Erica Walz** is the Program Director of OFRF and fulfilled numerous management and editorial tasks for the project. Research Assistants during the project's term were: **Peggy Felix**, **Josh Fodor**, **Reggie Knox**, and **Barbara Maximovich**.

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Executive Summary

Background

U.S. sales of organic foods exceeded $3.5 billion in 1996. The organic foods sector has grown at an average rate of 20% annually for the last seven years. Over 10,000 U.S. farms are engaged in profitable, agronomically successful commercial production without reliance on synthetic fertilizers and pesticides. Organic farming encompasses every region of the country and every crop grown in the U.S.

Despite this positive record, the potential of organic farming remains largely undeveloped. Research and development support for organic farming systems is needed to fulfill the promise of highly productive, non-toxic, ecologically sound agriculture. To assess the state of organic farming research, the Organic Farming Research Foundation initiated the National Organic Research Policy Analysis project (NORPA). During 1995 and 1996 **the NORPA project conducted a study to identify and catalogue federally supported agricultural research that pertains specifically to the understanding and improvement of organic farming.** In addition, the study contains a brief history of organic research policy and policy recommendations to USDA.

Methodology

The study used the Current Research Information System (CRIS) database which contains about 30,000 summaries of research projects supported by USDA. There is not a specific "organic" classification within the CRIS system, so an indirect search strategy was developed. An initial screening of the CRIS database was performed using 71 keywords related to organic farming systems. This process returned a pool of approximately 4,500 distinct project summaries. A rating scheme for evaluating "organic-pertinence" was developed based on the research topic, as well as the project's experimental context. Each of the 4,500 projects was reviewed and rated for organic-pertinence. Aggregate FY1995 funding data for organic-pertinent projects was compiled by USDA staff and forwarded to OFRF.

Results

Some excellent organic research projects were found, but they were few and far between. The results of the CRIS search found ***only 34 projects rated as "Strong Organic"***, meaning that the project was explicitly focused on organic systems or methods, and described an experimental setting consistent with conditions found on working organic farms. ***These projects represent less than one-tenth of one percent of USDA's research portfolio, both numerically and fiscally.*** An additional 267 projects were rated as "Weak Organic", meaning that the research topic was compatible with organic methods, but not explicitly placed in a context of organic agriculture. The "Strong Organic" projects with FY1995 funding received a total of $1.5 million in federal funding, although even this small amount overstates the actual support of organic-pertinent activities.

Conclusions

While some organic-pertinent research does exist, these projects mostly are unrelated to any coherent strategy or analysis of organic farmers' needs. Organic farming systems represent a vital scientific frontier in the development of environmentally sound agriculture. The growth of the organic production sector is also an important economic opportunity and an element of sustainable rural development. ***The national agricultural research system has failed to recognize this potential, let alone explore it seriously or help to improve the performance of organic farming systems.*** This failure is contradictory in light of policy goals seeking reduced environmental risks in agriculture (e.g. The President's IPM Initiative), greater diversity in cropping patterns (e.g. "Freedom to Farm" legislation), and the incorporation of "sustainability" as a guiding policy principle.

Recommendations

1. USDA should issue a basic policy statement recognizing that organic farming can play a significant role in meeting the nation's agricultural, environmental, and economic development needs.

2. Collection and dissemination of information about organic agriculture should be a routine and expected task for all relevant USDA agencies.

3. Current efforts to improve the CRIS system should incorporate a definition of organic-pertinence and integrate it into the reporting system.

4. Implementation of USDA national initiatives (e.g., Fund for Rural America, National Research Initiative, Integrated Pest Management, Food Safety, etc.) should support and utilize organic farming research and education.

5. Specific research and development support should be allocated for implementation of the National Organic Program.

6. USDA should undertake a national initiative for organic farming research, including:

*Assessment by all USDA research and education agencies of the potential contributions of organic farming to their Mission and Goals.

*Facilitating the development of scientific goals for organic farming research, bringing together producers and scientists to construct a long-term scientific agenda.

*Funding for multidisciplinary investigations emphasizing on-farm organic systems analysis, combining research and extension.

* Establishing a national network of dedicated organic experiment stations, guided by local organic farmers.

Foreword
Organic Farming: What It Is & What It Isn't

Organic Farming: What It Is & What It Isn't

The organic farming sector in the U.S. today encompasses 10,000-15,000 farms, working more than 1 million acres of crop and grazing land. It successfully includes every crop grown in this country. 1996 U.S. sales of organically grown and processed products surpassed $3.5 billion. Domestic sales have grown at a rate around 20% for each of the last seven years.

Overall, these organic farms produce average (or better) yields for their regions and crops, and they are competitively profitable. Over the long term, they exhibit systemic attributes of high biodiversity, adaptive resistance to pest and disease pressures, reduced pollution effects, reduced worker safety risks, and resiliency under extreme weather conditions.

Among these thousands of farms, there exists a fundamentally different set of biological and agronomic premises, in contrast to their "conventional", chemical-management-intensive counterparts. The point here is not to argue which system is "better", but to recognize that organic systems are qualitatively different, that they have different management principles, and to consider the potential benefits of investing explicitly in their research and development. The features listed above would suggest a closer look at such an investment for the country's agricultural research and education "portfolios".

Organic farming is NOT just a "different flavor" of farm inputs. The best organic farmers are not relying on purchased "biopesticides", nor are they managing crop fertility by simply substituting natural sources for equivalent pounds of chemical fertilizer. They are building and maintaining the balances of the farming system such that adequate resources are available to meet their crops' or animals' needs without inducing problems generated by artificial imbalances. These farms conspicuously display "preventive-intensive" attributes, and they have different management and informational needs accordingly.

The use by some organic farmers of botanical pest controls and other "borderline" materials does not undermine the basic distinctiveness of organic systems. These practices represent *transitional* processes, which are easily arrested – some growers get stuck on the borderline, legally organic but unable to move beyond the "soft" crutches which resemble conventional practice. This phenomenon is fundamentally a problem of knowledge, *not* an inherent limitation of organic practice. The strategies and patterns of organic transition have never received deliberate study, and growers have followed this road by trial and error without detailed scientific guidance.

Organic farms exhibit adaptive pest resistance, reduced pollution and safety risks, and competitive productivity.

We have barely begun to tap the full potential of organic farming systems. In many ways, the state-of-the-art of organic farming is still in a rudimentary phase. We know very little about *exactly how* our systems are working.

The patterns of systemic relationships between biological fertility and soil qualities on one hand, and pest resistance and disease suppression on the other, are barely beginning to be understood.

We have only glimpsed the outlines of the "soil food web": the complex mediation of nutrients and disease prevention by communities of living organisms in biologically active agricultural soils. We are just getting to the point where we can ask questions at the correct (i.e., systems) level, let alone ask the best questions (e.g., "what characterizes the optimum patterns of relationship among specific soil biotic constituents?"), ***let alone*** provide reliable answers to the important questions.

Despite the lack of detailed scientific explication, *we know organic farming works, and we know it works better over time.* The success of organic farming systems is simply undeniable. The breadth and longevity of this success prevents passing it off as "exceptions" or "anomalies". While many recent agricultural technologies are relatively short-lived, (e.g., rapid turnover of chemical products due to pest resistance and negative environmental effects) modern organic systems have a 50-year track record of improved performance and economic viability.

The long list of uninvestigated questions about organic farming belies many of the standard dismissals of its potential. Most of the stock arguments against pursuit of organic farming are in fact unscientific, ideological attacks. "Organic farming can't feed the world." "There is not enough natural nitrogen for everybody to be organic." And so on. All of these arguments are actually admissions of ignorance, and of the failure to investigate the potential improvements that might be realized with a deliberate research effort. Given the achievements of organic farming, gained without support from the nation's massive agricultural research system, there are many compelling reasons to pursue such an effort.

In developing the potential of organic farming, there is much to be gained for all practitioners of agriculture. Organic farming does not imply an attack on other farmers, nor does it mean a rejection of all "high-tech" agricultural methods (e.g., "precision farming"). Organic farming does imply placing these tools in the context of biological-system-management and optimizing their efficacy within this context.

In order to leverage the research attention that organic farming deserves—research that can benefit *all* farmers—it is important for farmers and policy makers to have a picture of what is or is not being done. We have tried to provide that picture, and offer some preliminary thoughts about what the picture ought to look like from an organic farmer's perspective.

The study we present here is a study by organic farmers, for all farmers who are interested in an ecological approach to agriculture. It is not an abstract exercise, and we do not pretend that it meets an academic test of "objectivity". Nor do we claim that this search for the "O-word" has been completely comprehensive. It is probable that some organic-pertinent projects in the USDA research database were not found by this investigation, but we are confident that we have found most of them.

In offering the results of our search, we hope to provoke the visibility of other organic research. We hope to encourage vigorous debate among farmers and scientists not only about "what counts" as organic farming research, but more importantly about "what's good" and "what works".

Arguments against the pursuit of organic farming... are actually admissions of ignorance.

Introduction
Chapter 1

1.1 Overview

The National Organic Research Policy Analysis Project (NORPA) of the Organic Farming Research Foundation (OFRF) performed a two-year search for federally-funded research on organic agriculture. The project was a practical approach to the question, "**What is the 'organic content' of the federal government's agricultural research portfolio?"** An important secondary question was, **"How readily can an organic farmer find this information?"** This report presents the results of our search and our recommendations for federal policies to support organic research and education. We hope that it will serve as a benchmark that future assessments can measure from.

The origins and objectives of the NORPA project are described in the remainder of Chapter 1. The premises and methods of our search are detailed in Chapter 3. In Chapter 4, we present the data and discussion of these results. Chapter 5 contains our conclusions and recommendations to USDA. The complete database of organic-pertinent projects is compiled in Appendix A.

Conducting this search has also required us to ask, **"How has organic farming been perceived within the national agricultural research system, and how has this perception affected the system's policies and priorities?"** Thus we have compiled a brief history of organic farming research policy, which is presented in Chapter 2.

The results presented here are a "snapshot" of the national agricultural research system. Like any snapshot, it was taken from a particular angle and perspective. In framing the picture some things around the border had to be left out. Despite such limitations, a snapshot can capture the essential aspects its subject, and we hope that this has been achieved here. Our approach to finding organic research was not elaborate or exhaustive, but we believe that it reveals an honest picture of organic farming research within the institutional mainstream.

1.2 Background: The Organic Farming Research Foundation and the *National Organic Farmers' Survey*

OFRF was created in the early 1990s partly in response to the prevailing lack of institutional support for organic farming research and education. During the 1980s, the experience of organic (and would-be organic) farmers seeking help from public agricultural information resources — land-grant colleges, State Experiment Stations, County Extension personnel or the USDA's Agricultural Research Service (ARS)— was almost universally negative. These institutions provided no help toward understanding organic systems or improving organic farming practices. Not only were traditional agricultural circles profoundly lacking in useful information, but institutional personnel often responded to organic farming questions with outright hostility. Despite this neglect, organic farming has grown steadily and significantly. In proving the success of organic agriculture, organic farmers have had to rely upon themselves and one another for research and information exchange. Developing this grower-based knowledge system is the essence of OFRF's identity.

The Foundation's purpose is, "To foster the improvement and widespread adoption of organic farming practices. Its mission is, "To sponsor research on organic farming, disseminate research results and to provide education about organic farming issues." In pursuit of its mission OFRF conducts a competitive grant-making program to support organic farming research and education. It publishes the *OFRF Information Bulletin* to present the results of projects which the Foundation has supported.

In addition, OFRF has implemented a biennial national survey of certified organic growers, with emphasis upon assessing their research priorities. Conducted in 1993 and 1995 (and slated again for 1997), *The National Organic Farmers' Survey* has revealed several key findings. In 1993 and 1995 OFRF collected all available lists of certified organic farmers in the U.S. and mailed to them the *National Organic Farmers' Survey,* seeking information on their research needs, their sources of information and other data. Several key results emerged from the *Surveys.* First, it was confirmed that organic growers are impeded in their efforts by a lack of institutional support.[1] Second, it was shown that there is significant need for dedicated organic research and that specific, researchable topics can be articulated by the producers.[2] Finally, the *Surveys* revealed that the grower community is a huge potential resource for research activity.[3]

Although the *Surveys'* assessment of research needs was primarily intended to guide OFRF's own grant-making program, the resources of the Foundation are extremely limited compared to even the smallest public institutions. In 1996, OFRF was able to fund about $57,000 worth of research. In its first six years, OFRF provided nearly $400,000 to 69 projects. This is an historic accomplishment but far from adequate to meet the needs of established organic farmers, let alone those who might be but lack information to guide them. During the mid-1990s USDA has been spending *$1.8 billion* per year on agricultural research and education. As OFRF's Executive Director Bob Scowcroft has put it, "the government is too slow to wait for, but too big to ignore."

1.3 Begging the Question: Where is the "O-word"?

With the beginnings of a grower-driven research agenda identified by the *Surveys* it was thus obvious to ask, "what research is being done in the public sector that meets the specific needs of organic farmers?"

> Organic farmers are impeded by a lack of institutional support.

The USDA could not (and still cannot) answer that question. One obvious impediment is the continuing lack of a formal regulatory definition for "organically produced". (The statutory basis for such a definition was passed by Congress in 1990, but as of this writing, USDA has not yet published its proposed regulations to implement that legislation.) Another important reason is the historical "taboo" on discussing the idea of organic farming research within USDA. (The construction and effects of the taboo are discussed in Chapter 2). For whatever reasons, there has been no effort by USDA in the last fifteen years to identify or collect organic farming knowledge.[4] In fact, for most of that time, we believe there has been a deliberate effort to *not* identify organic farming information.[5]

Three main factors combined to produce the National Organic Research Policy Project: 1) As indicated by the *Survey* and our own experience as growers, there is an expressed need for understanding and improvement of organic farming systems, and the public role in developing this information needed to be assessed; 2) There has been no institutional effort to compile such information, so we had to find it for ourselves (if it exists at all); and 3) The anticipated implementation of USDA's National Organic Program of regulations and production standards posed an important opportunity to scrutinize public policy about organic farming research.[6]

With these factors shaping our inquiry, OFRF created the National Organic Policy Analysis (NORPA) project in late 1994. The specific objectives of the project emerged as detailed below.

1.4 Specific Project Objectives

1) Identify "organic-pertinent" research funded by USDA national programs, using the Current Research Information System (CRIS) database.

Above all, our concern has been to identify existing organic farming research and investigators, in order to apply the research information and engage the researchers in both collaborative investigations and scientific agenda-building.

Defining organic-pertinence was a central challenge in performing this study and we hope that this is also one of its useful contributions. The use of the term "organic-pertinence" is meant to distinguish investigations that are specifically focused on understanding organic systems and improving their performance. This distinction is discussed further in Chapter 3.

2) Evaluate and catalogue the organic-pertinent research found, and compile quantitative and qualitative baselines for USDA's "organic research portfolio".

Realistically we could not expect this effort to comprehensively or definitively search the complete national research portfolio, but our objective was to search as much of it as we could and evaluate individual projects in a consistent way. Although it is the most complete and accessible database available, the CRIS system does not include every USDA-funded research project, and the information it offers on each project is very limited. Because of these limitations, the numerical benchmark of organic research projects may be most meaningful in describing orders of magnitude, rather than the precision of single digits.[7]

Characterizing some qualitative aspects of organic research projects (subject area, farmer participation, systems orientation, etc.) is of equal importance to the specific count of projects and dollars. Our intent has been to develop a replicable format so that future assessments can make comparable measurements.

3) Identify the levels of funding allocated to organic-pertinent research.

Again, the precise dollar amounts are not as important as the orders of magnitude and patterns suggested by funding data. Dramatic increases in funding levels for research that is only marginally useful would not be a worthwhile pursuit. Nevertheless, funding patterns are a useful indicator of policy priorities, however well or poorly the money is spent.

4) Test the research databases for farmer access and usefulness.

One of OFRF's main principles is the importance of direct farmer participation in research design and investigation, especially actual on-farm research. A corollary of this principle is increasing farmer access to information about research, and facilitating farmers' interaction with the research system. To that end, as we pursued our other objectives, we wanted to evaluate the accessibility and utility of the CRIS database from a farmer's point of view.

5) Provide policy recommendations to USDA concerning organic research policies and programs.

This project marks the beginning of OFRF's efforts to engage the policies and performance of the national agricultural research system. In seeking to make policy recommendations to USDA officials (and to others in the future), we recognize that such efforts require a significant educational effort regarding the facts and realities of organic farming, as opposed to the myths and stereotypes.

Implicit in this objective is the assumption that USDA has existing authority to pursue the recommended policies, and we believe that is the case. There is a tremendous amount of progress that can and should be made which does not require new legislative mandates or appropriations.

1.5 Related Policy Issues

It is not possible to engage the issues of organic farming research policy without some attention to wider policy issues shaping the agricultural research landscape. The following topics are some of the important tangents that touch upon our present project. These issues are raised in various parts of this report, and they represent future areas of analysis for OFRF's Policy Program.

Organic farming and "Sustainable Agriculture".

Organic farming plays a complex political and symbolic role in the debates about the meaning of sustainable agriculture, and in the pursuit of "sustainable agriculture research"[8]. For many advocates of "sustainable agriculture", organic farming is perceived as a political liability. Others take it for granted that the two terms are synonymous. We believe that advanced organic farming is the most tangible manifestation of sustainable agriculture, if "sustainability" can be said to exist at all. Our premise is that organic farming principles – as distinct from the minutiae of legal standards for organic labeling – are *necessary, but not sufficient* to achieve something called sustainable agriculture.

Pesticide use/risk reduction goals.

Lack of analysis with respect to the potential role of organic farming is especially pronounced in the pesticide-use-reduction policy arena. This lack of analysis is due partly to intentional avoidance of the "O-Word" and partly to absence of organized information that could affect these programs.

Institutional and professional attitudes towards organic farming.

Analysis of the two policy arenas mentioned above suggests that there are institutional "taboos" against organic farming research and education. These may occasionally take the form of explicit prohibitions, but more typically are expressed as a subtle "cultural" bias which makes it clear to researchers that such work will not advance their career.

Scientific capabilities for organic systems research.

Beyond the political and institutional taboos which may be discouraging pursuit of organic farming research, there are fundamental questions about the ability of the research system in general to undertake meaningful investigations of dynamic, self-regulating systems where the point is precisely not to isolate variables, but to integrate the relationships among as many aspects as possible. Much has been written about the obstacles to "multidisciplinary" and "systems" research, but little progress appears to have been made.[9]

It may be that the traditional models of agricultural research and experimentation are simply inappropriate for investigating and improving organic farming systems. This question in itself should be receiving research attention. Yet there are innovations occurring in research methods, and institutional structures are undergoing rapid change in many areas. Farmer-participation may be an important force in shaping future research approaches. These developments may present opportunities for defining new modes of investigation appropriate to organic systems management.

Recombinant-DNA technologies in agriculture.

It is impossible to discuss the prospects for any realm of agricultural research without confronting the headlong rush towards technologies of genetic modification. At the present time, there is in practice a clear prohibition against the use of recombinant-DNA products or organisms in organic agriculture. This consensus has two main aspects: the legal-labeling aspect of organic foods and the agroecological principles of organic farming. In the first aspect it is argued that r-DNA would violate consumer trust in organic foods, and undermine the definition of "prohibited materials" in organic production standards. The agroecological perspective asserts that beneficial gene expression is an *ecological* phenomenon. The extraction of gene sequences from their environmental context is likely to weaken the percieved benefits, and may well have negative long-term consequences.

The rejection of r-DNA products does not mean that organic agriculture is automatically in conflict with a "high-tech" approach to agricultural improvement, but it does imply evaluating technological advancements in an ecological context. Research applications of these technologies (as opposed to product development) can be very important to an organic research strategy, e.g., for the identification and monitoring of microorganisms in an organically-managed soil.

Organic farming research in other countries.

Organic farming implies evaluating new technologies in an ecological context.

While this issue proved to be beyond the scope of the current study, it is an obvious and important comparison to make for policy purposes. The stakes in this arena are both economic and scientific. The pursuit of organic farming research in other countries, especially the European Community, may provide them with a decisive advantage in fulfilling the growing global demand for organic foods. Perhaps more importantly, the U.S. may be failing to pursue a sound strategy for meeting its environmental, agricultural, and economic goals.

Chapter 1 Notes

[1] Erica Walz, 1995 National Organic Farmers Survey (Santa Cruz, CA: Organic Farming Research Foundation, 1996) 19. 63% of respondents stated that "Uncooperative or uninformed extension agents" were a barrier to beginning organic production. 59% stated that a barrier was "Information unavailable on organic production."

[2] Walz 1-4; 26-38. The *Survey* contains extensive data on growers' research needs. This data is in the form of both structured questions and open-ended responses.

[3] Walz 5-7. 63% of respondents said that they would be interested in formal participation in on-farm research projects. An equal percentage were already conducting on-farm experiments independently.

[4] As discussed in Chapter 2, USDA's single historical effort was the "Study Team on Organic Farming" formed in 1979 and concluded in 1980.

[5] Garth Youngberg, Neil Schaller, and Kathleen Merrigan, "The Sustainable Agriculture Policy Agenda in the United States: Politics and Prospects," Food for the Future: Conditions and Contradictions of Sustainability, ed. Patricia Allen (New York: John Wiley, 1993) 297-299.

[6] By creating an official definition of "organically produced", the forthcoming federal regulations should greatly enhance the ability of researchers to pursue investigations of organic systems. We can also expect that the implementation of this program will further increase the demand for organic products and therefore increase the need for research and development of knowledge about organic systems. However, the promulgation of the regulations should not be seen as the ultimate expression of federal policy with respect to organic farming. It is an understatement to note that the long delays and controversial issues in the rule making process have obscured the research and education issues. Once implemented, the rules for marketing and certification should move into the background as a fixed feature of the landscape, and more effort can thus be devoted to the scientific and socioeconomic aspects of organic production. In part, this study is intended to help shift the focus onto those other aspects. The relationship between the marketplace definition of "Organically Produced" and the scientific characterization of organic production systems is explored in Chapter 3.

[7] We hope and expect to provoke challenge and debate over the rating of specific projects, as well as overall patterns. In fact, we will be disappointed if we don't provoke some investigators to stand up and say, "You didn't find my organic research project!" or, "Why didn't you count my research as organic?"

[8] Youngberg 297-301.

[9] M.D. Anderson, "The Life Cycle of Alternative Agricultural Research," American Journal of Alternative Agriculture 10 (1995) : 4-5.

Chapter 2 A Brief History of Organic Research Policy

2.1 Pre-1980

In the late 1940s and 1950s, JI Rodale spoke about the "invisible pioneers" of organic farming, ignored by agribusiness, academia, and government agencies. He tirelessly advocated the proposition that the biological life of the soil was crucial to agricultural productivity, and that this biological complex could be managed with recycled natural materials for robust health and resilience, or conversely degraded by the use of salt fertilizers and chemical pesticides.

Rodale's views were summarily dismissed by university and government research institutions. In an era of (seemingly) fantastic technological progress and spectacular increases in short-term crop yields at low cost, criticism of synthetic fertilizers and pesticides was almost universally seen as anachronistic and anti-technology. Despite the large audience for Rodale's "Organic Gardening" magazine, his ideas were presumed to be irrelevant to commercial-scale agriculture.

During the post-war period, almost no effort was made by public research institutions to scientifically assess either the actual performance of established organic farms, or the underlying processes of microbial ecology which Rodale and others described as the basis for successful organic systems. Where such research did take place, it was little noticed. The overwhelming economic succcess of petrochemical farm supply industries and their alliance with university agriculture departments effectively shut out serious consideration of organic research paths.

Beginning with Rachel Carson's *Silent Spring* in 1963 and continuing through the 1960s and 1970s, increasing recognition of the negative impacts of chemical-intensive agriculture was lending credence to Rodale's critiques. The oil-price energy crisis of the early 1970s gave further impetus to the search for an "alternative" agriculture which was more energy efficient and not dependent on petrochemicals.

Rodale and his son Robert persisted and built a following of dedicated farmers and gardeners. Growers such as Betty and Paul Keene at Walnut Acres in Pennsylvania established large-scale farms using organic methods, demonstrating the long-term viability of these approaches. Meanwhile, the emergence of "natural foods" stores and food co-ops assisted the development of a consumer market for organically-grown foods. As questionable "organic" claims began to appear in the marketplace, Rodale launched a program in the early 1970s to create standards and verify organic practices, which led to the foundation of various grower-based certification groups around the country.[1]

Throughout this period, official USDA policy made no recognition of organic farming, except for the occasional negative dismissal. Earl Butz, the Secretary of Agriculture under Richard Nixon, was known to sum up the official government position in his early 1970s public speeches by saying, "When you hear the word organic, think starvation.[2]"

2.2 The USDA Organic Study Team - 1980

By the late 1970s several factors combined to allow a brief thaw in the institutional denial of organic farming. Most important was probably the continued growth of concern about the negative environmental consequences of chemical agriculture. The institutionalization of environmental regulation which occurred during the 1970s focused intently on the evaluation and regulation of pesticides through the enactment of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) and the creation of the Environmental Protection Agency. Despite the unquestioned assumption built into this process that agriculture required highly toxic materials, it was at least plausible that some attention might be given to alternative agricultural approaches that did not require highly regulated poisons. Prompting such attention was the persistence of successful organic farms and the continued vocal advocacy for non-chemical methods by the Rodales, Robert Van Den Bosch, Everett Dietrich and others. The longevity and demonstrated viability of the post-war organic pioneers, combined with the general societal concern about toxic pollution persuaded a number of farmers to consider reducing their chemical use and experiment with organic methods.

The perception of a groundswell of interest in organic approaches helped to prompt the first serious investigation of organic farms by USDA.[3] In 1979 the USDA Director of Science and Education, Dr. A. R. Bertrand, directed the formation of a Study Team to undertake a "comprehensive study of organic farming in the United States." This effort was justified as part of a broad effort by USDA to "assess possible consequences of certain trends in the structure of our agricultural production and marketing system."[4]

The Introduction to the Study Team's *Report and Recommendations on Organic Farming* recognized the historic perception that, "this method of farming is associated with a low level of productivity and is essentially unadaptable to widespread use in the United States."[5] The formation of the Study Team implied a strong suspicion that these earlier assessments of organic productivity might not be valid. Some basic information was lacking. For starters, the *Report* stated, the costs and benefits of organic farming were not known. Neither were the trade-offs known among energy and labor costs and efficiencies.

The Study Team further wished to know, **"Under what specific circumstances and conditions can organic farming systems produce a significant portion of our food and fiber needs?"[6]** Answering this succinct and profoundly important question was beyond the immediate scope of the Study Team, but they recommended a substantial research agenda toward this end. This question identified the critical policy issue at stake, and it still remains unexamined in 1997.

> In 1980, the USDA Study Team recognized that the costs and benefits of organic farming were not known.

The USDA team did indeed conduct an extensive assessment of organic farming in the U.S. Data was collected through a survey of subscribers to Rodale's *New Farm* magazine, and through direct examinations of 69 farms in 23 states. It surveyed the geographical and numerical scope of organic farms, including the demographic and socioeconomic character of organic farmers. In direct observation of 69 farms around the country they summarized and classified the basic agricultural practices employed. The study further included an extensive review of literature from the

U.S. and other countries, visits to organic farms and research sites in Europe and Japan, interviews with organic farming researchers and advocates, and a survey of State Cooperative Extension Directors. They analyzed markets, nutrient budgets, soil qualities, pollution effects, crop rotations, fertility inputs, pest controls, economic performance, labor and energy budgets, water use, and public policy interactions. The Study Team discussed factors contributing to successful organic farms, incentives, benefits, limiting factors and barriers. Most of these studies were preliminary efforts, meant to frame questions and research objectives more than to find definitive "answers". Despite the *Report's* tentative language, the work still remains the most comprehensive governmental analysis of organic agriculture in the U.S.

In the interest of making its assessment truly inclusive, the USDA team defined organic farming quite broadly. In its analyses and case studies, it included a number of growers that we would characterize today as "transitional" or "IPM", as they practiced "a combination of organic and conventional methods."[7] It is notable that the *Report* estimated that there were over 20,000 organic farmers in the U.S. in the late 1970s. This number is much higher than current estimates of commercial organic farmers (5,000 known certified, and estimates up to 12,000 total in commercial production). While there may indeed have been a surge of interest during the 1970s that subsequently diminished, it is likely that the broad definition used by the Study Team included many operators that would not be considered organic today. While not limiting its analysis in terms of formal and legalistic definitions based on the origin of farm inputs, the *Report* faithfully described the ecological basis of organic practices. Its investigations were grounded in the authentic historical identity of organic farming, and in the practical applications of organic philosophies by working farmers.

The *Report's* Summary listed 12 major findings, including the following highlights:

> (Finding #2) Organic farming operations are not limited by scale…In most cases the team members found that these farms, both large and small, were productive, efficient, and well managed.
>
> (Finding #4) Contrary to popular belief, most organic farmers have not regressed to agriculture as it was practiced in the 1930's…[They] use modern farm machinery, modern crop varieties, certified seed, sound methods of organic waste management, and recommended soil and water conservation practices.
>
> (Finding #8) Some organic farmers expressed the feeling that they have been neglected by the U.S. Department of Agriculture and the land-grant universities. *They believe that both Extension agents and researchers, for the most part, have little interest in organic methods and that they have no one to turn to for help on technical problems* (emphasis added).[8]

The Study Team ended its Summary by saying that,

> Many of the current methods of soil and crop management practiced by organic farmers are also those which have been cited as the best management practices for controlling soil erosion, minimizing water pollution and conserving energy…Moreover, many organic farmers have developed unique and innovative methods of organic recycling and pest control in the crop production sequences…*[T]he team feels strongly that research and education programs should be developed to address the needs and problems of organic farmers. Certainly, much can be learned from a holistic research effort to investigate the*

The 1980 *Report* remains the most comprehensive governmental analysis of organic agriculture.

organic system of farming, its mechanisms, interactions, principles, and potential benefits to agriculture both at home and abroad (emphasis added).[9]

The Study Team also compiled an extensive research agenda. They submitted 18 recommendations for research and education, "to address the needs and problems of organic farmers and to enhance the success of conventional farmers who may want to shift toward organic farming, adopt organic methods, or reduce their dependence upon agricultural chemicals." In addition, they reiterated 8 recommendations from a 1978 USDA study on "Improving Soils With Organic Wastes."

For the most part, these recommendations have been unheeded. Some of the *Report's* recommendations have been partially assimilated into the agendas and programs associated with "sustainable agriculture" and "Integrated Pest Management" since the late 1980s, but almost never within an explicitly organic context. The #1 recommendation of the USDA Study Team on Organic Farming remains urgently relevant 17 years later:

> Recommendation #1. Investigate organic farming systems using a holistic approach. The USDA case studies revealed that many organic farmers have developed unique and productive systems of farming…It is also likely that these systems are highly complex and involve unknown or poorly understood chemical and microbiological interactions. Much of the research conducted to date that relates to organic farming has been somewhat piecemeal and fragmentary. A holistic research approach, which may involve the development of new methodologies, is needed to thoroughly investigate these interactions…[10]

This statement captures a crucial point about organic farming research: there is a vast and diverse pool of knowledge inherently available on working organic farms. Furthermore, the premises of this knowledge are different from those of the conventional disciplinary approaches of agricultural science. The investigation of biologically intensive systems that perform successfully without the use of toxic controls and manufactured salt fertilizers must be conducted in and on those very systems.

Among the additional recommendations were other compelling concerns that are specific to the improvement and optimization of organic farming systems, and still very current:

> Determine the factors responsible for decreased crop yield during the transition from conventional to organic farming systems…Research is needed to determine the underlying causes of [short-term] yield reduction and to suggest ways that farmers could make this transition without suffering severe economic loss.
>
> Develop through breeding programs crop varieties that are adaptable to organic farming systems…[for example,] that are more efficient in extracting nutrients from the soil and from sources of limited solubility…

The recommendations for educational and Extension programs were logical and straightforward:

> Develop information materials for county Extension agents to assist them in providing services needed by organic farmers…explain the nature of organic farming practices to the general public…Extension personnel should have ready access to the latest information on crop rotations, green manures, [etc.]
>
> Foster the development of direct marketing of organically produced foods…assist organic producer associations in developing criteria for certifica-

The *Report* was disowned by USDA's leadership and the term "organic farming" officially became taboo.

tion standards…

Finally, the Study Team made a bold and far-reaching "Recommendation on Organization and Policy Matters":

> USDA should establish a permanent organic resources coordinator and multi-disciplinary advisory committee on organic agriculture. Because of the great interest in organic agriculture that has been expressed by both rural and urban communities throughout this study, *it is of utmost importance that USDA develop research and education programs and policy to assist farmers who desire to practice organic methods. At the same time, it is important that USDA continue to learn about all aspects of organic agriculture…*(italics added).

The study team clearly expected their work to be the beginning of a much more extensive effort, perhaps even a sea-change for the department and agriculture as a whole. In fact, for all practical purposes the *Report* was the pinnacle of USDA's interest in organic farming practices. It was met with "notable displeasure and opposition" by the established industrial and scientific leadership in agriculture.[11] With the election of Ronald Reagan as President and the appointment of John Block as Secretary of Agriculture, the Report was disowned by USDA's new leadership and the term "organic farming" officially became taboo (again).

2.3 The Organic Taboo and the Rise of "Sustainable Agriculture"

The leader of the 1980 USDA Organic Study Team, Dr. Garth Youngberg, wrote in 1993 that the organic agricultural community, "had hoped that the [Study Team's] report would finally and firmly establish the credibility and official acceptance of the role and importance of organic farming to all of agriculture." The opposite reaction occurred and organic farming became a forbidden subject for researchers and others in agricultural institutions. Youngberg, et al go on to say that

> The proponents of low-chemical production techniques had seriously underestimated the negative symbolism of organic farming, which had long since been dismissed by conventional agriculture as little more than a primitive, backward, nonproductive, unscientific technology suitable only for the nostalgic and disaffected back-to-the-landers of the 1970s.[12]

In retrospect, the Study Team may have underestimated some other things as well. They probably inflamed their critics' prejudices by framing their analysis in terms of an "ideology" of environmental responsibility and by calling for "holistic" research and education. Beyond these loaded terms, their recommendations contained two heretical notions. First, that there was a significant and growing constituency which USDA was essentially ignoring. Second, that USDA should be deliberately learning from farmers about systems and practices which were not the product of the scientific research system.

As a result of the negative reactions, advocates of reform in agriculture consciously began to avoid the term "organic" and began to substitute other terms such as "regenerative", "biological", "innovative" and the eventual winner: "sustainable agriculture".

> Advocates of reform began to avoid the term

As Youngberg et al point out, "sustainability" has a mom-and-apple-pie connotation that makes it hard to challenge. On the other hand, it is also a "refuge for an incredibly disparate array of agricultural interests." In making the idea of alternative farming methods less threatening, "sustainable agriculture" has become the focus of a seemingly interminable debate about its meaning. It has become increasingly difficult to be sure that it really means anything specific at all.

By accepting a watered-down definition, proponents of sustainable agriculture, without realizing it, have also endorsed the companion view that sustainability can be achieved by fine-tuning conventional agriculture…Thus the case for organic farming has been virtually reduced to that of serving niche markets for chemical-free products. In this sense, regrettably, the potential role of organic systems in achieving overall sustainability in U.S. and world agriculture could be overlooked.[13]

One could add that the organic farming movement has also been left without the scientific support which it needs to develop its potential beyond current practices.

The purely political requirement to define sustainable agriculture as something *like* organic farming and *perhaps incidentally including* organic farming, but *not really meaning* organic farming, has produced some interesting contortions. ***The tacit acceptance of the taboo on the "o-word" by critics of conventional agriculture has allowed for the dilution of "sustainable agriculture" and required the denial or redefinition of farmers and farming systems that are at the root of what was meant by "sustainable agriculture" in the first place.***

2.4 The Organic Taboo: Effects and Examples

In a very comprehensive analysis entitled *Agricultural Research Alternatives*, Molly N. Anderson and William Lockeretz commented in 1993 that, despite its "unscientific and countercultural image" and "agricultural experts' belief that it could not be economically competitive" organic farming was beginning to receive, "serious attention, largely because some farmers have been using it, apparently with reasonable success."[14] While this qualified optimism may be true as far as it goes, very substantial obstacles appear to remain. The organic taboo persists in several forms. The following sections briefly explore some of the main examples.

2.4.1 The SARE/LISA Program

The decade-long effort to institutionalize an alternative agriculture research program within USDA is the most obvious example of "O-word" avoidance. This effort began with the "Organic Farming Act of 1982" proposed by Rep. Jim Weaver of Oregon. It would have established a special program of research funding for pursuing the recommendations of USDA's Study Team. A similar bill, titled less provocatively as the "Innovative Farming Act of 1982", was introduced that same year in the Senate by Patrick Leahy of Vermont. When Leahy's bill also failed, "more and more supporters of organic farming came to believe that only by embracing a more palatable term could they hope to win significant policy support for the organic alternative to conventional farming."[15] These defeats also made it clear that no matter what the term, alternative approaches were not likely to be embraced without a serious fight against mainstream agricultural interests.

In subsequent legislative sessions the word "organic" disappeared from bills supporting alternative agricultural research. A "low-input" agriculture research program was first authorized in the 1985 Farm Bill (The Agricultural Productivity Act) and implemented in 1988 as the "Low-Input Sustainable Agriculture Program" (LISA). LISA established a competitive grants program to fund research and education on reduced-chemical practices. In the 1990 Farm Bill "sustainability" became a major focus (and battleground). LISA was expanded to encompass "Best Utilization of

Biological Applications" (BUBA) and ultimately these two acronyms were reconfigured as "Sustainable Agriculture Research and Education" (SARE).

Notably, the 1990 Farm Bill also included the Organic Foods Production Act (OFPA), which established labeling standards and a national regulatory program for the organic products marketplace. The earliest version of the OFPA introduced that year by Senator Leahy contained a section authorizing a research program specifically focused on organic production methods. The research portion of the bill received immediate and vehement opposition from farm commodity groups. The message was circulated that the bill would be "Dead On Arrival" if it contained authorization for organic research. The author reluctantly removed the research provision and settled for an organic labeling standard only. Even with this separation, the OFPA was the focus of a bitter floor fight in the House of Representatives.

Meanwhile "sustainable agriculture" advocates were focused on the LISA/SARE program authorization. The opposition to the organic research provisions only reinforced the perception that "organic" was not a politically viable vehicle for advancing alternative agriculture research, and that any reference to it would be suicidal. The legislative language and administrative guidelines for the SARE and LISA programs meticulously and totally avoided the words "organic farming".[16]

While there has been some support for organic farming research projects by SARE (and LISA before it) there is still no specific analysis which relates research on organic management to the overall goals of these programs. With a few notable exceptions, organic status has been treated largely as an incidental feature of SARE projects, a 'lifestyle' choice giving flavor to the qualities of "sustainability" but not really essential to the nature and performance of the system or its "sustainable" components.

The general discounting of organic systems research does appear to be changing gradually, at least within some of the regional Administrative Councils which govern SARE, and perhaps also at the National Program level. The "organic content" of the SARE program is part of our analysis and discussion in later chapters.

2.4.2 Researchers' Attitudes About the O-Word; Costs of Breaking the Taboo

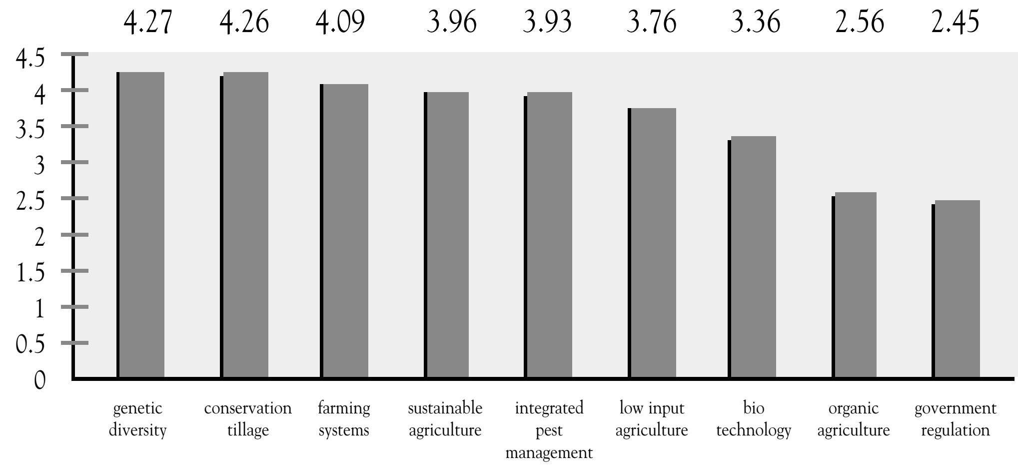
Another important result of the taboo against organic farming research is the attitude of research professionals. While there is little open discussion or analysis of this issue – it is plausible that the taboo itself prevents such discussion – we have glimpsed a few telling indicators of the conditioning against organic research which permeates the ranks of research scientists.

Amidst the continuing squabbles about the meaning of "sustainable agriculture", a study conducted in the early 1990s compared agricultural researchers' responses to various terms current in policy deliberations[17]. 584 Principal Investigators found on the CRIS system responded to a survey questionnaire in which they ranked nine terms or phrases on a scale of 1 (unfavorable) to 5 (favorable). "Organic farming" was the second least favorable term, just barely more acceptable than the truly evil "government regulation". The complete list of terms and their mean rankings are displayed in Table 1.

The survey results included open-ended narrative comments from the investigators. The authors note the high degree of, "hostility and cynicism that comprises the response to the term

Table 1

Mean response of agricultural scientists to selected terms.



Rating of terms by agricultural scientists (*n*=584). 1=least favorable, 5=most favorable.
From Harp and Sachs (1992)

organic."[18] The responses quoted in the study are non-scientific, defensive reactions based essentially on ideology and stereotype: 'organic means attacking the safety of our food supply'; 'there is nothing really different about organic farming'; 'organic farmers are capitalists too'. All of these "arguments" are standard stock in the construction and perpetuation of the organic taboo.

As the authors of the study point out, "the issues of funding and control over the research agenda is intertwined in this battle of words." In other words, the substantive perception and favorability of topics or concepts is partly (if not mostly) determined by the understanding of the terms as political "buzz words". At the time the survey was conducted (around 1990), the avoidance of "organic farming" was a fixed feature of the political landscape. "Low-Input" was institutionalized in the LISA program, but already giving way to "Sustainable Agriculture" as the dominant buzzword in agricultural policy debates.

The authors' analysis of their results focused on the dynamics of "appropriation". That is, the process by which dominant institutions absorb or co-opt their critics' terms and rhetoric, but not necessarily the substance of the critique. The authors note that,

> The negative reaction to organic agriculture indicates that the term "organic" has definitely not been appropriated by the dominant institutions. The failure to embrace the term organic is particularly noteworthy at a time when consumers have become increasingly familiar with the term and are demanding food grown organically and certified…The work of grass roots organizations and organic farmers in defining, defending and developing organic farming systems gives organic farming a material reality that is difficult to appropriate on a purely symbolic level.[19]

This analysis is consistent with that of Youngberg, *et al* discussed above: in the struggle for control over control over research agendas, the diffuse, all-encompassing nature of "sustainable agriculture" and its political acceptance by researchers and their institutions has allowed them to deflect substantive critique and avoid reorientation of research activities. The study by Harp and Sachs begs the question of whether researchers are the source of this resistance, willing accomplices, or victims without any real power to influence the official stance. It is probably a complex combination of all these situations for specific researchers, in specific settings and stages in their careers. Remedying the opposition will thus require a combination of education, changes in official policy, and active support for specific researchers willing to engage an organic research agenda.

The negative consequences of challenging the organic taboo have been real for scientists but are rarely glimpsed publicly. A discussion of this particular subject appeared in June of 1996 in the electronic message forum known as SANET (the Sustainable Agriculture Network).[20] A discussion thread (a chain of related electronic messages) entitled "Attacks on Organic Researchers" was prompted by the vigorous defamation of scientists who had just published a book about the effects of industrial pollutants on endocrine functions in wildlife and humans. The SANET exchange revealed a mixed set of experiences, with some participants suggesting that they had managed to achieve (limited) positive recognition for work on organic farming, while others encountered very serious opposition.

At best, the SANET discussion indicated that those in public university settings had, "nudged and pushed around the edges," ultimately seeing a small but noticeable cumulative effect within their institutions over the span of a decade or more.[21] At worst, the resistance to organic research activity was implacable:

> The more reprehensible and sinister response [in some institutions] is not simply public vilification (in the popular press, as well as verbally in public meetings) but behind the scenes efforts to ensure that said individual(s) never again see public funding…This has the effect of scaring off anyone who might have contemplated, in a weak moment, submitting some kind of proposal with a bearing on organic farming. In one event of fairly recent vintage, a colleague had the temerity to publish a report concluding that organic farmers made more money than conventional farmers. Not only was he subjected to the most explicit and humiliating ridicule from well placed sources, but there was even a call (by some sources) to sue him to return the public funding spent on the project…Needless to say, that was pretty well the last time public money was spent in support of meaningful organic farming research.[22]

In another study, the experiences of several pioneering organic farming research advocates were explored in the context of "The Moral Factor in Innovative Research". The author of this study recounted the "clear and acute" personal costs incurred by these innovators and the process by which they were labeled as "professionally deficient".[23] These "examples" and those described in the SANET discussion illustrate the powerful constraints operating on researchers, and the necessity of making public institutions "safe" for organic farming research.

2.4.3 Organic by Every Other Name: EBPM & BIPM

Despite the prohibition against using the "O-Word", the continuing commercial growth and agronomic success of organic farmers cannot be completely denied. Because of this, the inability of institutions to absorb or "appropriate" organic farming as described above has led to some interesting distortions. One recurring result is the "reinvention" of organic farming theory under different names, and proposing "novel" research programs as if there were not already thousands of farmers successfully practicing such methods.

The most stunning example of this process is a recent publication by the National Research Council's Board on Agriculture entitled, "Ecologically Based Pest Management (EBPM): Solutions for a New Century"[24]. This treatise very effectively summarizes the failures and negative impacts of conventional chemical management, the digression of "Integrated Pest Management" from its original ecological basis, the poor state of biological knowledge about soils, and the obvious benefits of seeking new ecological understanding of farming systems. In short, a perfect rationale for an organic farming research agenda. Yet, the words "organic farming" never appear in this book's 115 pages of text. There is literally no acknowledgment of the thousands of farmers, hundreds of thousands of acres or the billions of dollars in sales of organically grown foods. There is no reference to the literature on agroecology. It is as if this information does not exist or is not valid, because the National Research Council has not "discovered" it.

In fact, the NRC's EPBM piece is designed to justify massive research expenditures on the development of packaged biopesticides. Despite the lip service given to the idea of ecosystem knowledge and management practices based on that knowledge, the real agenda of "EBPM" appears to be replacing the chemical pesticide treadmill with another treadmill which runs on manufactured biological inputs and recombinant-DNA cultivars and livestock breeds.

A much more honest, but still somewhat disappointing example of the continuing effect of the organic taboo is seen in the recent book on "Biointensive Integrated Pest Management" (BIPM) by Dr. Charles Benbrook and Consumers Union[25]. This work effectively provides a framework for evaluating and ranking "IPM" practices. At the most advanced end of Benbrook's scale is "biointensive" IPM, characterized by the deliberate cultivation and maintenance of natural biological resources to control pest populations. Many examples of BIPM cited by Benbrook are organic farmers. Yet, their organic status is barely acknowledged and there is no analysis of the relationship or correlation between certified organic status and the success of BIPM methods.

2.5 Current Policy Initiatives: The USDA Sustainable Agriculture Working Group & USDA's Strategic Plans

Two recent initiatives within the USDA deserve particular mention as indicators of the state of the "O-Word" in research policy in early 1997: the USDA Interagency Sustainable Agriculture Working Group (USDA-SAWG), and the Strategic Plan of the Research, Education and Economics (REE) Mission Area.

During 1995 USDA convened an inter-agency study group to investigate the state of "sustainable agriculture" within the department and to, "identify barriers to and opportunities for improving the USDA's policies and programs to support greater agricultural sustainability." Its report was issued in August of 1996[26].

In its Introduction the report mentions that organic sales have been rising at an estimated annual rate of 20%, but only as an example of greater diversity in consumers' buying behavior. In its findings and recommendations, the Working Group made only one specific mention of organic farming, and that was under the heading of "Economic and Marketing Issues". Immediate action was recommended to "Accelerate implementation of the National Organic Standards Program," at that time three years overdue (and still not yet published in mid-1997).

No mention was made in the section on "Research Issues" of organic farming systems as a resource for sustainable agriculture information, nor as a focus for research efforts to maximize sustainable practices. Other than its mention as a "marketing choice" by consumers, the report offered no analysis of the relationship between organic systems and "sustainable agriculture"[27].

Yet the Working Group's report supports several recommendations that could lead to far-reaching changes in research practice and administration. Noting that, "new approaches are needed to bring about research that successfully transcends disciplines" and that, "these new approaches may require institutional innovation," the USDA/SAWG report calls for "new types of institutes or centers that allow interdisciplinary research and development with a focus on problem- solving" as well as short-term changes to encourage more interdisciplinary systems projects[28]. Furthermore, the report supports much more active integration of producers as partners in all aspects of the research process, from setting priorities to conducting and evaluating research projects. The implementation of these recommendations would provide a much more conducive environment for organic farming research. Such changes would also directly beg the question, "why aren't we using organic farms as a resource for research and development of 'interdisciplinary, sustainable systems' ?"

Also during 1995 and 1996, USDA developed a series of Draft Strategic Plans, in accordance with the requirements of the Government Performance and Results Act (GPRA). There is an overall plan for the entire REE mission area, as well as subsidiary plans for each of its constituent agencies, including the Cooperative State Research Education and Extension Service (CSREES), the Agricultural Research Service (ARS), and the Economic Research Service (ERS)[29].

The GPRA exercise marks the first time that USDA has ever developed agency-wide mission statements as such. Not surprisingly, the Draft Strategic Plans have a distinctly "status quo" flavor to them. They emphasize the more efficient delivery of existing "products", and make more explicit the primacy of global trade considerations.

Needless to say, there are no references to organic farming in any of the plans. However, like the USDA SAWG report, there are elements of the plans that organic farming could contribute substantially to, if the taboo against acknowledging the organic sector is lifted. There is a Strategic Objective to, "Promote sustainable agricultural systems by enabling producers to use cost-effective, environmentally friendly production practices and systems."[30] Another Strategic Objective would virtually demand systematic observation and analysis of organic farms: "Ensure that policy makers and program managers have timely, objective data and analysis on the efficacy, efficiency, and equity aspects of alternative agricultural, resource, and environmental programs."

Whether or not any specific initiatives will be taken to provide timely and objective data to policy makers about the potential contributions of organic farming remains to be seen. Despite the logic of pursuing such efforts, the history of research policy and the persistence of the organic taboo are not encouraging. Both of these USDA policy developments illustrate the compelling possibilities for organic farming in meeting current policy goals, as well as the deliberate blind spot which prevents official recognition of this potential.

2.6 Organic Research Assessments Since 1980

The final note in the historical background of our study is the consideration of precedents for similar assessments of organic research. Despite the official rejection of the Organic Farming Study Team's *Report* in 1980 , continuing scientific interest in organic farming research produced one important follow-up. F.W. Schaller and H.E. Thompson, emeritus professors at the Iowa State University Agricultural Experiment Station undertook an analysis of the USDA Current Research Information System (CRIS) database to identify research projects "relevant to organic farming"[31].

The Iowa team reviewed 6,413 "farming systems research" projects with FY1982 funding. Using the full complexity of CRIS' classification scheme, the projects were allocated to 142 "research topic" categories. Within each category, projects were rated as having "no relevance", "neutral relevance", or "special relevance" to organic farming.

The criteria used by the Iowa State investigators to determine "special organic relevance" were broader than those used in our current study, but they were not unreasonable at the time. (Unfortunately, the publication of their results did not include any examples of actual project descriptions, just tallies of projects under their topic headings.) In general they seem to have been faithful to the basic parameters of "organic farming" as defined by the USDA Study Team *Report*, but these boundaries were drawn very inclusively for the purposes of a broad national survey. For example, projects concerned with sewage sludge were considered to be "specially relevant" to organic farming, but sludges are clearly prohibited in organic production today. More importantly, the study did not consider the research setting or context of the project. The investigation of an "organic" method, (e.g. crop rotation, or green manure) was considered to have "special organic relevance" even if studied in an otherwise conventional, chemical intensive setting. This is a crucial distinction from the premises of our study.

The results of the Iowa study are therefore not directly comparable with our present work. By our current standards, the effort was not really an assessment of organic research per se, but could be characterized appropriately as an early assessment of "sustainable" agriculture research in the sense of that term's original, less universal connotations. Viewed in that light, the study perhaps foreshadowed the later appropriation of "sustainable agriculture" to the point where almost anything could be justified under its canopy.

The Iowa study found 403 projects with "special organic relevance", representing 6.3% of the projects reviewed. Federal funding for these projects totaled $13.5 million, which was 5.3% of total federal funding for all 6,413 projects reviewed. Most notable, however was the "neutral relevancy class": 5,586 projects, fully 87% of the total reviewed, were classified as "neutral with respect to organic or conventional systems"[32]. It was this vast pool of "neutral" research dollars and scientist-years that set the precedent for USDA's claims in the late 1980s that the large majority of federally funded agricultural research was relevant to "sustainability".

Despite the failure to identify research that actually took place in an organic setting, the 1984 study is notable for its sincere willingness to address the question of organic research at all. The status of the authors as professors emeritus perhaps insulated them from the pressures of career considerations. The authors noted "growing interest" within the scientific community with "organic or alternative farming systems", as well as the expressed needs of farmers seeking more information about organic methods.

The authors' hopes that their study would be useful in planning future research proved to be in vain. The ostracization of organic farming from national research policy was already fully entrenched in Congress and USDA, and no positive use was made of the study's results. In asking and attempting to answer, "What organic farming research is being supported by federal agricultural programs?" the authors were speaking to an almost empty room. Since their effort in the early 1980s, nobody else has repeated the question, until now.

Recent USDA developments illustrate the compelling possibilities for organic farming... as well as the deliberate blind spot which prevents official recognition of this potential.

Chapter 2 Notes

[1] Ken Mergentime, "Organic Industry Roots Run Deep," Organic Times 1994:4-6. This piece is an excellent historical summary of the early organic farming movement.

[2] Robert Scowcroft, personal communication, December 15, 1996.

[3] USDA Study Team on Organic Farming, Report and Recommendations on Organic Farming (Washington DC: United States Department of Agriculture, 1980) 2. The *Report* cites, "The growing interest in organic agriculture".

[4] USDA Study Team 2.

[5] USDA Study Team 2.

[6] USDA Study Team 2.

[7] USDA Study Team 6-9.

[8] USDA Study Team xii-xiii.

[9] USDA Study Team xiv.

[10] USDA Study Team 88.

[11] Youngberg, Schaller, and Merrigan 297.

[12] Youngberg, Schaller, and Merrigan 298.

[13] Youngberg, Schaller, and Merrigan 310.

[14] William Lockeretz and Molly D. Anderson, Agricultural Research Alternatives (Lincoln, NE: University of Nebraska Press, 1993) 57.

[15] Status Report on Pesticides (Washington DC: Friends of the Earth, 1982).

[16] United States Department of Agriculture - Cooperative State Research Service, National Guidelines for Best Utilization of Biological Applications (Washington DC: USDA, 1992).

[17] Aaron Harp and Carolyn Sachs, "Public Agricultural Researchers: Reactions to Organic, Low Input and Sustainable Agriculture," Agriculture and Human Values, 9.4 (1992).

[18] Harp and Sachs 63.

[19] Harp and Sachs 63.

[20] The address of the SANET electronic mail group is sanet=mg@amani.ces.ncsu.edu.

[21] Raymond Weil, online posting, SANET mail group, June 21, 1996.

[22] E. Ann Clark, online posting, SANET mail group, June 21, 1996.

[23] Stan Dundon, "The Moral Factor in Innovative Research", The Agricultural Scientific Enterprise, A System in Transition, eds. Lawrence Busch and William B, Lacy (Boulder CO : Westview Press, 1986) 42-49.

[24] National Research Council, Board on Agriculture, Ecologically Based Pest Management: Solutions For a New Century (Washington DC: National Academy Press, 1996).

[25] Charles M. Benbrook, Pest Management at the Crossroads (Yonkers NY: Consumers Union, 1996).

[26] USDA Interagency Sustainable Agriculture Working Group, Toward a More Sustainable American Agriculture (Washington DC : 1996).

[27] The avoidance of the "O-Word" was further underlined by the presence of several certified organic farmers on a "Producer Panel" at one of the Working Group's meetings, but the growers were not even identified as such.

[28] USDA Interagency Sustainable Agriculture Working Group 10-11.

[29] The plans are all available on the Internet. The main USDA site is at http://www.usda.gov and the various agency sites are available from there.

[30] United States Department of Agriculture, Draft Strategic Plan for the Research, Education and Economics Mission Area (Washington DC: USDA, September 1996) 17.

[31] F.W. Schaller, H.E. Thompson, and C.M. Smith, Conventional and Organic-Related Farming Systems Research: An Assessment of USDA and State Research Projects (Ames IA: Iowa State University, 1984).

[32] Schaller, Thompson, and Smith 11-13.

Chapter 3 Methodology

This Chapter describes the process of "searching for the 'O-word' " in USDA's Current Research Information System (CRIS) database, including: the premises and definitions leading to our rating protocol, the keyword strategy for narrowing our search, the application of the rating protocol, and the format of our additional data collection. In addition, this Chapter describes the separate review and evaluation of market development projects funded by USDA's Federal-State Market Improvement Program (FSMIP).

3.1 Why "Organic-*Pertinence*"?

Organic-pertinence is the term we chose to describe the main object of our evaluation process, and it refers to research that is directly based on the assumptions of organic management, or takes place in an organic setting. Our definition of "organic" is stated in detail below.
The term p*ertinence* was particularly chosen as a departure from the term *relevance*. In the past, *relevance* has been used as the object of research assessments, as in the 1984 Iowa State study of organic research[1] and Dr. George W. Bird's extensive studies of sustainable agriculture research[2]. In our view, relevance is a less stringent test than pertinence. From an organic farmer's perspective, almost anything that is not specifically focused on synthetic chemicals might be *relevant*, i.e., might contain some potentially useful information. However, for research to *pertain* to organic farming would imply an explicitly organic context, and therefore a much bigger potential payoff in knowledge and much more certainty about cost-effective application on organic farms.

The concerns for specific applicability and closely targeted scientific "payoffs" reflect a key assumption of our effort: that ***organic farming knowledge is still relatively underdeveloped***. While organic practitioners have developed successful management systems, we are far from optimizing their performance. We still employ a number of "crutches" (albeit natural ones) that represent imperfect ability to manage organic system dynamics, and rudimentary tools adapted from conventional agriculture. In terms of understanding underlying processes (e.g., humus formation and functions, suppression of diseases by soil microbial ecologies, biological transformations of nitrogen for use by crops) and the practical refinement of organic farming systems (e.g., non-chemical weed management, cost-effective compost production), organic farmers find a severe lack of detailed scientific support. Therefore the goal of our search was research that directly addresses the need for information focused on organic systems.

3.2 Defining "Organic": "small-'o' " and "Capital-'O' "

Organic farming has a dual personality. The small-o definition of organic is prescriptive in nature and provides the agronomic identity of organic farming. The capital-O definition of Organic is essentially prohibitive, constituting the legal standard for production labeled as "Organically

Produced". Both definitions have roots in the philosophy and ethics of farming in cooperation with nature, but represent different aspects of how that ideal meets reality.

The small-o identity, first fully articulated by J.I. Rodale and others in the 1940s, prescribes maintaining high levels of soil organic matter, reliance on ecological processes for pest and disease management, closure of energy and material flows within the production operation, and reduction of external inputs (of all types). It is fundamentally systemic in approach, emphasizing the balance of *relationships* among various aspects of the system. This definition of organic farming implies long-term management, rotation of crops and/or livestock, and the encouragement of biological diversity. The most advanced developments of organic theory and practice have been described as an *agroecological* approach by Altieri and others.[3]

The legalistic, capital-O identity dates from the early 1970s and the appearance of commercial markets for "Organically Grown" foods. While including some of the prescriptive aspects from the small-o definition (e.g., crop rotations), the various state and private versions of the capital-O definition emphasize the prohibited application of "synthetically compounded materials" to cropland for specific amounts of time, before a product can bear an Organic label.[4] As of this writing, the federal government's regulatory definition of "organically produced" for marketing purposes has not yet been issued. [5] In lieu of the impending federal standards, we used the Final Recommendations of the National Organic Standards Board, which are the basis for USDA's rulemaking process.[6]

In qualifying research projects as organic for our study, *both* definitions were applied, i.e., projects had to meet a dual test of "organicness". The following section explains the application of the two definitions.

3.3 Defining Organic *Research*

A fundamental premise of our effort to identify organic farming research is that successful, fully developed organic systems behave differently from other farming systems. They require a different set of management principles and assumptions, and they require a specific investigative context to research them effectively. They behave differently in terms of nutrient cycles, disease suppression and pest resistance. This premise is derived from the collective experience of many organic farmers, as well as the few scientific investigations of bona fide, long-term organic farms at the whole-farm level.[7] Therefore the application of the agronomic, small-o organic definition required that the experimental context also be organic.

In the case of applied (practical, farm-level) research, this means ideally that the investigation is conducted in an expressly organic setting where fields (test plots) have received active organic management over time. At least, the project must take place in an arguably "non-chemical" subsystem that closely resembles an organic system, and this resemblance is not undermined by other aspects of the experimental setting. In the case of basic (laboratory-based) studies, the organic context requirement means that the conceptual assumptions and design of the investigation take into account the behavior of organically managed systems. Ascertaining the context of individual research projects posed certain challenges which are described in the next section of this Chapter.

> Projects had to meet a dual test of "organicness," including both content and context of the research.

The test of organic-context ruled out a number of projects that focused on the integration of non-chemical methods (e.g. cover crops) into a conventional, chemical-intensive system. Non-chemical tools and methods need to be tested and understood in the setting that provides the most information about their efficacy and potential. Investigations of non-chemical methods or materials in a conventional context are only marginally useful to organic farmers who already employ these practices but need them optimized for an organic system.

An important corollary of the organic-context premise is our approach to "comparative" projects. Research which includes an "organic replication" or "system comparison" did not necessarily qualify as organic-pertinent. It is not necessary to demonstrate that "organic farming works". We know it works. What we need to know is, how it works, and how to make it work better. Projects which purport to "compare" organic and conventional farming often have an incomplete definition of "organic" (e.g.. "only uses manure", or "no management at all"). In order to qualify as "organic-pertinent", a comparative project must first have indicated a valid understanding of organic identity. Second, and more importantly, the research must have been designed to yield some useful information about *why* the organic system or method performed as it did. Projects which treated the organic system as a static variable, or simply compared yields or pest damage, without exploring any aspect of the organic system, did not qualify.

The legalistic, capital-O aspect of organic identity required that the experimental content of the project not include materials or methods prohibited under the NOSB recommendations. While this definition was generally more straightforward to apply than the agronomic one, "gray areas" in the recommended national standards (and most state regulations) are problematic for research assessment. The status of some materials (e.g. fluorescent detergent dyes in biocontrol formulations) will be ambiguous until the federal organic standards are finalized.

Investigations of recombinant-DNA products or organisms were definitely ruled out as organic research. The recommendations of the National Organic Standards Board prohibit the use of such inputs, as do most state organic standards. However, the use of r-DNA as a research tool, (e.g., for tagging and tracking soil microbes) did not automatically disqualify a project.

3.4 Ranking Organic-Pertinence: Subcategories of Organic Identity

Both aspects of organic identity - context and content - were further differentiated as described in the following section. The resulting scheme for categories of organic-pertinence is displayed in Table 2. *(page 33)*

Projects with a positive organic context were divided into "STRONG" and "WEAK" subcategories, based on the explicitness of the project's organic identity. Project reports in the USDA Current Research Information System (CRIS) vary greatly in the precision with which the projects are described. (Although in no case is very great detail provided.) In some cases the organic identity was made clear and explicit. In many other cases, this was not so easy to determine, particularly with respect to the small-o organic context of a study. In these cases various clues or suggestions in the narrative or other data (e.g., publication titles) in the CRIS report were used to *infer* a project's context. Projects were therefore rated as "Strong" where the organic identity was explicit, and "Weak" where the organic identity was inferred.

> Investigations of recombinant-DNA products or organisms were definitely ruled out as organic research.

Projects with a positive organic content were subcategorized as "SYSTEMS", "COMPONENT" or "EDUCATIONAL" according to the methodological type of investigation. "Systems" projects were those that integrated multiple variables and attempted to study systemic interactions behavior beyond the effects of a single variable. "Component" projects were those that addressed a single aspect. A small number of projects were categorized as "Educational" for demonstration or training activity. A very small number of projects concerned with market analysis were also placed in the Educational category.[8]

Notably, all "Systems" organic projects were rated "Strong" in terms of their context – there were no projects with an ambiguous context conducted at a systems level. However, "Systems" projects were further subcategorized according to whether the project was *comparative*, i.e. analyzed organic and non-organic systems together, or *dedicated*, studying only organic systems. Likewise, all "Educational" organic projects were rated "Strong". "Component" projects included both "Strong" and "Weak" projects.

3.5 Other Project Categories

Projects not qualified as organic-pertinent were assigned to one of six other categories: "Potentially Organic", "Neutral-Plus", "Neutral", "Incompatible", "Unrelated" and "Foreign". The summary descriptions of these categories are also displayed in Table 2.

Projects that were uncertain with respect to their capital-O organic content (because the method or material investigated fell into a "gray area" of the legal requirements for organic production) were rated as "Potentially Organic". These projects were almost universally weak or neutral with respect to their small-o organic context. Projects which were clearly neutral or only weakly negative in their context, but had experimental content that might be informative for organic methods were labeled as "Neutral-Plus". A large proportion of "Integrated Pest Management" and "biological control" projects were assigned to the "Potential" and "Neutral-Plus" categories. Taken together, these categories can be interpreted as "transitional" approaches, moving toward organic systems.

Projects which were simply not relevant to organic methods, but not technically incompatible were rated as "Neutral". Those which explicitly incorporated methods or materials prohibited in Organic systems were categorized as "Incompatible". In addition a small number of projects were rated as "Unrelated" where the project report was for a non-farming systems project, such as forestry, turfgrass, pollution control, etc., and also where the CRIS report was for an administrative or "umbrella" appropriation for a number of unspecified projects. Finally, a handful of projects were labeled as "FOREIGN" where the project was conducted by foreign, non-U.S. institutions.

DESCRIPTION OF RATING CATEGORIES FOR CRIS REPORT EVALUATION

TABLE 2

<u>STRONG ORGANIC PROJECTS (Categories 1-4):</u>

1. Organic-Systems, Dedicated (OS+): Multidisciplinary investigation of organic farming systems, designed to improve and/or increase understanding of organic systems behavior and management. Reported as dedicated to organic systems, not as comparisons with other agricultural systems.

2. Organic-System, Comparative (OS): Multidisciplinary investigation of organic farming systems, part of a comparison to other systems, designed such that specific knowledge could be gained about the underlying processes and dynamics of the organic system.

3. Organic-Educational (OE): Demonstration and training projects, other dissemination of information or economic/social analysis pertaining to organically produced foods & fiber.

4. Organic-Component, Explicit (OC+): Single-disciplinary investigation of methods or materials which are both compatible with organic standards and that are explicitly reported in the context of an organic system. May or may not include comparison with non-compatible methods/materials.

<u>WEAK ORGANIC PROJECTS (Category 5):</u>

5. Organic-Component, Inferred (OC): Investigation of methods or materials which are both compatible with organic standards, and that appear to be conducted in the context of non-chemical or "biointensive" subsystem (e.g. pest control or crop fertility), but does not state specifically organic context (i.e., organic-pertinent identity is inferred). Usually not in comparison with non-compatible methods/materials.

<u>"TRANSITIONAL" PROJECTS (Categories 6-7):</u>

6. Potentially Organic (PO): Research which could theoretically lead to organic-pertinent knowledge if applied in an organic context, but is not reported in a context apparently compatible with organic farming; investigations of materials/practices which are uncertain or problematic with respect to organic standards; basic science that is possibly relevant to natural processes underlying organic farming systems, but with no pertinent outcomes identified.

7. NEUTRAL-PLUS (N+): Not pertinent to organic farming, but not incompatible. May provide useful information on a non-chemical/bio-intensive component which could theoretically be extrapolated to organic farming systems.

<u>NON-ORGANIC PROJECTS (Categories 8-11)</u>

8.NEUTRAL (N): Not incompatible with organic systems, but not leading to information potentially useful for organic farming.

9. INCOMPATIBLE (IC): Investigation of methods or materials directly incompatible with organic standards. Includes most applied recombinant-DNA research and development.

10. UNRELATED (U): Projects not pertaining to farming systems, including turfgrass and forestry; administrative/umbrella grants.

11. FOREIGN (F): Projects conducted outside of the U.S.

3.6 Narrowing the Search

The USDA Current Research Information System (CRIS) system contains roughly 30,000 project reports. CRIS encompasses agricultural research projects performed by USDA's in-house agencies (Agricultural Research Service, Economics Research Service) and those performed by state universities, colleges and agricultural experiment stations with federal funding administered by USDA under various programs (e.g., Smith-Lever, Hatch Act, National Research Initiative). CRIS does not include projects conducted only with state funding, such as those performed by many state Extension Specialists. It only partially includes projects funded by the USDA Sustainable Agriculture Research and Education Program (SARE).

Each report contains brief narrative information about the project ("Objectives", "Approach" and, in most cases a "Progress Report") as well as basic administrative data (Investigators' names, institutions, start & end date, etc.). In addition, each report is elaborately cross-coded for classification by "Research Problem Area", "Commodity", "Research Activity" and "Field of Science". These classification schemes include hundreds of general and specialized designations, but none of the Classification Codes in any category are specific to organic farming.[9] (An example CRIS report is found in Appendix B).

The resources available for this project were not sufficient to search the entire haystack of 15-20,000 research projects concerning farming systems, let alone the entire 30,000 projects in the CRIS database. A deliberate strategy was adopted at the beginning of the study to narrow the task by restricting the search to selected "Keywords". Each Principle Investigator must assign keywords which categorize the project's areas of investigation.[10] Typically 5-20 are used. Thus, the Keyword list was built to "screen in" a reasonably sized pool of projects that could be searched for content pertinent to organic farming, while still reliably encompassing most of the potential "universe" of organic-pertinent research.[11]

3.7 Selection of Keywords

An initial set of about 15 keywords was developed "intuitively" by the project staff from our own farming knowledge. These included the obvious terms, such as "organic-matter", "crop-rotation", "compost", and "sustainable-agriculture". An additional 10-12 keywords were then added by studying approximately 200 grant proposals which had been submitted to OFRF's grantmaking program for on-farm organic research and ascribing keywords to those project proposals.

We began querying CRIS with our initial set of keys, and examined the resulting projects for related keywords. This process added approximately 25 more keywords to the list. The accumulated list of about 50 keywords was circulated for comment to the projects advisors, members of OFRF's Board of Directors, and others. The resulting comments and suggestions added about another 20 items, bringing us to a final total of 71 keywords.

The final list of keywords used in the search appears in Table 3.

KEYWORDS USED TO SEARCH CRIS DATABASE

TABLE 3

IPM	cover-crops	nitrogren-fixation
SARE	crop-ecology	non-chemical-control
actinomycetes	crop-rotation	organic-farmers
aerobic-bacteria	cultural-control	organic-farming
aerobic-decomposition	decomposition	organic-farms
agroecosystem/s	diabrotica	organic-fertilizers
allelopathy	disease-suppression	organic-foods
alternative-pesticides	earthworms	organic-livestock
beneficial-insects	foliar-application	organic-matter
beneficial-microorganisms	green-manure/s	plant-ecosystems
beneficial-nematodes	homeopathy	plant-nutrition
biocontrol	humates	rotational-grazing
biodynamics	humus	semiochemicals
biological-control	intensive-grazing	soil-amendments
biological-control-(diseases)	intercropping	soil-fertility
biological-control-(insects)	kelp	soil-microflora
biological-control-(weeds)	living-mulch/es	soil-microorganisms
botanical-pesticides	low-input-agriculture	soil-organic-matter
brix	manure	soil-organisms
chrysomelidae	manures	soil-plant-nutrient-relations
clover	microbial-ecology	solarization
compost	microbial-pesticides	suppressive-soils
composting	mycorrhizae	sustainable-agriculture
composts	natural-substances	

3.8 SEARCHING THE DATABASE

Two World Wide Web sites on the Internet were used in the search process. In mid-1995 we started the search with the Community of Sciences server[12] because the USDA site was not yet reliably functional. By mid-1996, the USDA site[13] was operational and we finished the search process using both versions. Both search engines normally have a maximum return of 200 "hits" in response to a given search. About a dozen of our keywords returned more than 200 project titles. Getting around this limit required different approaches on the two different sites. In the Community of Sciences site, the easiest method was to split up the search by start- or end-dates (e.g., one search for all projects started before 1/1/93, and one search for all projects started after that.) On the USDA/CRIS site, the start/end dates are not searchable, but other categories are. We used the "Region" category, which divides all projects into one of four geographic regions, and ran four searches for the larger keywords. [14]

Most of the searches were run early in 1996, although the entire list covered almost fifteen months, beginning in August of 1995. Some changes occurred in the databases over that time, but relatively few. The earlier searches were checked later in 1996 to ensure that the lists had not changed substantially (none were found to have changed by more than 3-4%, most by fewer than five individual projects).

Each search produced a list of project titles containing the keyword. Each project title could be selected for display of the actual report. Each project within a given list was called up on the screen, one-by-one, for evaluation.

3.9 Applying the Rating Scheme

The rating scheme is described in Table 2. A tentative rating was initially applied to each project along with commentary by the reviewer. A first round of evaluations was conducted by the author as well as several assistant reviewers, all of whom have some training in research methods, and are familiar with a wide range of organic farming practices. Subsequently, all evaluations were reviewed a second (and sometimes a third) time by the author. The secondary reviews served to "iron out" inconsistencies between the primary reviewers, scrutinize borderline or ambiguous projects, and incorporate refinements of the rating protocol.[15]

It must be noted that many project reports included more than one line of investigation. In these cases, the Progress Report and Publications were primarily used to determine the project's main focus and the basis for evaluation.

While it was apparent in a number of cases that the CRIS report did not provide a truly accurate picture of a researcher's activity (both positively and negatively with respect to organic pertinence), we were committed to taking these reports at face value. The purpose of this study was to evaluate what the research community *says* it is doing, as well as what it is *actually* doing. If organic research is not identified correctly as such, it is not of much use to farmers. Where we made inferences, we made them in the absence of, not in contradiction to, clear information.

3.10 Database of Organic-Pertinent Projects.

Information from projects rated as Organic-Pertinent (i.e., assigned to categories 1-5) was transferred to a master spreadsheet to conduct cross-tabulations, and for future reference. The complete database for all Organic-Pertinent projects is presented in Appendix A. In addition to information obtained directly from the CRIS reports, two additional categories of data were ascribed to each project: "Farmer Participation" and a scheme for describing the "Research Topic".

3.11 Determining Farmer Participation

Project narratives were reviewed for indications that working farmers were involved with the investigation, either as hosts for field trials, consultants in the project's design or execution, or any other form of participation.

3.12 Assigning "Research Topic" Categories

To evaluate the patterns of subject matter within the Organic-Pertinent projects, we devised the scheme presented in Table 4. The categories and sub-categories are not all mutually exclusive, but do reasonably distinguish the central subject of each project. Use of the CRIS classification scheme was considered for this purpose, but it consists of so many overlapping categories by which researchers code their projects, that the resulting list would not have been coherent or meaningful to us. The categories we used were derived from our observations of patterns among the projects selected as organic-pertinent. The substance of the categories is discussed in detail in

TABLE 4

RESEARCH TOPIC CATEGORIES

bc-b=Biocontrol-Breeding
bc-i=Biocontrol-Introduced
bc-s=Biocontrol-Systemic
bs-e=Basic Science-Entomology
bs-m=Basic Science-Microbial
co-e=Compost Effects
econ=Economics
edu=Educational/Demonstration
co-t=Compost Technology
sm-b=Soil Management-Biological
sm-m=Soil Management-Mineral
sm-p=Soil Management-Physical
sm-s=Soil Management-Systemic

Section 4.12.

3.13 Analysis of the Federal-State Marketing Improvement Program

Separate from our analysis of the CRIS database, we reviewed 159 projects funded by USDA's Federal-State Marketing Improvement Program (FSMIP). This program is conducted by USDA's Transportation and Marketing Division within the Agricultural Marketing Service. FSMIP provides matching funds to states for innovative marketing development and feasibility studies. The projects funded by FSMIP are not entered on the CRIS system.

Our analysis was conducted early in the course of the NORPA project, as a "test run" for identifying organic-pertinent projects. The project summaries were listed in a 7-year report for the FSMIP program, summarizing its activities from 1985-91[16] Evaluation of the projects relied entirely on the published project titles and short summaries. While brief, these summaries are very explicit in describing the projects' contents. Organic-pertinence was easily determined. Results of the FSMIP analysis appear in Section 4.2.

Chapter 3 Notes

[1] Schaller, Thompson, and Smith, 2.

[2] George W. Bird, Sustainable Agriculture: A Case Study of Research Relevancy Classification, 1995 Annual Meeting of the American Association of for the Advancement of Science, Atlanta, GA, February 20, 1995.

[3] Miguel Altieri, Agroecology: The Science of Sustainable Agriculture (Boulder, CO: Westview Press, 1995).

[4] The prohibition of synthetic inputs almost always includes a short list of exemptions, historically accepted as compatible with organic farming. These are simple compounds, such as lime-sulfur, and copper sulfate.

[5] After nearly twenty years of inconsistent state and private standards, The U.S. Organic Foods Production Act was passed in 1990 as part of that year's Omnibus Farm Bill. It set some basic parameters of a national standard. The NOSB recommendations represent a valid effort over five years to build a consensus resolution to the varied state and private definitions which have been in use (and sometimes conflict) over the last twenty years.

[6] The development of these legal standards has allowed for the proliferation of "natural inputs" for fertility and pest control. There is an ongoing dynamic tension between the two definitions of organic, which is played out in the ongoing codification of national and international standards. For a good critique of the erosion of the agroecological essence of organic production, see Miguel Altieri and Peter Rosset, "Agroecology versus Input Substitution: A Fundamental Contradiction of Sustainable Agriculture," Society and Natural Resources 10 (1997).

[7] L.E. Drinkwater, *et al*, "Fundamental Differences Between Conventional and Organic Tomato Agroecosystems in California," Ecological Applications 5 (1995) 1109. This study is one of the few published legitimate studies of real organic farming systems across a number of sites. In the extra-cautious, understated language of scientists daring to challenge agronomic orthodoxy, the authors state that, "Our results support the hypothesis that biotic agents play a role in compensating for synthetic chemical inputs, and suggest that the mechanisms involved are more complicated than substitution."

[8] We wish to note that we did *not* rule out social-science investigations. However, beyond the small number of economic analyses, we did not find any projects that attempted to apply social-scientific disciplines to organic farms or organic methods.

[9] National Agricultural Library, "Current Research Information Classification Manual", online document, http://ctr.uvm.edu/cris/crisman.

[10] The Keyword process is distinct from, but largely redundant with the complex system of "Classification Codes". However, it clearly offers investigators the flexibility to occasionally use terms such as "organic farming".

[11] Browsing the Classification Codes electronically did not become possible until late in our project's duration. Once available, some trial searches proved that they alone would have been less useful than the Keyword strategy we eventually used. The single most pertinent Code we found was RPA# PST2 "Improve Means of Non-Pesticidal Controls", under the heading of "Pesticide Targets", a sub-category of "Special Classification". A search on Code "PST2" turned up slightly under 2000 projects. A scan of these projects revealed a significant overlap with the project pool we had generated with Keywords, but almost no new potentially organic-pertinent ones. Needless to say, a large number of the projects in this category were focused on recombinant-DNA applications.

[12] http://cos.gdb.org/best/fedfund/usda/

[13] http:// cristel.nal.usda.gov:8080/

[14] In the USDA site this limit can now be overcome by using the "Expert Search" mode.

[15] Examples of the ratings were discussed with advisors to the project, providing extremely constructive feedback, but systematic parallel evaluation was not conducted. From the outset of the project, it has been acknowledged that reliance on the author's evaluations constituted a degree of "subjectivity". However, this subjective point of view is intrinsic to the experience which enables meaningful evaluation. Since there is no truly "objective" determination for organic-pertinence that could be confirmed by a double-blind scheme or parallel review, it was neither necessary or desirable to attempt to correct for potential bias. It was deemed much more important to ensure consistency in application of the rating scheme.

[16] Harold S. Ricker, Federal-State Marketing Improvement Program, 7-Year Report, 1985-1991 (Washington DC: USDA, 1993).

Chapter 4
Results & Analysis

The following chapter provides details of the search results and analyzes several aspects of the data. The level of detail and analysis may seem too elaborate for the small total of organic projects. While the overall orders of magnitude are the most important message here, the detailed analysis is presented as a baseline from which to measure future assessments of organic farming research. Considering the various scientific and institutional aspects of the data set may also help to provoke strategic thinking about what a future organic research portfolio might look like.

4.1 Overview: A Few Needles in the Haystack

The USDA Current Research Information System (CRIS) is a database containing one-page summaries and administrative data for approximately 30,000 active or recently completed projects funded by various USDA agencies. Our search for projects pertinent to organic farming initially returned in approximately 4,500 projects for individual review, based on keywords likely to be attached to organic projects.

-Out of 4,500 projects reviewed directly, 301 were found to be "organic-pertinent".

-Of the 301 projects qualified as organic-pertinent, 34 were rated as "Strong Organic", indicating that the CRIS report explicitly mentioned an organic farming setting or applications. The remaining 267 were rated as "Weak Organic", meaning that the organic context of the project could only be inferred.

-The 34 "Strong Organic" projects constitute about one-tenth of one percent of the CRIS database. For the 1995 Fiscal Year, federal funding of Strong Organic projects totaled $1.5 million, also slightly less than one-tenth of one percent of USDA's annual research and education budget.

4.2 Results of the FSMIP Analysis

From 1985 through 1991 a total of 159 projects were funded by USDA's Federal-State Marketing Improvement Program (FSMIP). These projects received a total of $7,394,857 in federal funds, matching an equal amount of states' funding. 6 projects were found to be specifically pertinent to organic foods production and marketing[1]. Funding for these 6 projects totaled $234,720, or 3.2% of the seven-year total. However, all of the organic projects were funded in 1990 or 1991. Three projects funded in 1990 received a total of $55,000, which was 4.5% of the $1,121,350 distributed that year by FSMIP. Three projects funded in 1991 received $179,720, representing 14.4% of $1,249,884 granted that year.

In addition to the six explicitly organic projects, three projects mentioned organic production or marketing as one item within a list of diversified marketing/development efforts.

4.3 Results of CRIS Project Ratings for Each Keyword

Table 5 *(page 42)* shows the total number of projects found under each Keyword search, and the number of projects assigned to each rating category. Note the totals at the bottom do not represent counts of unique projects. A given project may have been reviewed as many as three or four times under different keywords. Also note that within the "Organic Systems" category, both "Dedicated" (OS+) and "Comparative" (OS) sub-categories are combined. Likewise, within "Organic Component" the "Explicit" (OC+) and "Inferred" (OC) subcategories are combined. This is due to the fact that in some initial reviews, the subcategories had not yet been established. *(See Table 2, page 33, for key to abbreviations.)*

4.4 Estimates of Redundancy in the Keyword Search

In checking for duplicate reviews among the OS/+, OC/+, OE and PO projects, we calculated a total redundancy rate of 20.6% (160 duplicates in 777 reviews). Since the other categories were significantly more frequent, they may also have had a somewhat higher redundancy rate. A conservative estimate of 33% for total redundancy in the entire sample would provide a figure slightly greater than 4,500 unique projects reviewed. This is a reasonable minimum estimate. A high-end estimate of 20% total redundancy would be slightly more than 5,500 projects.

4.5 Comments on the Keyword Search

From the very beginning of our search it was clear that "organic" as a keyword element was not going to be very helpful. The small number of projects found under the term "organic farming" was not as surprising as the fact that 12 of the 26 projects did not qualify as organic-pertinent. A number of the disqualified projects were concerned with pesticide use reduction in a conventional context, or the application of organic soil amendments in an otherwise chemical-intensive setting. This finding reinforced our suspicion that the term "organic" is easily misapprehended by researchers.

Equally disappointing were the catch-all terms, "sustainable-agriculture" and "low-input-agriculture". The two terms combined yielded organic-pertinent projects at rates of 20 out of 310 (6.4%) and 11 out of 242 (4.5%) respectively. Anyone who thought that organic was synonymous with these terms is not in touch with the research community. In fact, while the majority of projects under these terms were rated "Neutral" or "Neutral-Plus", organic-pertinent projects were decisively outnumbered by those that were "Incompatible" with organic.

> Out of 4,500 projects reviewed directly, 301 were found to be "organic-pertinent."

Quite aside from the organic portion of these two keywords, we were surprised at what was called "sustainable agriculture". A wide range of projects used this term, many of them indistinguishable from standard chemical efficacy/maximum yield research programs. The lack of distinctiveness in many of these "sustainable" projects raises serious questions about the term's usefulness. For example, project #9160223, "WEED MANAGEMENT SYSTEMS FOR PERENNIAL FORAGE CROPS" is simply an herbicide efficacy trial for control of bermuda grass. A number of standard herbicide efficacy and efficiency trials were found under the "sustainable agriculture" keyword. An example of stock fertilizer trials found in this keyword search is #9167989, "ENHANCING

Table 5

Results of CRIS Keyword Search

KEYWORD	TOTAL#	OS/+	OC/+	OE	PO	N+	N	IC	U	F
IPM	123	1	8	0	2	32	16	27	31	6
SARE	66	2	4	1	0	19	11	0	27	1
actinomycetes	15	0	0	0	0	5	1	9	0	0
aerobic-bacteria	6	0	0	0	0	1	2	3	0	0
aerobic-decomposition	3	0	1	0	0	1	0	1	0	0
agroecosystem/s	4	0	0	0	0	3	0	1	0	0
allelopathy	62	0	1	1	0	8	16	36	0	0
alternative-pesticides	40	0	2	1	0	10	1	26	0	0
beneficial-insects	109	2	4	0	0	51	6	34	12	0
beneficial-microorganisms	107	0	3	0	0	38	36	23	7	0
beneficial-nematodes	26	0	13	0	2	5	0	0	5	1
biocontrol	32	0	0	0	0	16	5	11	0	0
biodynamics	0	0	0	0	0	0	0	0	0	0
biological-control	121	0	1	4	0	71	3	18	23	1
biological-control-(diseases)	420	0	41	0	51	131	30	105	61	1
biological-control-(insects)	623	5	98	0	107	134	59	96	110	14
biological-control-(weeds)	290	0	38	0	44	69	19	34	84	2
botanical-pesticides	0	0	0	0	0	0	0	0	0	0
brix	0	0	0	0	0	0	0	0	0	0
chrysomelidae	14	0	0	0	0	0	4	3	3	4
clover	103	0	1	0	0	64	2	10	2	24
compost	22	0	2	0	0	4	0	1	0	15
composting	81	0	5	0	1	50	3	12	2	8
composts	87	1	8	1	0	42	18	7	8	2
cover-crops	224	6	17	4	4	78	55	51	8	1
crop-ecology	0	0	0	0	0	0	0	0	0	0
crop-rotation	380	2	12	0	2	108	64	175	17	0
cultural-control	33	0	2	0	2	11	0	12	5	1
decomposition	60	0	4	0	0	19	3	5	29	0
diabrotica	44	0	2	0	4	4	12	21	1	0
disease-suppression	2	0	1	0	0	1	0	0	0	0
earthworms	32	1	1	0	0	18	3	7	0	2
foliar-application	27	0	0	0	0	9	0	17	1	0
green-manure/s	59	1	3	0	0	22	10	23	0	0
homeopathy	0	0	0	0	0	0	0	0	0	0
humates	0	0	0	0	0	0	0	0	0	0
humus	10	0	0	0	0	1	4	5	0	0
intensive-grazing	0	0	0	0	0	0	0	0	0	0
intercropping	3	0	0	0	0	0	0	1	1	1
kelp	0	0	0	0	0	0	0	0	0	0
living-mulch/es	14	0	1	0	0	4	0	8	1	0
low-input-agriculture	242	2	5	4	0	100	53	60	9	9
manure	51	1	0	0	0	1	1	5	0	43
manures	178	1	6	1	0	71	25	28	42	4
microbial-ecology	185	1	13	0	7	46	28	41	48	0
microbial-pesticides	112	0	16	0	6	19	30	32	9	0
mycorrhizae	154	1	6	0	12	23	29	12	64	7
natural-substances	62	0	4	0	0	16	1	9	29	3
nitrogren-fixation	171	0	2	0	8	41	48	65	2	5
non-chemical-control	85	0	8	1	0	42	4	25	5	0
organic-farmers	0	0	0	0	0	0	0	0	0	0
organic-farming	26	5	8	1	0	8	1	2	0	1
organic-farms	0	0	0	0	0	0	0	0	0	0
organic-fertilizers	14	0	0	0	0	5	2	1	5	1
organic-foods	4	0	1	2	0	1	0	0	0	0
organic-livestock	0	0	0	0	0	0	0	0	0	0
organic-matter	62	0	4	1	0	13	8	3	32	1
plant-ecosystems	45	0	2	0	0	18	4	4	17	0
plant-nutrition	444	0	5	0	4	57	145	86	135	12
rotational-grazing	58	1	0	0	1	19	19	2	13	3
semiochemicals	95	0	12	0	3	25	7	30	16	2
soil-amendments	198	1	7	1	3	60	27	21	70	8
soil-fertility	221	1	6	0	2	39	51	34	77	11
soil-microflora	8	0	0	0	0	4	0	2	2	0
soil-microorganisms	176	2	8	0	2	36	20	34	69	4
soil-organic-matter	210	0	7	0	1	37	30	15	110	10
soil-organisms	9	0	0	0	0	5	1	2	1	0
soil-plant-nutrient-relations	529	2	7	2	13	116	93	76	202	18
solarization	12	0	0	0	0	9	0	3	0	0
suppressive-soils	35	2	10	0	0	20	1	1	1	0
sustainable-agriculture	310	4	15	1	2	73	133	33	49	0
TOTAL	6938	45	425	26	283	1933	1144	1408	1445	226

NUTRIENT EFFICIENCY FOR WESTERN KANSAS" comparing various applications of phosphorous and urea-ammonium nitrate for maximum yield in dryland wheat production.

Two aspects of the term's plasticity might be at work. First, many researchers probably sincerely believed that their existing work belongs under the "sustainable" umbrella, whatever that term might mean to somebody else. Second, they perhaps felt that their regional administrator/dean/department chair wanted to see some "sustainable agriculture", so that's what they called their work. Such dynamics are probably not limited to this particular keyword, but "sustainable agriculture" clearly continues to mean many different things to research scientists and administrators.

The complexion of "sustainable agriculture" research represented here is also altered by the fact that **many projects funded by USDA's Sustainable Agriculture Research and Education (SARE) program are <u>not</u> entered on CRIS.** SARE is a special case for our study that is discussed in section 4.7.

Other broad terms in our list included "agroecosystem/s"[2] (4 projects/none organic), "plant-nutrition" (444 projects/5 organic), and "soil-plant-nutrient-relations" (529 projects/11 organic).

Another notable aspect of the keyword result pattern is the class of "zero-returns". That is, those keywords which did not produce any project reports at all. Eleven out of 70 keywords showed zero projects. Notable among these were "biodynamics", "brix", "crop-ecology", "homeopathy", "kelp" and "organic-livestock"[3]. Some of these terms may appear to represent "fringe" concepts, but all of them would be obvious topics for a farmer or rancher moderately acquainted with organic methods.

Not surprisingly, the largest topical group of projects we reviewed were those concerning biological or non-chemical pest controls. Over 25% of the total projects reviewed were found under "IPM"[4], one of five variations on "biological-control", "beneficial-insects", "beneficial-nematodes", "beneficial-microorganisms", "cultural-control", "microbial-pesticides", "non-chemical-control" and "semiochemicals". (See Table 5). The projects selected as organic-pertinent from this group in turn comprised 2/3 of all organic-pertinent projects found, but only 1/3 of all "Strong-Organic" projects. (See Table 7).

"Organic" as a keyword was not very helpful... only 12 of 26 projects under 'organic farming' qualified as organic-pertinent.

Two terms were added to the list specifically in response to the results of OFRF's *1995 National Organic Farmers' Survey*. Organic growers reported two groups of insect pests as their most important pest-control research priorities: *diabrotica spp.* ("diabrotica") and flea beetles ("chrysomelidae")[5]. These searches produced 44 projects (none organic-pertinent) and 14 projects (two organic-pertinent), respectively.

4.6 Unique Totals for Rating Categories 1-6

Table 6 shows the count of unique totals for each of the five categories of organic-pertinence, as well as the unique total for Category 6, "Potential Organic". Also shown are the combined totals for the "Strong" (Categories 1-4) and "Weak" (Category 5) groups.

The 34 Strong Organic projects represent approximately one-tenth of one percent of the total CRIS database. 301 total organic-pertinent projects represents approximately one-percent of the total projects in the CRIS database.

Table 6

UNIQUE TOTALS FOR ORGANIC-PERTINENT RATING CATEGORIES 1-6

Category	1-OS+	2-OS	3-OE	4-OC+	5-OC	6-PO
Total	5	8	7	14	267	215

STRONG ORGANIC Projects (OS+, OS, OE, OC+) = 34
WEAK ORGANIC Projects (OC) = 267
POTENTIAL/TRANSITIONAL ORGANIC = 215

4.7 SARE As A Special Case; Estimated Program Totals

The Sustainable Agriculture Research and Education Program is an important element of USDA's approach to alternative agriculture, and the program has been a major focus for advocates of more holistic farming practices. SARE evolved from attempts to mandate an organic farming research program but ultimately the words "organic farming" did not appear in the authorizing legislation or the program's National Guidelines. SARE is *not* an "organic farming program". Despite the lack of recognition for organic farming as an element of "sustainable" agriculture" the SARE program does fund some organic-pertinent research and education. Assessing the organic content of SARE's "portfolio," however, proved difficult for us.

Most SARE projects do not appear on the CRIS database. SARE projects appear on CRIS only where an investigator would be filing a CRIS report anyway (because of other federal funding), regardless of SARE participation. When this is the case, the CRIS report includes the string "#SARE" in its keyword list. Only 38 such projects were found by searching on "SARE"[6]. In FY1995 alone the SARE program selected 229 projects for funding. The SARE program has been developing a comprehensive database for all projects that it has funded, but it was not completed at the time of this writing. Project titles and funding amounts were available, but not project summaries or abstracts which could be considered the equivalent of a CRIS report. Each of SARE's four Regional Administrative Councils publishes information about their activities, but both the reporting cycles and the level of detail in project descriptions varies between regions. Analysis of the SARE program on a national level will be difficult until the complete database is published. The SARE database will be available electronically via the Sustainable Agriculture Network website[7]. Because of the SARE Program's importance in assessing USDA's efforts with respect to organic farming we have attempted to *estimate* the organic-pertinent portion of SARE.

Three sources were used in formulating an estimate of SARE's organic content: the CRIS search results, telephone conversations with SARE administrators and a review of project titles for FY 1995 grant awards. The CRIS keyword search produced 37 actual SARE projects, seven of which were rated as organic-pertinent for a project ratio of 19%. Conversations with several SARE regional and national administrators produced a range of (regional and national) estimates that organic farming projects constituted between 5% and 40% of the total projects. Finally, a review of 229 project titles[8] for FY 1995 SARE grants found 14 titles (6%) stating an organic context and another 30-40 titles (13-17%) with a reasonable probability of being organic-pertinent.

> The frequency of organic-pertinent projects within SARE is estimated to be about 20%.

Each of these three sources suggests that a reliable estimate of organic-pertinent projects' numeric occurrence in SARE is about 20%. With somewhat less confidence we estimate that the proportion of "Strong-Organic" projects within the 20% occurrence may be as high as 50%. Given that some projects are already on CRIS, *we estimate that a full review of current SARE projects would add 30-50 organic-pertinent projects (Strong and Weak combined) to our overall total (see Table 6).*

The estimated impact of SARE projects on funding totals for organic research is addressed in section 4.15.

4.8 The Good Stuff: 34 Strong Organic Projects

Within the group of 34 projects identified as "Strong Organic", a very small number of research efforts (13) were found that attempted to investigate organic farming systems *as whole systems*. Within this group are several exemplary investigations, and we would expect them to generate a number of important scientific questions about systems behavior for further inquiry. We also might hope that the methodology of systems-level research will also be advanced by this work. However, only five of the thirteen are dedicated exclusively to organic management.

Three related projects at the University of California, Davis stand out as the "state-of-the-art" of university-based organic farming *systems* research. "DECOMPOSITION OF PLANT RESIDUES AND SUPPRESSION OF ROOT DISEASES IN ORGANIC FARMS" (#9162489), "ROLE OF SOIL MICROBIAL BIOMASS AND MICROBIVOROUS NEMATODES IN SUSTAINABLE AGRICULTURAL SYSTEMS (#9167730) and "A COMPARISON OF CONVENTIONAL, LOW-INPUT AND ORGANIC FARMING SYSTEMS:TRANSITION AND LONG-TERM VIABILITY" (#9167734) are all focused on patterns of relationship over time among biological factors, soil qualities, farming practices and system performance. The investigators are all part of the University's "Sustainable Agriculture Farming Systems (SAFS) Project", a long term dedicated set of experiments, with a blue-ribbon advisory panel of working organic farmers. The SAFS cluster has benefited from support by both the USDA and University of California Sustainable Agriculture Research and Education Programs.

The component-oriented Strong-Organic projects are less far-reaching than the systems projects, but many are impressive in their ecologically-oriented approach. They are also important as "toeholds" within their respective institutions. Hopefully they are also models of "good science" with an organic farming focus.

> The strongest organic-systems projects focussed on patterns of relationship over time.

A notable group of Strong-Organic component projects was found at Michigan State University, exemplified by #9150054, "BIOLOGICAL AND CULTURAL MANAGEMENT OF PLANT-PARASITIC NEMATODES" with an emphasis on "nematode community ecology".

As a group, the Strong-Organic research projects will provide the opportunity for detailed analysis of the approaches and outcomes of organic-pertinent research. This opportunity hopefully will be seized by USDA and others.

4.9 "Weak Organic", "Potential Organic" and "Neutral-Plus" Projects

The organic or non-chemical context of the "Weak Organic" projects was, by definition, inferred. In some cases this inference was based on direct statements in the project report. For example, project # 9135039 "INTEGRATED PEST MANAGEMENT OF INSECT AND MITE PESTS AFFECTING COLORADO FRUIT PRODUCTION", stated that "Growers cooperated in a pest management program in which no insecticides were applied to apples after bloom".

In other cases the inference of a non-chemical context was based only on the apparent logic of the project's design. Typically these were soil-management projects, such as #9157761, "CROP ROTATION EFFECTS ON SOIL MICROBIAL ACTIVITY, NUTRIENT USE EFFICIENCY AND PRODUCTIVITY".

For many of the "Weak Organic" projects, this process of inference meant extending the "benefit of the doubt" where this could be justified at all, and perhaps some wishful thinking. Overall, we tried to err on the higher side of the line between "Weak Organic" and the lower categories of "Potential Organic" and "Neutral-Plus".

The "Potential Organic" category contained projects that were considered "borderline" in terms of inferring a "Weak" organic identity, but were too uncertain in their content to extend the benefit of that doubt. In order to recognize that some of this research may indeed be valuable to organic farmers, we assigned projects to this category for future analysis.

The "Potential Organic" group contained 215 unique (non-redundant) projects. Two distinct areas of uncertainty characterized these projects. Primarily, these projects were concerned with the development of biopesticides that are problematic with respect to allowability for organic production. For example, #9146301, "USE OF A NOVEL BIOCONTROL FORMULATION TO CONTROL DAMPING-OFF OF PEPPER AND EGGPLANT" describes a formulation process that is uncertain (although doubtful) as to its compatibility with organic production standards. Similar questions put other projects into the "Potential" category. Until the federal regulations are proposed and finalized, these determinations will be difficult.

A smaller number of the "Potential Organic" projects were "basic" research where the expected knowledge might be applicable specifically to organic systems, but could also be incompatible with those systems. For example, #9146143, "MODE OF ACTION OF YEAST BIOCONTROL AGENTS OF POSTHARVEST DISEASES OF FRUITS" is very basic research on the biochemistry of yeasts. The project's objective is to "enhance" the efficacy of yeast as a disease antagonist. While this in itself is not incompatible with organic production, there is an implication of genetic recombination as the ultimate end of this inquiry, which would be incompatible with organic standards. Furthermore, there is no suggestion whatsoever of searching for antagonists optimized for fruit grown under organic methods.

> Many projects reflect a shift towards 'softer' pesticides... but do not embrace the premises of ecological management.

While the relatively large number of "Potential Organic" projects might seem to imply a lack of confidence in the overall results, such a conclusion is not warranted. As it is, the boundaries of the "Weak Organic" designation have been stretched considerably. The "Potential Organic" projects did not make it across this already loosened barrier, but were also too vague to place in the “lower” categories. A more accurate interpretation would take into account the even larger category of “Neutral-Plus” projects. The projects in this category include those that emphasize biological or non-chemical aspects of farming systems, but are more explicitly placed within a conventional, chemical-input context than are the “Potential Organic” projects.

These two categories taken together do reflect a broad shift in research and development towards “softer” pest control methods (e.g. biopesticides) and the search for cultural practices which can help to augment the efficiency or efficacy of conventional agricultural chemical inputs (or, perhaps more accurately, mitigate their negative environmental consequences and stave off their failure due to pest resistance). These projects are certainly worthy in their own right, and we have tried to recognize the specific contributions of such efforts by making the various distinctions that we have. *However, these classes of research do not fundamentally embrace the premises of biological fertility and ecological pest management that are at the core of our search.*

A more practical analysis of the “Potential Organic” category (from a farmers’ point of view) might combine these projects with the most input-oriented “Weak Organic” projects and the least chemical-dependent “Neutral-Plus” investigations into a *Transitional* classification. This body of research and development encompasses many of the practices and approaches which appear to characterize the process of transition from conventional to organic practices. Such an analysis could be superficially useful in building a “menu” of transitional options, but it would be misleading because this collection does not in any way constitute a *strategy* for transition.

4.10 The Organic Reservoir: Band-Aids and Extractions

A very noticeable trend in many of the projects reviewed is the attempt to graft components or features of organic systems onto conventional systems. In responding to the widespread demands for reduction of pollution impacts and other risks from agricultural chemicals, organic farms are being used as a reservoir of techniques (e.g., crop rotations, cover crops) to be investigated as Band-Aids on conventional systems.

In our search through CRIS, we found projects within every rating category which exhibited this trait. In some cases these investigations are gratuitous additions to otherwise chemical-intensive research programs; in others they seem to indicate a deliberate shift in the direction of biological management.

The attempt to reduce or mitigate chemical use by “integration” of non-chemical techniques is most obvious in an area such as nematology, where conventional pesticides are increasingly ineffective. For example the project “ECOLOGY AND MANAGEMENT OF PLANT-PARASITIC NEMATODES” (Accession #9164093) lists a string of 6 objectives focused on “nonchemical nematode management options”.

Beyond the borrowing of specific practices, organic farms are also used as a source of biological control agents. In seeking antagonistic species for control of pests, researchers face a fundamental obstacle in conventional fields. That is, not only the elimination of pest species, but also the suppression of potential enemies. Logically, this search turns to locations where there are active populations of a pest species and its enemies. While this may occur in the wild or in some exotic locations, it also reliably occurs in commercial farming regions on organic farms.

Many projects attempt to graft features of organic systems onto conventional systems.

At one level, this means collecting data about potential biocontrol agents, as in "SYSTEMATICS OF NORTH AMERICA SPECIES OF PARASITES OF WHITELFILES" (Accession#9147493). This Agricultural Research Service project worked with several organic vegetable operations in regions suffering from whitefly infestations to identify whitefly enemies in their fields.

The extraction of beneficial organisms from organic farms ignores the ecological context which produces them.

More dramatic yet is the actual extraction of beneficial organisms and gene sequences from organic farms and soils. Relatively few project reports acknowledge this specifically, but there are dozens of reports which describe the investigation of agricultural soils "naturally suppressive to disease organisms" (#9144550) or "soils suppressive to agricultural plant-parasitic nematodes" (#9138971) for the identification, isolation, and extraction of potential biocontrol agents. In some cases, the effort is directed towards the ultimate extraction and recombination of gene sequences which "produce" the biological control function.

Whether found on organic farms or not, these efforts to isolate beneficial organisms are almost completely failing to apprehend the ecological context which produces them. ***The investigation of organic and other pest-suppressive systems is almost totally restricted to the isolation of biopesticides, as opposed to the understanding and development of biologically resilient conditions and adaptive systems.***

4.11 Utility of the CRIS Database; Art and Politics of Research Reporting

The functionality of the CRIS Internet Web Site was found to be extremely powerful, with only a few relatively minor complaints and one major one (restriction of funding data). Once one is familiar with the search routines, information about research activities is very easy to obtain. The dexterity of the CRIS search engine is high, allowing for precise extraction of the data that is available. If one is well-versed in the Commodity and Area of Science classification schemes, and these are pertinent to one's subject, defining the universe of active research projects is easy. At the risk of appearing overly fascinated with electronic media, it is difficult to overstate the potential utility of this system for analysis of the "research portfolio" by various constituencies outside of the professional research community. The *accessibility* of this information *can* provide much more effective interaction of farmers with investigators, administrators and policy-makers.

These high marks for the mechanism of the CRIS retrieval system do not apply to the *quality of content* on the database. There appear to be many layers of overlapping and sometimes conflicting purposes built in to the various parts of the database. The administrative need for detailed bureaucratic data are combined with those of the scientific community for information flow, as well as with the needs of policy-makers for justification and accountability. These requirements are not always consistent, and it is difficult to know which master is being served in a given report or statement.

The CRIS Web Site is a powerful tool for analysis of the "research portfolio."

In using the CRIS reports for our study we learned that there is a great deal to read between the lines. Project narratives are clearly dressed up to meet certain expectations, which can cut many ways. On one hand, for example, standard herbicide trials might be emphasized in a CRIS report by a researcher interested in non-chemical alternatives in order to make the work look respectable to a conservative administrator. On the other hand, a gratuitous cover crop trial might be included in a report to make standard chemical-intensive work appear "sustainable" to policy-makers. In both cases the accuracy of the report as an honest picture of research activity is compromised.

The aspect of the CRIS system that we found most troubling was the policy restricting access to funding data. USDA policy is that funding data for individual projects is not publicly available. As a matter of basic government accountability, this policy is highly objectionable, and its ostensible rationale (protecting investigators from harassment) is difficult to appreciate.

4.12 Analysis of Organic-Pertinent Research Topics

Table 7 *(Page 52)* shows the counts for each of twelve "Research Topic" categories, also broken down by Organic-Pertinence rating. For all 301 organic projects, 69% were categorized as "biocontrol" projects; 5% were "Basic Science", 7% were "Compost-Related" projects, 2% were "Educational" or economics-related, and 17% were categorized as "Soil Management".

Overall, the organic-pertinent research found in CRIS is heavily dominated by projects categorized as *biological control* (208 of 301 projects). Of three sub-categories (*breeding, introduced,* and *systemic*) the large majority (162 of 208)are *introduced biocontrol* projects. That is, projects which are investigating the introduction of biocontrol organisms from an external source.

These projects include a wide range of subjects: the classical mass introduction of insect-vs.-insect parasitoids, such as "UNDERSTANDING AND IMPROVING TRICHOGRAMMA TECHNOLOGY FOR CODLING MOTH AND LEAFROLLER CONTROL" (Accession#9149534); investigation of viral and fungal pathogens of insect pests (#9154845 "BROAD SPECTRUM ENTOMOPATHOGENS FOR CONTROL OF LEPIDOPTEROUS PESTS"); a wide spectrum of biological weed antagonists ("DISCOVERY AND DEVELOPMENT OF PLANT PATHOGENS FOR BIOLOGICAL CONTROL OF WEEDS", #9150292, 9150348, 9150349); microbial antagonists of soilborne diseases (#9149513, "BIOCONTROL OF SOILBORNE PLANT PATHOGENS USING NATURAL ATTRIBUTES OF MICROBES AND THEIR ENVIRONS") and a few novel subjects such as #9167887, "A COST-EFFECTIVE BACTERIAL SEED TREATMENT FOR SEED ROT".

Almost all of the *introduced biocontrol* projects are rated as Weak Organic. (Only one of these 162 projects actually is described in a specific organic context: #9157299, "BIOLOGICAL SUPPRESSION OF SOILBORNE PLANT PATHOGENS".) While these projects are all potentially of interest and use to organic farmers, they are not the most worthwhile. They mostly illustrate the two general failures of current "IPM" efforts: they are not usually targeted or optimized for systems that are already based on non-chemical management, and they attempt to treat beneficial biological entities as packageable commodities rather than emergent features of dynamic agricultural ecosystems.

Most "biocontrol" projects are not optimized for organic management, and are not systems-oriented.

The few projects which we characterized as *systemic biocontrol* (43 total, 9 Strong Organic, 34 Weak Organic) are clearly distinctive in their objectives and approach. Among the Strong Organic projects, a good example is #9084860 "HABITAT MANAGEMENT FOR BIOLOGICAL CONTROL OF INSECT PESTS OF VEGETABLE, FRUIT AND ROW CROPS": "Determine the ecological mechanisms underlying pest regulation in diversified agroecosystems…test insect population dynamics and pest mortality induced by biological control agents…[under] several crop associations and sequences". A good Weak Organic example is #9152030 "INSECT MANAGEMENT: AN ECOSYSTEM ANALYSIS APPROACH FOR PREVENTIVE PEST MANAGEMENT": "develop the conceptual framework for ecosystem analysis of pest-crop systems [and] evaluate alternative insect management strategies."

The final sub-category of biocontrol *breeding* projects included only three projects, all Weak Organic. This illustrates the absence of any interest in non-recombinant-DNA plant breeding for systems based on non-chemical management.

A special category in our analysis of organic-pertinent research topics is *compost.* 21 projects with a specific emphasis on compost were identified, all Weak Organic. Ten of the projects were sub-categorized for compost *effects*, and 11 for compost production *technology*.

Most of these projects would be considered "rudimentary" by organic farmers and established producers of high-quality composts. Most of these projects treat "compost" as a monolithic variable and do not attempt to deal with the detailed microbiological variables and processes that are at the frontier of practical compost science. Among the best of these projects is #9162744 "SUSTAINED SUPPRESSION OF PYTHIUM DISEASES: INTERACTIONS BETWEEN COMPOST MATURITY AND NUTRITIONAL [CONTENT]". This project's objective was to relate, "organic matter decomposition level, soil microbial biomass and activity, microbial species composition, population of Pythium spp., and root rot severity."

Another special category in our analysis is that of *basic science*. While the basis for this category is less distinctive than the others, it recognizes that some projects are pursued with no specific practical goal, but develop new scientific knowledge that can underpin multiple potential applications. We assigned 14 projects to the *basic science* category. Eight projects were put in the *basic entomology* subcategory and six projects in the subcategory *basic microbiology.* An example of the *entomology* group is #9152513, "TRITROPHIC INTERACTIONS IN NATURAL AND MANAGED ECOSYSTEMS" which aimed to "understand how and why the ability of natural enemies to recognize hosts varies with the plant genotype on which the host is raised [and] determine how host plant chemicals mediate interactions between herbivorous insects and their natural enemies." Within the *microbiology* subcategory, three projects shared the same title: "DIVERSITY AND INTERACTIONS OF BENEFICIAL BACTERIA AND FUNGI IN THE RHIZOSPHERE" (#9168960, #9168978, #9170547). These projects performed a variety of investigations examining basic processes of soil microbial communities.

The fourth main category of research topics is *soil management.* This is the second largest category with 51 total projects. It is the largest topical group of Strong Organic projects (17 of 34). The large proportion of Strong projects indicates that this is currently the most fruitful area for research with a particular organic focus. While this is not saying much in the scheme of things, it is a positive sign. These projects are important building blocks for assembling a successful organic research program.

> "Soil Management" is currently the most fruitful area for Strong Organic research.

The *biological soil management* subcategory (21 projects) included a variety of research aimed at creating yield or soil quality effects by manipulating biological factors. One of two Strong Organic projects in this group is #9167730 "ROLE OF SOIL MICROBIAL BIOMASS AND MICROBIVOROUS NEMATODES IN SUSTAINABLE AGRICULTURAL SYSTEMS" which analyzed a number of soil biological parameters in relation to certain cropping practices within a comparative systems-trial setting. Among the Weak Organic projects a good example is #9163501 “MANAGING MYCORRHIZAL FUNGI FOR INCREASED CROP YIELDS AND NUTRIENT RETENTION” which focused on the “effects” of vesicular-arbuscular mycorrhizae as a variable soil quality feature.

The *mineral soil management* group (six projects) had two Strong Organic projects, including #9097217 “THE COMPOSITION AND DYNAMICS OF SOIL ORGANIC MATTER” which studied the long-term dynamics of Carbon and Nitrogen in an organic farming system.

The *physical soil management* projects (2) featured a very interesting project, #9138650 “CONSERVATION TILLAGE SYSTEMS AND MANAGEMENT OF PLANT RESIDUES FOR PRODUCTION OF CABBAGE”. This project examined, “the effects of soil temperature, methods of managing cover crop residues, and tillage systems on growth and yields of cabbage.” The most interesting aspect of this work was development of a combination “no-till” transplanter and residue-management tool for vegetable production.

Surprisingly, the largest soil management subcategory (22 projects) was *systemic soil management.* This included 17 Strong Organic projects, half of the entire Strong total. Among these projects are several whose stated objectives approach the ideal of systems-oriented organic farming research. For example, #9170040 “THE TRANSITION FROM CONVENTIONAL TO LOW-INPUT OR ORGANIC FARMING SYSTEMS:SOIL BIOL. & SOIL FERTILITY”, proposes these objectives:

> 1. To determine the effect [of] organic matter inputs on the abundance, dynamics, and function of the soil microbial community. 2. To determine the effects of management of soil microbial abundance on soil food web structure, diversity, and function. 3. To determine the relationship between nitrogen form and availability in the rhizosphere and its uptake and partitioning by plants.

Another Strong Organic project (#9171738, “DEVELOPMENT OF INDICATORS OF SOIL HEALTH IN AGRICULTURAL SYSTEMS”) described objectives that emphasize the advancement of appropriate methods for both studying biological fertility in the lab, as well as on the farm:

> Identify sensitive laboratory measurements indicative of a soil ecosystem that maintains a high level of active soil organic matter in the long-term and is favorable for beneficial soil organisms. Develop practical field measurements of soil health, and nutrient and carbon budgets for use in managing on-farm conventional and/or organic/biological cropping systems.

The best projects appear to represent the foundations of excellent organic research programs.

To the extent that these projects can fulfill their objectives, they appear to represent the foundations of excellent organic research programs.

TABLE 7

COUNT OF ORGANIC-PERTINENT PROJECTS BY TOPIC AND RATING

RESEARCH TOPIC		RATING: OC	OC+	OE	OS	OS+	Grand Total
BIOCONTROL	bc-b	3	0	0	0	0	3
	bc-i	161	1	0	0	0	162
	bc-s	34	5	0	0	4	43
BIOCONTROL Total	....	198	6	0	0	4	208
BASIC SCIENCE	bs-e	8	0	0	0	0	8
	bs-m	6	0	0	0	0	6
BASIC SCIENCE Total	....	14	0	0	0	0	14
COMPOST	co-e	10	0	0	0	0	10
	co-t	11	0	0	0	0	11
COMPOST Total	....	21	0	0	0	0	21
EDUCATIONAL	econ	0	0	3	0	0	3
	edu	0	0	4	0	0	4
EDUCATIONAL Total	....	0	0	7	0	0	7
SOIL MGMT.	sm-b	19	1	0	1	0	21
	sm-m	4	2	0	0	0	6
	sm-p	2	0	0	0	0	2
	sm-s	9	5	0	7	1	22
SOIL MGMT. Total	....	34	8	0	8	1	51
GRAND TOTAL		**267**	**14**	**7**	**8**	**5**	**301**

RATING=EVALUATION OF ORGANIC CONTENT

OC =Organic Component, organic identity inferred
OC+ =Organic Component, organic identity explicit
OE =Organic Educational/Economic, organic identity explicit
OS =Organic System, comparative with other systems
OS+ =Organic System, dedicated

TOPIC=RESEARCH EMPHASIS

bc-b=Biocontrol-Breeding
bc-i=Biocontrol-Introduced
bc-s=Biocontrol-Systemic
bs-e=Basic Science-Entomology
bs-m=Basic Science-Microbial
co-e=Compost Effects
co-t=Compost Technology
econ=Economics
edu=Educational/Demonstration
sm-b=Soil Management-Biological
sm-m=Soil Management-Mineral
sm-p=Soil Management-Physical
sm-s=Soil Management-Systemic

4.13 COMMODITY EMPHASIS OF ORGANIC PROJECTS

Table 8 shows the commodity focus for all organic-pertinent projects and the split between Strong and Weak Organic projects for each commodity.

Vegetables were largest distinct commodity focus among all organic-pertinent projects (59 of 301). However, the overlapping categories of “corn/soybeans” (38), “field crops” (27), “grains” (7) and “oilseeds” (3) combine for a total of 75 projects. The various fruit-related categories have a combined total of 58 projects. Overall these results indicate a fairly even distribution among the major categories of plant crops.

Among only Strong Organic projects the results are similar. Vegetables are the highest single number (9), but field crops and corn/soybeans combined included 10 projects.

Only two projects were found that specifically focused on livestock husbandry. The combined categories of “rangeland” and “forage crops” had 17 projects, indicating some focus on livestock-related systems, but these were focused mainly on weed biocontrols as an aspect of land manage-

TABLE 8

ORGANIC PROJECTS BY COMMODITY

COMMODITY	Strong	Weak	Grand Total
vegetables	9	50	59
corn/soybeans	2	36	38
field crops	8	19	27
mixed	7	16	23
fruit/apples	1	19	20
fruit&nuts/misc.	1	19	20
potatoes	1	15	16
cotton	1	15	16
wheat	0	13	13
compost	0	12	12
rangeland	0	10	10
fruit/citrus	0	10	10
fruit/grapes	2	6	8
grains	1	6	7
forage crops	0	7	7
ornamentals	0	5	5
rice	0	3	3
oilseeds	0	3	3
coffee	0	2	2
dairy	1	0	1
cattle	0	1	1
Grand Total	**34**	**267**	**301**

TABLE 8A

ORGANIC PROJECTS BY TOPIC AND COMMODITY

	TOPIC					
COMMODITY	biocon	basic sci	compost	edu	soil mgt.	Grand Total
vegetables	43	1	5	2	8	59
corn/soybeans	24	1	0	0	13	38
field crops	15	2	0	1	9	27
mixed	13	3	0	4	3	23
fruit&nuts/misc.	18	0	0	0	2	20
fruit/apples	17	1	1	0	1	20
cotton	14	1	0	0	1	16
potatoes	10	1	0	0	5	16
wheat	10	1	1	0	1	13
compost	0	0	12	0	0	12
fruit/citrus	8	2	0	0	0	10
rangeland	10	0	0	0	0	10
fruit/grapes	7	0	0	0	1	8
forage crops	6	1	0	0	0	7
grains	3	0	0	0	4	7
ornamentals	3	0	1	0	1	5
oilseeds	2	0	0	0	1	3
rice	3	0	0	0	0	3
coffee	1	0	1	0	0	2
cattle	1	0	0	0	0	1
dairy	0	0	0	0	1	1
Grand Total	**208**	**14**	**21**	**7**	**51**	**301**

ment, rather than any aspect of livestock management *per se.*

Table 8a *(Page 54)* provides the breakdown of each commodity category by research topic area, showing particularly strong relationships between vegetables and biocontrol, and between soil management and corn/soybeans.

4.14 Institutional Features of Organic Projects

Table 9 *(Page 56)* shows the occurrence of organic projects by state, and the breakdown for ARS and non-ARS projects in each state. For all projects, the highest state totals were California (33), Florida (29), Maryland (18), Washington (17), and New York (17), Ohio (11), Texas (10), and Wisconsin (10). These eight states encompass 145 projects, 48% of all organic-pertinent projects.

When ARS projects are excluded to more accurately show individual state support, the rankings shift to California (28), Florida (21), New York (16), Ohio (11), Wisconsin (10), and Alabama (9). The total for these six states (95) is 45% of all non-ARS organic-pertinent projects.

For Strong Organic projects only, including ARS projects, the highest occurrences are in California (8), and Michigan, North Carolina, and Ohio each have 3. These four states represent 50% of all the Strong Organic projects found.

The concentration of organic projects in a few states is not surprising, given the overall scarcity of organic research. The influence of a few key faculty members in a state university, the conviction of a lone Extension agent, or the organized demands of organic foods industry members would be sufficient to generate a few projects in a single state and show up as a noticeable "blip" on an otherwise very quiet radar screen.

Table 10 *(Page 57)* shows the distribution of Strong and Weak Organic Projects according to USDA agency funding source. These agency baselines will be a particularly useful tool for future evaluation of USDA's organic research commitments.

> ARS funded only two Strong Organic projects, suggesting deeper persistence of the organic taboo within the agency.

The number of Strong Organic Projects funded by ARS is certainly very low (two out of 82 total ARS projects), perhaps reflecting deeper persistence of the organic taboo within the USDA's own research facilities. Also of interest is the total (2 Strong, 23 Weak) from the Competitive Research Grants Office (CRGO). This office administers funds of the National Research Initiative (NRI), a national competitive grants program intended to overcome institutional and scientific inertia within the land grant university system. Since ARS is a much larger agency, these results put the NRI in a favorable light. The contrast between these two agencies probably says more about ARS than the NRI, but it may also indicate the benefits of a competitive funding format, and perhaps a greater opportunity to pursue systems-oriented research under NRI funding.

TABLE 9

ORGANIC-PERTINENT PROJECTS BY STATE AND AGENCY TYPE

STATE	ARS	NON-ARS	TOTAL
AK	0	1	1
AL	0	9	9
AR	0	8	8
AZ	1	0	1
CA	5	28	33
CO	1	4	5
CT	0	1	1
DC	3	0	3
DE	0	1	1
FL	8	21	29
GA	4	3	7
HA	2	1	3
HI	0	5	5
IA	0	1	1
ID	2	6	8
IL	2	3	5
IN	0	3	3
IO	0	1	1
KS	1	5	6
KY	0	5	5
MA	0	3	3
MD	16	2	18
ME	0	2	2
MI	1	8	9
MN	0	6	6
MO	0	1	1
MS	2	0	2
MT	5	5	10
NC	1	6	7
ND	0	2	2
NE	0	2	2
NJ	0	1	1
NM	0	3	3
NY	1	16	17
OH	0	11	11
OK	1	0	1
OR	1	2	3
PA	3	5	8
SC	0	3	3
SD	1	2	3
TN	0	1	1
TX	5	5	10
UT	0	3	3
VA	0	3	3
WA	11	6	17
WI	0	10	10
WO	1	0	1
WV	4	3	7
WY	0	2	2
Grand Total	**82**	**219**	**301**

TABLE 10

ORGANIC PROJECTS BY AGENCY AND RATING

RATING	AGENCY ARS	CRGO	CSRS	OCI	SAES	SBIR	Grand Total
OC	80	23	143	1	14	6	267
OC+	2	0	12	0	0	0	14
OE	0	0	4	0	2	1	7
OS	0	1	5	0	2	0	8
OS+	0	1	2	0	2	0	5
Grand Total	**82**	**25**	**166**	**1**	**20**	**7**	**301**

4.15 Analysis of Funding Data

Due to standing departmental policy, we were not able to obtain funding data from USDA for individual projects. After several requests and the contemplation of a lengthy disclosure process under the Freedom of Information Act, we were able to get combined data for Fiscal Year 1995 only. Due to the time and potential costs of an FOIA request, we accepted the aggregate data for the purposes of this report. The aggregate funding data is summarized in Table 11 *(Page 58)*, along with our estimates for the potential contribution of SARE program grants not found on CRIS. The state-by-state details are shown in Tables 12 and 13. Table 12 *(Page 59)* shows funding amounts by state and region for the 15 Strong Organic projects that received USDA funding in FY1995. Table 13 *(Page 60)* shows the data by state and region for 192 organic-pertinent projects (Strong and Weak combined) with FY 1995 funding.

For the 15 Strong Organic projects, total USDA funding in FY 1995 was $1.5 million. **This total is less than one-tenth of one percent of USDA's 1995 total research and education appropriation of approximately $1.8 billion.** Even this small amount is misleading: one single project accounts for 81% of the Strong Organic total. **The remaining 14 projects received a total of only $280,000 in FY 1995**.

Based on our estimate of SARE program support of organic research (Section 4.7), we think that it could add an additional $100,000-$500,000 to the total of Strong Organic annual USDA funding. The wide range of this estimate is the product of two combined uncertainties: 1) which projects were actually included in the aggregate funding data provided by USDA, and 2) which SARE projects actually qualify as Strong Organic.

> Total USDA FY'95 funding for Strong Organic projects on CRIS was $1.5 million.

For all organic-pertinent projects (Strong and Weak combined), 192 projects had FY1995 funding from USDA. The aggregate funding data supplied by USDA are shown in Table 12, totaling $15.5 million. This amount is approximately 0.9 percent of all USDA research and extension appropriations. Again, a handful of large ARS projects appear to make up a large chunk of the funding totals.

The additional contribution of SARE projects not already included in the aggregate data for all organic-pertinent projects is very roughly estimated at $1- to $2 million.

The aggregate figures compiled for us by USDA have a certain amount of uncertainty attached to them, but they do provide a basic benchmark for the order of magnitude of support for organic

TABLE 11

SUMMARY OF FY1995 FUNDING DATA FOR ORGANIC-PERTINENT PROJECTS

	Aggregate FY 1995 USDA funding ($ millions)	Approximate % of USDA 1995 Research & Extension Appropriations
STRONG Organic Projects	1.5	0.08%
STRONG Organic Projects, with SARE estimate	1.6 - 2.0	0.09-0.11%
All Organic-Pertinent Projects (STRONG+WEAK)	15.5	0.86%
All Organic Projects, with SARE estimate	16.5-17.5	0.92-0.97%

The funding data is another indicator for USDA's failure to recognize the growing importance of organic farming.

FY95 FUNDING FOR 15 "STRONG ORGANIC" PROJECTS

TABLE 12

	ARS	CSREES	Total USDA	Other Fed	Non Fed	TOTAL
Northeastern Region						
DELAWARE	0	0	0	0	0	0
DIST. OF COLUMBIA	0	0	0	0	0	0
MAINE	0	0	0	0	330	330
MARYLAND	0	0	0	0	0	0
MASSACHUSETTS	0	0	0	0	0	0
NEW YORK	0	0	0	0	0	0
PENNSYLVANIA	0	0	0	0	0	0
WEST VIRGINIA	0	0	0	0	0	0
Region Total	$ -	$ -	$ -	$ -	$ 330	$ 330
Southern Region						
ALABAMA	0	0	0	0	0	0
ARKANSAS	0	0	0	0	0	0
FLORIDA	0	0	0	26,211	70,441	96,652
GEORGIA	0	1,771	1,771	0	38,214	39,985
KENTUCKY	0	0	0	0	0	0
MISSISSIPPI	0	0	0	0	0	0
NORTH CAROLINA	0	0	0	0	0	0
OKLAHOMA	0	0	0	0	0	0
SOUTH CAROLINA	0	0	0	0	0	0
TEXAS	1,239,808	0	1,239,808	0	0	1,239,808
VIRGINIA	0	0	0	0	0	0
Region Total	$ 1,239,808	$ 1,771	$ 1,241,579	$ 26,211	$ 108,655	$ 1,376,445
North-Central Region						
ILLINOIS	0	0	0	0	0	0
INDIANA	0	0	0	0	0	0
IOWA	0	0	0	0	152,903	152,903
KANSAS	0	0	0	0	30,302	30,302
MICHIGAN	0	17,984	17,984	0	89,075	107,059
MINNESOTA	0	0	0	0	0	0
MISSOURI	0	0	0	0	0	0
NEBRASKA	0	0	0	0	0	0
NORTH DAKOTA	0	0	0	0	0	0
OHIO	0	0	0	0	0	0
SOUTH DAKOTA	0	7,679	7,679	671	18,065	26,415
WISCONSIN	0	23,962	23,962	0	21,249	45,211
Region Total	$ -	$ 49,625	$ 49,625	$ 671	$ 311,594	$ 361,890
Western Region						
ARIZONA	0	0	0	0	0	0
CALIFORNIA	0	225,000	225,000	906	163,158	389,064
COLORADO	0	0	0	0	0	0
HAWAII	0	0	0	0	0	0
IDAHO	0	0	0	0	0	0
MONTANA	0	0	0	0	0	0
NEW MEXICO	0	0	0	0	0	0
OREGON	0	0	0	0	0	0
UTAH	0	0	0	0	0	0
WASHINGTON	0	3,811	3,811	0	111,142	114,953
Region Total	$ -	$ 228,811	$ 228,811	$ 906	$ 274,300	$ 504,017
TOTAL	**$ 1,239,808**	**$ 280,207**	**$ 1,520,015**	**$ 27,788**	**$ 694,879**	**$ 2,242,682**

TABLE 13 FY95-96 AGGREGATE FUNDING DATA FOR 192 "ORGANIC -PERTINENT" PROJECTS

	ARS	CSREES	Total USDA	Other Fed	Non-Fed	TOTAL
Northeastern Region						
DELAWARE	0	15,000	15,000	0	45,851	60,851
DIST. OF COLUMBIA	248,000	0	247,912	0	0	247,912
MAINE	0	0	0	0	330	330
MARYLAND	3,539,000	0	3,539,186	0	2,465	3,541,651
MASSACHUSETTS	0	0	0	0	0	0
NEW YORK	228,000	240,000	467,870	6,131	209,036	683,037
PENNSYLVANIA	302,000	35,000	336,940	6,354	89,136	432,430
WEST VIRGINIA	1,037,000	52,000	1,088,841	0	63,700	1,152,541
Region Total	**5,355,000**	**341,000**	**5,695,749**	**12,485**	**410,518**	**6,118,752**
Southern Region						
ALABAMA	0	107,000	107,021	0	129,075	236,096
ARKANSAS	0	36,000	36,471	0	250,718	287,189
FLORIDA	135,000	143,000	277,552	119,106	855,724	1,252,382
GEORGIA	431,000	2,000	432,639	782	62,698	496,119
KENTUCKY	0	168,000	168,454	0	365,832	534,286
MISSISSIPPI	650,000	0	650,419	0	0	650,419
NORTH CAROLINA	25,000	200,000	224,271	19,740	323,970	567,981
OKLAHOMA	334,000	0	333,794	0	0	333,794
SOUTH CAROLINA	0	207,000	206,615	0	0	206,615
TEXAS	2,155,000	335,000	2,489,277	18,213	677,095	3,184,585
VIRGINIA	0	50,000	50,245	40,588	227,292	318,125
Region Total	**3,729,000**	**1,247,000**	**4,976,758**	**198,429**	**2,892,404**	**8,067,591**
North-Central Region						
ILLINOIS	462,000	79,000	540,689	39,504	174,860	755,053
INDIANA	0	28,000	28,099	75,748	145,869	249,716
IOWA	0	47,000	46,787	0	246,999	293,786
KANSAS	785,000	28,000	812,450	30,646	163,916	1,007,012
MICHIGAN	25,000	216,000	240,562	5,843	208,091	454,496
MINNESOTA	0	201,000	200,762	0	123,082	323,844
MISSOURI	0	16,000	16,084	0	52,129	68,213
NEBRASKA	0	25,000	25,338	0	170,770	196,108
NORTH DAKOTA	0	25,000	24,840	0	26,890	51,730
OHIO	0	85,000	84,672	172,350	414,720	671,742
SOUTH DAKOTA	400,000	8,000	407,415	671	18,065	426,151
WISCONSIN	0	190,000	190,477	54,046	192,668	437,191
Region Total	**1,671,000**	**947,000**	**2,618,175**	**378,808**	**1,938,059**	**4,935,042**
Western Region						
ARIZONA	126,000	0	125,626	0	0	125,626
CALIFORNIA	355,000	659,000	1,014,290	27,322	1,931,835	2,973,447
COLORADO	31,000	198,000	228,554	177,156	196,723	602,433
HAWAII	36,000	70,000	106,248	0	178,317	284,565
IDAHO	49,000	156,000	205,577	22,664	261,371	489,612
MONTANA	263,000	173,000	435,777	16,988	213,866	666,631
NEW MEXICO	0	61,000	60,531	34,975	80,243	175,749
OREGON	0	23,000	22,547	39,383	173,315	235,245
UTAH	0	34,000	34,073	23,203	109,580	166,856
WASHINGTON	0	7,000	7,287	8,130	256,896	272,313
Region Total	**859,000**	**1,381,000**	**2,240,510**	**349,821**	**3,402,146**	**5,992,477**
TOTAL	**11,615,000**	**3,917,000**	**15,531,192**	**939,543**	**8,643,127**	**25,113,862**

farming research. Clearly, the funding directed towards projects investigating organic farming methods within a stated organic context is so low as to be almost off the screen. Without even addressing the issue of fairness, the funding data is another indicator of the basic strategic and scientific failure to recognize the growing importance of organic farming in the fabric of America's agricultural system.

Chapter 4 Notes

[1] Ricker, 1993. The six projects are:

-"Marketing Organic Fresh Produce in Colorado Supermarkets", Colorado, 1990, $33,000.

-"Deep Root Organic Growers – Marketing and Distribution", Massachusetts, 1990, $19,000.

-"Examining the Marketing of Locally raised Organic Meat, Eggs, and Animal Products", Massachusetts, 1990, $3,000.

-"Development of an Information Clearinghouse for the Organic Produce Market", New Jersey, 1991, $58,500.

-"Evaluating Agronomic Materials of the Organic Foods Industry", Oregon, 1991, $80,000.

-"Northern Plains Organic Crops Marketing Analysis", North Dakota, 1991, $41,720.

[2] We also tried "agroecology", which returned zero projects.

[3] Searches for all of these terms included various permutations, e.g., "seaweeds" for kelp, or "homeopathic-remedies" for homeopathy.

[4] The acronym "IPM" was used for the keyword search, although the full string, "integrated-pest-management" was actually more prevalent. A check of "integrated-pest-management" showed that the vast majority of non-chemical projects in that search also used the keyword "biological-control", and therefore was redundant with other keyword searches.

[5] Walz, 1996, 4.

[6] The "SARE" keyword search actually produced 65 returns, but 28 of these were "umbrella" grants, documenting the annual disbursement of funds to the four Regional Administrative Councils. The Councils then award funds to individual projects.

[7] The SARE website address is http://www.ces.ncsu.edu/san

[8] Kim Kroll (SARE Associate Director), personal communication, February 24, 1997. This list included all types of SARE projects: "Chapter 1" institutional research grants, "Chapter 3" Extension Professional Development Grants, and "farmer/producer research grants".

Conclusions & Recommendations

Chapter 5

5.1 Overview: What's Wrong With This Picture?

With this study we have obtained a "snapshot" of the national agricultural research portfolio, focused on the small section dedicated to organic farming. In this snapshot, organic-pertinent research is disproportionately small against the background of the organic sector's size and growth rate. Organic farming research is also jarringly undersized with respect to the wider background of existing policy goals to reduce environmental risks in agriculture and pursue "sustainability". Against these backdrops, the minuscule level of organic research activity doesn't make much sense.

Within the snapshot's main area of focus there are a few bright spots ("Strong Organic" projects), actual highlights that seem to contain some important information. A significant feature of the organic part of the picture is the relatively high proportion of on-farm investigations and/or farmer participation. Around the periphery of the core area is a somewhat larger, less focused region ("Weak Organic" and "Potential Organic" projects) that contains some items of genuine but limited use to the organic sector.

The limited quality of the picture as a whole makes the act of recognition somewhat unreliable, but the relative proportions and contrasts seem (unfortunately) consistent with what we have experienced. The "camera" which we have used (the CRIS electronic database) seems capable of capturing very precise, clear images, but the substantive content has numerous flaws undermining the quality of the picture.

The key findings of our study are stated briefly below, followed by our policy recommendations to USDA.

5.2 Key Findings

-Organic farmers (and would-be organic farmers) are severely under-served by the research system. Persistent ideological barriers prevent exploration of organic farming's potential contributions to the nation's agricultural, environmental, and economic goals.

This conclusion comes as no surprise, given the historical antipathy of the research system towards organic farmers. Since the 1980 *Report and Recommendations on Organic Farming*, organic farming has been officially invisible to the national research policy leadership. While USDA
wasn't looking, the organic foods industry grew into a domestic market of over $3.5 billion in retail sales, served by over 10,000 farms throughout all areas of the country. This occurred with

almost no support whatsoever from the public agricultural research system.

The low frequency of organic-pertinent research is indicative of a general underinvestment in ecological knowledge, especially with respect to soil microecologies. There is a vast realm of scientific ignorance simply regarding the *identification* of soil microbial life, let alone understanding or managing the infinitely complex interactions that occur in healthy agroecosystems. Phenomena such as *humus* and *organic matter* are largely treated as "black boxes" with vaguely understood beneficial properties but remaining mysterious in their specific functions and interactions. Overcoming these barriers is scientifically possible, but may require significant changes in institutional structures and methodological paradigms.

-The small group of "Strong-Organic" projects found represents some important scientific leads. However, (with one or two exceptions) these projects are not the result of any coherent policy or scientific strategy. Neither are they purposefully related to the specific needs of organic farmers.

This handful of projects constitutes the "leading edge" of agroecological research within the traditional research system. As such, how worthwhile are they? The actual quality of the research "product" from these projects is not possible to ascertain from the CRIS reports, but their presence alone is an important foundation on which an organic research agenda can begin to be built.

While the presence of these projects can be viewed positively, there is still no deliberate intent to pursue organic farming research as a strategic objective. As a result, we see that organic research projects occur haphazardly. Most of them are clumped in a few institutions and otherwise they are scattered widely. Nor is there any systematic effort to collect existing knowledge about organic methods or deliver such information to a targeted audience.

-Organic farms are largely unacknowledged as a reservoir of methods and biological resources for the development of "IPM", "sustainable practices" and recombinant/biopesticide products. These extractions of isolated features are overlooking the systemic ecological context from which these features arise.

The large body of current research focused on "Integrated Pest Management" and "biological control" is laudable as far as it goes. However, almost all of this work still takes place in the context of routine pesticide use and reliance on soluble-mineral fertilizer inputs. Most of this research focuses on manufactured biological pesticide inputs or exotic predators, and very little on the understanding and management of ecological processes inherent in the agricultural environment. In effect, much of this work seems directed at replacing the chemical pesticide treadmill with a biopesticide one.

While much of IPM/biocontrol research is of only marginal benefit to managers of organic farming systems, the reverse is not true. Practices developed and refined by organic farmers appear frequently in the CRIS database as attempts to "patch" these practices onto conventional systems as partial substitutes for chemical inputs or enhancements to their efficiency. Thus in the name of "use reduction", researchers are conducting trials on cover crops, beneficial insect habitats, composts, crop rotations, etc. Likewise, we found examples of research projects that are attempting to extract organisms or gene sequences from organic farms where pest- or disease-suppressive behav-

There is still no deliberate intent to pursue organic farming research as a strategic objective.

ior has been observed.

However, the function and efficacy of these components cannot be separated from their overall ecological context. The natural support system – the context of biological relationships in which the beneficial traits have emerged – is missing. They will not substitute effectively over time for individual chemicals as isolated features of a conventional system.

-Access to the CRIS system on the Internet is a profoundly powerful tool for direct farmer involvement with the research process, including accountability for pursuit of policy goals. The content of CRIS reports is generally poor for that purpose. Organic farming information is particularly obscure within the CRIS system.

Although the content leaves much to be desired, farmers' use of the CRIS database by way of personal computers is a fast and effective way to find the information that is there. There will be an increasing need for producers to shorten the loops and time lags between the identification of their problems, the pursuit of research programs, and the application of research results to farm management. Electronic access to current research information holds great potential for shortening those loops.

As funding decisions and priority-setting become increasingly driven by "stakeholder" participation, familiarity with the substance of research programs will become more important. Producers are only one among many "customers" of the agricultural research system, and access to information such as CRIS is essential to advocating our interests and providing accountability for performance.

The search for a "non-disciplinary" term such as "organic farming" was particularly difficult. With no Commodity Code or Area of Science Code reserved for this area of investigation, we were left to the whims of researchers' keyword selections. While this was an extremely educational exercise for us, it should not be necessary for others in the future.

5.3 Recommendations

The following policy recommendations are directed primarily to the U.S. Department of Agriculture. Advancing an organic farming research agenda will ultimately require adoption of complementary policies at all levels of the research system, but direction from USDA is a necessary step. We feel that these recommendations logically reflect the findings of this study and are necessary to *begin* redressing the last 17 years of official neglect.

These recommendations are also offered to the organic farming and scientific communities as a starting point for dialogue about the policy framework for organic farming research. Since the dismissal of the 1980 *Report and Recommendations on Organic Farming*, such dialogue has been almost totally absent. Whether or not there is agreement with any of these recommendations, if they provoke direct engagement by organic farmers and advocates with agricultural research policy-makers, then this effort will have succeeded to a large degree.

Our recommendations are presented in three sections: *Policy Recognition, Short-Term Actions* and *Longer-Term Actions.*

Policy Recognition

1. USDA should issue a basic policy statement recognizing that organic farming can play a significant role in meeting the nation's agricultural, environmental, and economic development needs.

The long-standing taboo against recognizing and investigating organic farming in its own right must be decisively exorcised. A policy statement by the Secretary of Agriculture will not alone dispel the ideological hostility which still pervades much of the agricultural research system, but the anti-scientific antagonism towards organic research will surely never be countered without such a statement. Those who are working to change attitudes from the bottom upward must be met by a signal of acceptance from the top.

It is our belief that the scientific value, and the food security and environmental benefits of organic farming systems, are at least as compelling as the economic growth currently exhibited by the organic foods industry. If the taboo is broken, these attributes will ultimately be able to stand on their own as justifications within the competitive environment of shrinking allocations for public research.

An extremely valuable opportunity to present an organic research policy statement will arrive with the promulgation of national regulatory standards for organically produced products. The issuance of these standards will mean, finally, that an official USDA definition exists which can inform and clarify research activity. This will be an ideal time for USDA to simply say, "Organic farming is part of American agriculture and it has a legitimate place in the portfolio of national research priorities."

Short Term Actions

2. Collection and dissemination of information about organic agriculture should be a routine and expected task for all relevant USDA agencies.

Each USDA Agency whose Mission is relevant to farming production systems, agricultural markets or food consumption should have designated staff responsible for the collection and dissemination of information on organic farming that is appropriate to its Mission. USDA should establish an inter-agency network of such designated staff, possibly under the Sustainable Development Council, to coordinate informational efforts, encourage policy support for organic agriculture and develop performance objectives related to each agency's Strategic Plan.

3. Current efforts to improve the CRIS system should incorporate a definition of organic-pertinence and integrate it into the reporting system.

The CRIS Classification System should add a Commodity Code and/or an Area of Science Code for organic farming research. A CRIS classification for organic research would be a major improvement with relatively low costs. It must have two minimum requirements, as we have described in our study: compatibility with the National Organic Program's regulatory standards, and a research context (field setting or laboratory design) that specifically describes or anticipates applicability to organic systems.

CRIS reforms should recognize the inherent democratic power of electronic (Internet) access to research data, and re-design research reports with direct farmer-access in mind. Suggestions for making CRIS "producer-friendly" include: a one-paragraph description of, "What this means to farmers"; a "flag" for projects which include direct farmer-participation, and a brief description of the nature of the participation; and descriptions of a project's relationship to any stated producer-group agenda. An obvious related suggestion is to require all CRIS reports to reference a stated goal or objective of the funding agency (i.e., under the GPRA strategic planning process).

4. Implementation of USDA national initiatives (e.g., Fund for Rural America, National Research Initiative, Integrated Pest Management, Food Safety, etc.) should support and utilize organic farming research and education.

The guidelines for all such initiatives should recognize that organic farming can contribute strongly to environmental stewardship, rural community development, the profitability of American agriculture, and other goals. Organic farmers should be represented as stakeholders on the review and implementation panels for these programs.

5. Specific research and development support should be allocated for implementation of the National Organic Program.

This includes evaluation of production inputs and processing aids, collection and analysis of market data, and methods of verifying compliance with the standards. These tasks should be adopted as performance objectives by the appropriate USDA agencies.

Longer-Term Actions

6. USDA should undertake a national initiative for organic farming research.

A national effort to define and support organic farming research need not require new legislative authorization. Organic research is legitimately within the existing authority of all USDA research and education programs. A long-term national initiative should include the following features:

* **Assessment by all USDA research and education agencies of the potential contributions of organic farming to their Mission and Goals.**

Based on this assessment, resources should be allocated to strategically increase the investment in organic farming research, education and development. Pursuit of organic farming research, development and education should be integrated into the Strategic Plans of all relevant Department agencies.

* **Facilitating the development of scientific goals for organic farming research, bringing together producers and scientists to construct a long-term scientific agenda.**

USDA participation in an organic agenda-building effort would be completely consistent with the relationships that USDA has with numerous scientific associations and producers' groups.

* **Funding for multidisciplinary investigations emphasizing on-farm organic systems analysis, combining research and extension.**

This goal requires the development of methodological breakthroughs for investigating and extrapolating the *patterns of success*, i.e., the common relationships and systemic attributes among working organic farms. Despite the disappointing results of such prescriptions in the past, there are examples of effective on-farm systems research that can be built upon.

* **Establishing a national network of dedicated organic experiment stations, guided by local organic farmers.**

A national network of organic experiment stations will be crucial not only for controlled investigations of organic methods, but also for training research and extension professionals in an institutional setting. An advisory panel of producers would be the catalyst for interaction with the research community and help build bridges to research on working farms as well.

Afterword: Towards an Organic Farming Research Agenda

Following the NORPA Study

The Organic Farming Research Foundation will follow this study with several initiatives. First, the results of the study will be distributed to agricultural research policy makers and program administrators. Our objectives are to confront official neglect, raise awareness of the need for organic farming research and education, and provoke the identification of organic-pertinent research which was not found by this study.

OFRF will announce the study's results to the public at large with an energetic publicity campaign. Ultimately, the U.S. agricultural research program belongs to the country's taxpayers. As part of our mission to educate the public, the NORPA project may help to engage wider public debate about the nation's investment in agricultural research and the presence (or absence) of organic farming as a priority.

Follow-up activity will also focus on the scientific community. This report will be distributed to the scientific investigators who conducted the organic-pertinent projects found in our search. OFRF will ask the investigators for information about the results and applications of the research projects we have identified, in order to begin assessing their substantive quality. In addition, we will query the researchers about their interest in joining with farmers to begin building a long-term scientific agenda for organic farming research. Facilitating the construction of such an agenda will become a major objective for the Foundation.

During 1997, OFRF will conduct the third national survey of organic farmers. The 1997 survey will add greater detail to the body of data about organic farmers' research interests and needs obtained from two earlier national surveys. The 1997 survey analysis will examine multi-year trends indicated by data generated over six years' time.

The Foundation will continue to track organic-pertinent research activity. A repeat of this study to measure national progress will be considered for 1998 or 1999. Another important assessment task we will consider is analyzing research and extension activity at the state level. One particularly interesting search we have already begun is the identification of dedicated organic ground at agricultural experiment stations.

> Facilitating the construction of a scientific agenda for organic research will be a major objective for OFRF.

All of these plans and possible activities will take place in addition to the Foundation's ongoing grant-making program to support on-farm organic research.

Patterns of Success: Potential Directions for Organic Farming Research

As a step towards building a national agenda for organic farming research, the following ideas are offered for consideration. This is only a conceptual sketch of some possible directions for future work.

1) A national organic research agenda must utilize the good work that already has been done, however limited it is. There are a handful of excellent multidisciplinary studies that are rich with interesting questions and data about the behavior of organic farm systems. An important early task is to collate the best of this work and build hypotheses based on the issues they have raised.

2) It is imperative that we catalyze an explosion of applied science focussed on natural microbiological management. This effort would focus on what Dr. Elaine Ingham of Oregon State University has characterized as "the soil foodweb": the balance of beneficial "critters" in the soil, the quality of their habitat and their dynamic relationships with plants and pathogens. To borrow a phrase from Bill Mollison's permaculture lexicon, this would lead to a strategy of building *recombinant ecologies* (in contrast to the strategy of recombining isolated genetic traits).

3) We can use the best available technology —a significant effort to develop applied soil microbial ecology is not a low-tech proposition. It will require a great deal of our agricultural "rocket science" capacity, but focused in a new direction, starting fundamentally from the observation and analysis of working organic farms.

4) In an "organic model" of research strategy, we might expect the development of *replicated interdisciplinary teams* of scientists and farmers. Such teams could build regional soil-food-web databases, correlating beneficial organisms, soil types and seasonal variations. As farmers educate scientists about the integration of multiple variables in farm management, scientists should teach farmers how to collect scientific data and record it. We can envision a process of correlating scientific/experimental findings with patterns of behavior and performance on working farms, over time and based on many sites.

5) A commitment to easing the transition to organic systems suggests two obvious areas of development. The most basic aspects of successful organic farming are 1) the build-up and maintenance of organic matter in the soil, and 2) ecological diversity on the farm and crop rotation. Simply focusing on cost-effective improvement of these two fundamentals could provide enormous benefits to all segments of American agriculture.

In the first area, research and extension activity should address *lowering the capital costs of organic matter and soil biological activity.* This goal would encompass, for example, local and regional strategies of organic waste management, efficacy tests of microbiological additives and development of appropriate machinery.

The second fundamental area implies developing a strategy of *facilitating diversity.* This approach would include such topics as equipment design adaptable to many crops, new marketing infrastructures for multiple crop production, non-recombinant breeding and hybridization of varieties optimized for diversified organic systems, and integration of crop-livestock systems.

The suggestions above are only proposed as an introduction to what we hope will be a vigorous dialogue about the process and content of organic farming research. Whatever specific strategies

> We should catalyze an explosion of applied science focussed on natural microbiological management.

and topics are chosen, this effort is an investment in the long-term health and resiliency of our agricultural resources. It is an investment in restoring balance to the nation's agricultural research portfolio. Above all it is about collecting, integrating, disseminating and building upon the tremendous amount of knowledge that is growing on thousands of successful, organically managed farms. In other words, discerning and extrapolating the *patterns of success* inherent in the organic sector.

Constructing and implementing an organic research agenda is a long-term proposition. Whatever changes occur in public policy with respect to organic farming research, growers will continue looking to each other for knowledge, and facilitating this exchange will remain OFRF's primary activity for decades to come.

Two key development goals: lowering the costs of organic matter and facilitating ecological diversity on the farm.

Appendix A. Database of Organic-Pertinent Research Projects

Key To Appendix A

Appendix A contains data from 301 projects identified as "organic pertinent" in our search of the USDA Current Research Information System (CRIS) database during 1995-96. This Key outlines the data fields (**in bold**) and explains the abbreviations in each field. Projects are listed in 5 groups according to "Rating", and within each group in order of "ACC #". The CRIS database can be accessed via the Internet at <*http://cristel.nal.usda.gov:8080/*>. Project listings continue across two pages, linked by the "ACC#."

ACC #. This is the "accession number", the primary identifying code for each project report in the CRIS system. This number can be used to find the particular project report in the CRIS database.

TITLE. Title of the project as listed in CRIS.

S/W. Categorizes the project as "Strong Organic" (S) or "Weak Organic" (W) (see Chapter 3 for further explanation).

RATING. Categorizes project according to degree of "organic pertinence" (see Chapter 3).
'OS+'=Organic System, dedicated only to organic.
'OS'=Organic System, comparative with other systems.
'OE'=Organic Educational or Economic project, explicitly focused on organic farming.
'OC+'= Organic Component, explicitly studied in an organic farming context.
'OC'=Organic Component, inferred as studied in an organic or non-chemical management context.

TYPE. Categorizes project's general area of research (see Chapters 3 and 4). 'bc-b'=biocontrol-breeding; 'bc-i'=biocontrol-introduced; 'bc-s'=biocontrol-systemic; 'bs-e'=basic science-entomology; 'bs-m'=basic science-microbial; 'co-e'=compost-effects; 'co-t'=compost-technology; 'sm-b'=soil management-biological; 'sm-m'=soil management-mineral; 'sm-p'=soil management-physical; 'sm-s'=soil management-systemic.

AGENCY. Indicates the USDA agency which funded the project (see Chapter 3).

'ARS'=Agricultural Research Service.
'CRGO'=Competitive Research Grants Office.
'CSRS'=Cooperative State Research Service (now the Cooperative State Research Education and Extension Service).
'SAES'=State Agricultural Experiment Stations
'SBIR'=Small Business Incubator Research

COMMODITY. Indicates the primary crop application of the research.

INSTITUTION/DEPARTMENT. Indicates the Institution and Department listed in the CRIS report.

INVESTIGATORS. Principal Investigator is listed first, followed by any others listed in the CRIS report.

NOTES. Brief notes concerning the project's focus made by the project staff during reviews. An asterisk (*) in the Notes field indicates that the project apparently included farmer participation.

Appendix A. Database of Organic-Pertinent Research Projects

ACC#	TITLE	S/W	RATING	TYPE	AGENCY	ST.	COMMODITY
9084860	HABITAT MANAGEMENT FOR BIOLOGICAL CONTROL OF INSECT PESTS OF VEGETABLE, FRUIT AND ROW CROPS	S	OS+	bc-s	CSRS	CA	fruit/grapes
9156114	A CASE STUDY AND MODEL IN THE ESTABLISHMENT OF AN ORGANIC DAIRY	S	OS+	sm-s	SAES	WI	dairy
9162489	DECOMPOSITION OF PLANT RESIDUES AND SUPPRESSION OF ROOT DISEASES IN ORGANIC FARMS	S	OS+	bc-s	CRGO	CA	vegetables
9167614	ASSESSING THE IMPACT OF BENEFICIAL INSECT POPULATIONS ON ORGANIC FARMS	S	OS+	bc-s	CSRS	NC	vegetables
9170611	BENEFICIAL INSECTS ON ORGANIC FARMS - EVALUATION	S	OS+	bc-s	SAES	NC	vegetables
9139593	ALTERNATIVE FARMING SYSTEMS	S	OS	sm-s	CSRS	SD	grains
9153454	ECONOMIC, ECOLOGICAL & ENVIRONMENTAL ANALYSES OF FARMS UNDER LONG-TERM LOWER CHEMICAL INPUT MANAGEM	S	OS	sm-s	SAES	OH	mixed
9167730	ROLE OF SOIL MICROBIAL BIOMASS AND MICROBIVOROUS NEMATODES IN SUSTAINABLE AGRICULTURAL SYSTEMS	S	OS	sm-b	CSRS	CA	field crops
9167734	A COMPARISON OF CONVENTIONAL, LOW-INPUT AND ORGANIC FARMING SYSTEMS:TRANSITION & LONG TERM VIABILITY	S	OS	sm-s	CSRS	CA	field crops
9168206	A COST/BENEFIT/RISK ANALYSIS OF VARIOUS SOIL IMPROVING PRAC ICES	S	OS	sm-s	CSRS	KS	field crops
9170040	THE TRANSITION FROM CONVENTIONAL TO LOW-INPUT OR ORGANIC FARMING SYSTEMS:SOIL BIOL. & SOIL FERTILITY	S	OS	sm-s	CRGO	CA	mixed
9170441	DEVELOPMENT AND IMPLEMENTATION OF SUSTAINABLE AG AND IPM PRACTICES IN SMALL FRUIT AND VEG SYSTEMS	S	OS	sm-s	SAES	NC	vegetables
9171738	DEVELOPMENT OF INDICATORS OF SOIL HEALTH IN AGRICULTURAL SYSTEMS	S	OS	sm-s	CSRS	PA	field crops
9138817	NORTHEAST ORGANIC/SUSTAINABLE AGRICULTURE PROJECT	S	OE	edu	SAES	NY	mixed
9150603	ORGANIC MARKETING DEVELOPMENT IN NEW MEXICO	S	OE	econ	CSRS	NM	vegetables
9150912	SUSTAINABLE AGRICULTURE EDUCATION INTERNSHIP TO PROMOTE CONSERVATION	S	OE	edu	SAES	OH	mixed
9154068	ON-FARM DEMONSTRATIONS AND RESEARCH OF LOW-INPUT SUSTAINABLE FARMING	S	OE	edu	CSRS	GA	mixed
9166774	ASSESSING MARKETS FOR PRODUCTS OF SUSTAINABLE AGRICULTURAL SYSTEMS	S	OE	econ	CSRS	GA	mixed
9167742	ASSISTING RESOURCE-POOR, SMALL-SCALE FARMERS WITH ADOPTION OF LOW-INPUT TECHNOLOGIES	S	OE	edu	CSRS	CA	vegetables
9167917	SYRUP PRODUCTION FOR SMALL-SCALE, LIMITED RESOURCE FARMERS AND GENERAL RURAL DEVELOPMENT	S	OE	econ	SBIR	AL	field crops
9094524	THE SUSTAINABILITY OF AGRICULTURE IN WASHINGTON STATE	S	OC+	sm-s	CSRS	WA	field crops
9097217	THE COMPOSITION AND DYNAMICS OF SOIL ORGANIC MATTER	S	OC+	sm-m	CSRS	NY	corn/soybeans
9146146	INTEGRATED CONTROL OF YELLOW STARTHISTLE IN VINEYARDS	S	OC+	sm-b	ARS	CA	fruit/grapes
9148547	MASS PROPAGATION/AUGMENTATION OF WASP PARASITES TO MANAGE WEEVILS, CATERPILLRS AND OTHER PESTS	S	OC+	bc-s	ARS	TX	cotton
9150054	BIOLOGICAL AND CULTURAL MANAGEMENT OF PLANT-PARASITIC NEMATODES	S	OC+	bc-s	CSRS	MI	mixed
9152060	ASSESSMENT AND MODELING OF NITRATE LEACHING UNDER CONVENTIONAL AND ORGANICALLY MANAGED CORN	S	OC+	sm-m	CSRS	MI	corn/soybeans
9154166	POTATO CROPPING SYSTEMS RESEARCH	S	OC+	sm-s	CSRS	ME	potatoes
9156539	LOW INPUT SUSTAINABLE AGRICULTURE AS APPLIED TO VEGETABLE PRODUCTION SYSTEMS	S	OC+	sm-s	CSRS	OH	vegetables
9157299	BIOLOGICAL SUPPRESSION OF SOILBORNE PLANT PATHOGENS	S	OC+	bc-i	CSRS	CA	vegetables
9161037	INTEGRATION OF NATURAL ENEMIES FOR MANAGEMENT OF THE SWEETPOTATO WHITEFLY AND ASSOCIATED DISORDERS	S	OC+	bc-s	CSRS	FL	vegetables
9165036	HABITAT MODIFICATION TO IMPROVE BIOLOGICAL CONTROL IN APPLE ORCHARDS	S	OC+	bc-s	CSRS	WI	fruit/apples
9165114	NEW APPROACHES IN SUSTAINABLE STRAWBERRY PRODUCTION TO BENEFIT PRODUCERS, CONSUMERS, AND ENVIRONMENT	S	OC+	sm-s	CSRS	IO	fruit&nuts/misc.
9165738	ALTERNATIVE CROP PRODUCTION SYSTEMS FOR NORTHEASTERN SOUTH DAKOTA	S	OC+	sm-s	CSRS	SD	field crops
9167292	OVERWINTER SURVIVAL OF HETERODERA, PRATYLENCHUS, AND ASSOCIATED NEMATODES IN THE NORTH CENTRAL	S	OC+	bc-s	CSRS	MI	field crops
9067928	BIOCONTROL OF SOILBORNE PLANT PATHOGENS	W	OC	bc-s	CSRS	MI	corn/soybeans
9072171	MANAGING PLANT-MICROBE INTERACTIONS IN SOIL TO PROMOTE SUSTAINABLE AGRICULTURE	W	OC	bc-i	CSRS	CA	vegetables
9072313	UTILIZATION OF ENTOMOPATHOGENIC NEMATODES IN THE BIOLOGICAL CONTROL O F PESTIFEROUS INSECTS	W	OC	bc-i	CSRS	CA	vegetables
9077478	MANAGING PLANT MICROBIAL INTERACTIONS IN SOIL TO PROMOTE SUSTAINABLE AGRICULTURE	W	OC	bc-s	CSRS	NY	vegetables
9080423	BIOCONTROL OF SOILBORNE PLANT PATHOGENS	W	OC	bc-i	CSRS	IA	corn/soybeans
9082143	BIOLOGICAL CONTROL IN PEST MANAGEMENT SYSTEMS OF PLANTS	W	OC	bc-i	CSRS	NM	fruit&nuts/misc.
9084775	DEVELOPING LIVING MULCH SYSTEMS FOR USE WITH SUSTAINABLE HORTICULTURAL SPECIALTY CROP PRODUCTION	W	OC	sm-s	CSRS	WI	vegetables
9086804	BIOLOGY AND MANAGEMENT OF COLORADO POTATO BEETLE	W	OC	bc-s	CSRS	NY	potatoes
9094343	BIOCONTROL OF SOILBORNE PLANT PATHOGENS	W	OC	bc-i	CSRS	IL	wheat
9095958	INSECT PEST MANAGEMENT WITH SEMIOCHEMICALS	W	OC	bc-i	CSRS	CO	corn/soybeans
9096610	BIOLOGY AND IMPACT OF NATURAL ENEMIES OF INSECT PESTS IN INDIANA	W	OC	bc-i	CSRS	IN	corn/soybeans
9132996	SUPPRESSION OF FUSARIUM PYTHIUM AND RHIZOCTONIA DISEASES WITH BIOCONTROL AGENT - FORTIFIED SUBSTRATE	W	OC	co-e	CSRS	OH	ornamentals
9134330	BIOLOGICAL CONTROL OF NOXIOUS KNAPWEEDS IN WASHINGTON	W	OC	bc-i	CSRS	WA	rangeland
9135039	INTEGRATED PEST MANAGEMENT OF INSECT AND MITE PESTS AFFECTING COLORAD O FRUIT MANAGEMENT	W	OC	bc-i	CSRS	CO	fruit/apples
9136729	INCREASING SOIL PRODUCTIVITY FOR THE HUMID TROPICS THROUGH ORGANIC MATTER MANAGEMENT	W	OC	sm-m	CSRS	HI	fruit/apples
9136785	ESTABLISHMENT AND MAINTENANCE OF ORNAMENTAL PLANTS	W	OC	sm-b	CSRS	TN	ornamentals
9137483	ENHANCING BENEFICIAL MICROORGANISMS IN THE RHIZOSPHERE	W	OC	sm-b	CSRS	WV	corn/soybeans
9137618	ENHANCING BENEFICIAL MICROORGANISMS IN THE RHIZOSPHERE	W	OC	sm-b	CSRS	DE	corn/soybeans
9137897	ENHANCING BENEFICIAL MICROORGANISMS IN THE RHIZOSPHERE	W	OC	sm-b	CSRS	FL	field crops
9138650	CONSERVATION TILLAGE SYSTEMS AND MANAGEMENT OF PLANT RESIDUES FOR PRO DUCTION OF CABBAGE	W	OC	sm-p	CSRS	VA	vegetables
9138708	PLANT-COLONIZING BACTERIA FOR USE IN PLANT DISEASE CONTROL OR PLANT G ROWTH PROMOTION	W	OC	sm-b	CSRS	AL	cotton
9138971	BIOCONTROL OF PLANT PARASITIC NEMATODES WITH PASTEURIA SPP. AND OTHER SOIL-BORN ANTAGONISTS	W	OC	bc-i	CSRS	FL	corn/soybeans
9139581	BIOLOGICAL CONTROL OF INSECTS AND WEEDS USING BENEFICIAL INSECTS	W	OC	bc-i	CSRS	CT	potatoes
9142909	POTATO EARLY DYING: BIOLOGICAL CONTROL	W	OC	sm-b	ARS	ID	potatoes
9143629	IDENTIFICATION AND PRINCIPLES OF USE OF INSECT ATTRACTANTS OF PESTS OF APPLE, PEAR AND POTATO	W	OC	bc-i	ARS	WA	fruit&nuts/misc.
9143734	BIOLOGICAL CONTROL OF FIRE BLIGHT DISEASE OF PEAR AND APPLE	W	OC	bc-i	ARS	WA	fruit&nuts/misc.
9143808	PRODUCTION OF FUNGAL SPORES FOR BIOCONTROL OF NOXIOUS WEEDS	W	OC	bc-i	ARS	IL	corn/soybeans
9143917	EFFECT OF CONVENTIONAL AND SUSTAINABLE AGRICULTURE UPON MYCORRHIZAL FUNGI	W	OC	sm-b	ARS	PA	corn/soybeans
9144204	BASIS OF RHIZOSPHERE COMPETENCE OF PLANT BENEFICIAL MICROBES	W	OC	bs-m	ARS	MD	vegetables
9144348	MICROBIOLOGICAL CONTROL OF AGRONOMIC WEEDS	W	OC	bc-i	ARS	MS	rice
9144445	BIOLOGICAL MANAGEMENT OF DECIDUOUS TREE FRUIT INSECT AND DISEASE PESTS	W	OC	bc-s	ARS	WV	fruit/apples
9144447	DEVELOPMENT OF BIOLOGICALLY BASED CONTROL METHODS OF VEGETABLE PESTS	W	OC	bc-i	ARS	MD	vegetables
9144449	PILOT TEST TO INTEGRATE PARASITOID AUGMENTATION AND STERILE FLY RELEASES	W	OC	bc-i	ARS	HA	fruit&nuts/misc.
9144472	ANALYSIS OF SOIL MICROBIOLOGICAL PROCESSES WHICH AFFECT LOW-INPUT SUSTAINABLE CROP/LIVESTOCK SYSTE	W	OC	sm-s	ARS	MD	mixed
9144550	MECHANISM OF ACTION OF MICROBIAL PEST CONTROL AGENTS AGAINST PLANT PA THOGENS	W	OC	bc-s	ARS	MD	vegetables
9144745	SUPPRESSION OF INSECT POPULATIONS IN STORED GRAIN BY AUGMENTATION OF PARASITES AND PREDATORS	W	OC	bc-i	ARS	TX	rice

INSTITUTION	DEPT.	INVESTIGATORS	NOTES
U of California, Berkeley	Biological Ctrl	MA Altieri	*real organic
U of Wisconsin Madison	Agronomy	JL Posner	*whole organic farm analysis - the real thing
UC Davis	Plant Pathology	AH Van Bruggen	carbon lability, cover crops, decomposition
NC State	Entomology	GG Kennedy/HM Linker	*the real thing
N Carolina S U, Raleigh	Crop Sciences	HM Linker	*beneficials behavior in organic system
SD State Brookings	Plant Science	JD Smolik	*comparative, economic analysis
Ohio State U, Wooster	Entomology	BR Stinner/CA Edwards	*comparison analysis — organic status inferred; whole-farm study & econ. anal.
UC Davis	LA&WR	K Scow	comparison inc. organic systems; systemic effects of practices SARE
UC Davis	Agronomy	S Temple	comparison inc. organic systems; systemic effects of practices SARE
Kansas State Manhattan	Agronomy	RR Janke/JL Havlin/GJ Kluitenberg	*comparative; 2 of four farms certified organic; mgt. practices effects on soil quality
UC Berkeley	Nematology	H Ferris	microbial ecology in organic transition
NC State Raleigh	Plant Pathology	FJ Louws	organic systems analysis; microbial ecology "knowledge base"!
Penn State	Experiment Station	H Cole,CR Krueger,LE Lanyon	biological activity indicators; carbon cycles in biological context
Cornell	Agricultural Economics	WA Knoblauch/JJ Green	*general educational sessions
NM State Las Cruces	Agricultural Economics	C Falk	*strange - progress report totally unrelated
Ohio State Wooster	Entomology	CA Edwards/BR Stinner	*ten-week internship program
U of Georgia	CFSA	WW Dow	*on-farm demos & outreach
U. of Georgia, Athens	Agricultural Economics	L Lohr	market analyses including organic produce market dynamics
UC Berkeley	Soil Science	PL Gersper	*training organic methods for farmworkers becoming small farmers SARE
Hall's Syrup		CH GAndy	*organic processing method
Washington State Pullman	Crop & Soil Science	JP Reganold/AJ Busacca/RI Papendick	*strong organic identity; comparative; little analysis of org. system
Cornell U, Ithaca	Agronomy	JM Duxbury	strong org. identity; C&N soil dynamics at Rodale
West Reg Res Cntr, Albany	ARS	WT Ranini/CE Turner	*organic vineyard context; competitive weed antagonists
Agr Res Serv, Weslaco		EG King Jr/DA Nordlund/KR Summy	natural enemy propagation; tested on commercial O-cotton
Michigan State	Entomology	GW Bird	*crop rotation/systems comparison; "organic enterprise technologies" included
Michigan State	Crop & Soil Science	E Paul/PR Grace	nitrate modeling at Rodale
U of Main, Orono	Entomology	AR Alford/M Marra/GA Porter	*systems comparison; not quite explicit organic
Ohio State	Horticulture	MA Bennett	*cover crop comparisons w/ "organic" replication SARE
U of California, Davis	Plant Pathology	AHC VanBruggen	source of disease suppression in organically managed soils
U of Florida, Gainesville	AR&EC, Immokale	PA Stansly	*comparison pest control on organic vs. conventional farms, weak system focus SARE
U of Wisconsin, Madison	Entomology	DL Mahr/PM Whitaker	*ecological pest management in organic orchards
Iowa State U, Ames	Horticulture	GR Nonnecke	effects of organic inputs and cultivars; "organic" system replications
South Dakota State, Brookings	Plant Science	JD Smolik	comparative system/rotation; 3 of 5 systems organic; only measuring yields?
Mich. State	Entomology	G Bird/H Melakeberhan	comparison inc. "organic enterprise"; effect of mgt. on pest nematodes
Michigan St U-E. Lansing	Plant Pathology	G Safir	rotational systems & mycor.
U of California-Berkeley	Plant Pathology	JG Hancock/AR Weinhold/MN Schroth	not doing systems part
U of California, Davis	Nematology	HK Kaya	weak context
NY Agr Expt Sta, Geneva	Plant Pathology	GS Abawi/HC Hoch	weak organic identity
Iowa St U-Ames	Plant Pathology	CA Martinson	good approach; weak context
New Mexico SU, Las Cruces	Ent & Plnt Path	JJ Ellington	total substitution of insecticides
U of Wisconsin	Horticulture	HC Harrison	living mulch; weed and nutrient effects
Cornell	Entomology	MJ Tauber/CA Tauber/WM Tingey	weak organic identity but good ecophysiology
U of Illinois	Plant Pathology	HT Wilkinson	weak org. identity, mostly breeding for resistance
Co. State U Fort Collins	Entomology	LB Bjostad	pheromones
Purdue U, W. Lafayette	Entomology	RJ O'Neil	natural enemies
Ohio St U- Wooster	Plant Pathology	HA Hoitink/DL Coplin/LV Madden	compost microflora &disease suppression
Washington S U, Pullman	Entomology	GL Piper	weak
Colorado St U, Ft Collins	Horticulture	RJ Zimmerman	*standard IPM biocontrol
U of Hawaii	Agronomy	NV Hue	green manures
U of Tenn	Horticulture	D.B. Williams	allelopathic mulches
West Virginia, Morgantown	Plant & Soil Science	JB Morton	basic sci - VAM
U of Delaware	Plant Science	JJ Fuhrmann	weak context; cultivating beneficial microbes
U of Florida, Gainesville	Plant Pathology	NC Schenck	weak context; cultivating beneficial microbes
Va. Poly Inst. & State U	Horticulture	RD Morse	no-till transplanter! mechanical covercrop removal
Auburn U	Plant Pathology	JW Kloepper	weak context; cultivating beneficial microbes
U of Florida Gainesville	Entomology	DW Dickson/DJ Mitchell	beneficial nematodes; organic source?
U of Connecticut, Storrs	Plant Science	RA Ashley/RG Adams	non-chem CPB mgt.
U of Idaho, Aberdeen	ARS	DR Fravel/JR Davis	cover crops & disease mgt.
Agricultural Research Ser		LM Mcdonough/HG Davis	pheromones
Agr Res Serv, Wenatchee		RG Roberts	antagonistic bacteria
N Regional Res Ct, Peoria	ARS	RJ Bothast/DA Schisler/MA Jackson	biocontrol agent formulations
E. Region Res. Ctr.		DD Douds	VAM ecology; almost explicit organic content
Agr Res Cntr, Beltsville	ARS	DP Roberts	microbial ecology of beneficial organisms
ARS Stoneville MS		CD Boyette/RE Hoagland/HK Abbas	bioherbicide
Agr Res Ser,Kearneysville		MW Brown/GJ Puterka	general ecology of tree fruit pest-prey complex
Agr Res Cntr Beltsville		RF Schroder/PA Martin	shotgun
Agr Res Serv., Honolulu		MF Purcell/EJ Harris/RT Cunningham	sterile fly releases
Beltsville Agr Res Center	ARS	DD Kaufman/PD Milner/LJ Sikora	comparative systems analysis; suggests GIS for biological indicators
Agr Res Center,Beltsville		RD Lumsden	analysis of "suppressive soils"
Beaumont		RR Cogburn	biocontrol agents for stored grains

ACC#	TITLE	S/W	RATING	TYPE	AGENCY	ST.	COMMODITY
9144908	DISEASES AND NEMATODES OF DECIDUOUS FRUITS IN THE SOUTHEASTERN UNITED STATES	W	OC	bc-b	ARS	GA	fruit&nuts/misc.
9144982	BIOLOGICAL CONTROL OF POSTHARVEST BROWN ROT OF TREE FRUITS	W	OC	bc-i	ARS	CA	fruit&nuts/misc.
9145354	CONTROL OF PLANT PESTS AND PATHOGENS WITH BY-PRODUCTS OF NEEM SEED	W	OC	bc-i	ARS	DC	ornamentals
9145422	ARTHROPODS FOR BIOLOGICAL CONTROL OF WEEDS	W	OC	bc-i	ARS	CA	rangeland
9145543	LABORATORY EVALUATION OF COMMERCIAL FORMULATION OF BACILLUS THURIGENE SIS	W	OC	bc-i	ARS	WA	fruit/apples
9145548	BIOLOGICAL CONTROL OF SWEET POTATO WHITEFLY AND DIAMONDBACK MOTH ON V EGETABLE CROPS	W	OC	bc-i	ARS	TX	vegetables
9145600	CULTURAL CONTROL OF THE RING NEMATODE, CRICONEMELLA XENOPLAX	W	OC	sm-b	ARS	GA	fruit&nuts/misc.
9145679	BIOLOGICAL CONTROL OF CORN ROOTWORMS AND CEREAL APHIDS	W	OC	bc-i	ARS	SD	corn/soybeans
9145903	HOST PLANT RESISTANCE & MICROBIAL ANTAGONISTS AS NONCHEMICAL MEANS TO CONTROL NEMATODES ON POTATOE	W	OC	bc-b	ARS	NY	potatoes
9145927	BIOLOGICAL CONTROL OF RUSSIAN KNAPWEED	W	OC	bc-i	ARS	MT	rangeland
9145978	BACTERIA AS BIOCONTROL AGENTS OF NEMATODES AND REPLACEMENTS TO GRDWATER CONTAMINATING NEMATICIDE	W	OC	bc-i	ARS	MD	corn/soybeans
9146142	ALTERNATIVE CONTROL STRATEGIES FOR INSECT PESTS OF PECAN	W	OC	bc-i	ARS	MS	fruit&nuts/misc.
9146156	EVALUATION OF MICROBIAL AND BOTANICAL INSECTICIDES FOR THE CONTROL OF CODLING MOTH ON APPLES	W	OC	bc-i	ARS	WA	fruit/apples
9146297	SUPPRESSION OF INSECT POPULATIONS IN STORED GRAIN BY AUGMENTATION OF PARASITES AND PREDATORS	W	OC	bc-i	ARS	GA	corn/soybeans
9146570	CONTROL OF PLANT PESTS AND PATHOGENS USING BOTANICALLY-DERIVED COMPOSITIONS	W	OC	bc-i	ARS	DC	ornamentals
9146584	THE AMOUNT AND TYPE OF PHEROMONE NEEDED TO CONTROL CODLING MOTH BY MATING DISRUPTION	W	OC	bc-i	ARS	WA	fruit/apples
9146610	DISTRIBUTION AND PERSISTENCE OF NEMATODES APPLIED FOR WEEVIL CONTROL	W	OC	bc-i	ARS	FL	fruit/citrus
9146634	APPLICATION OF S. RIOBRAVIS TO SUPPRESS CORN EAR- WORM FALL ARMYWORM PINK BOLLWORM & BOLL WEEVIL	W	OC	bc-i	ARS	TX	corn/soybeans
9146767	INTEGRATION OF ANTAGONISTIC BACTERIA INTO MANAGEMENT OF FIRE BLIGHT O F POME FRUITS	W	OC	bc-i	ARS	WA	fruit&nuts/misc.
9146850	BIOLOGICAL CONTROL OF BEET ARMYWORM AND OTHER PESTS OF COTTON	W	OC	bc-i	ARS	GA	cotton
9146854	ON-FARM COMPOSTING OF GRASS STRAW	W	OC	co-t	ARS	OR	compost
9147126	AGRICULTURAL USES OF COMPOSTS AND STABILIZED ORGANICS: NUTRIENT MANAGEMENT, ROOTS, MICROBES	W	OC	co-t	ARS	PA	compost
9147328	UNDERSTANDING ADULT CODLING MOTH BEHAVIOR TO DEVELOP THE TECHNIQUE OF MATING DISRUPTION	W	OC	bc-i	ARS	WA	fruit/apples
9147417	CLIMATIC AND EDAPHIC FACTORS: EFFECT ON ENTOMOPATHOGENIC NNEMATODES	W	OC	bc-i	ARS	FL	fruit/citrus
9147493	SYSTEMATICS OF NORTH AMERICA SPECIES OF PARASITES OF WHITEFLIES	W	OC	bs-e	ARS	MD	cotton
9147582	DEVELOPMENT OF ALTERNATIVE CONTROL STRATEGIES FOR CODLING MOTH AND LE AFROLLERS	W	OC	bc-i	ARS	WA	fruit/apples
9147765	DEVELOPMENT OF MATING DISRUPTION IN CODLING MOTH AND LEAFROLLERS	W	OC	bc-i	ARS	WA	fruit/apples
9147766	EVALUATION OF MATING DISRUPTION FOR CODLING MOTH	W	OC	bc-i	ARS	WA	fruit/apples
9147769	RUSSIAN WHEAT APHID MANAGEMENT STRATEGIES USING BARLEY PLANT RESISTAN	W	OC	bc-s	ARS	WO	grains
9147773	EFFECT OF CONVENTIONAL AND SUSTAINABLE AGRICULTURE UPON MYCORRHIZAL FUNGI	W	OC	sm-b	ARS	PA	corn/soybeans
9147782	SUPPRESS PINK BOLLWORM POPULATIONS WITH STEINERNEMA RIOBRAVIS CARPOCA PSAE	W	OC	bc-i	ARS	AZ	cotton
9147830	POTATO EARLY DYING: BIOLOGICAL APPROACHES THROUGH USE OF COVER CROPS	W	OC	sm-b	ARS	ID	potatoes
9147850	POPULATION BIOLOGY & IMPACT OF NATURAL ENEMY INTRODUCTIONS FOR CONTRO L OF RUSSIAN WHEAT APHID	W	OC	bc-i	ARS	CO	wheat
9147870	BIOLOGICAL CONTROL OF GRASSHOPPERS	W	OC	bc-i	ARS	MT	rangeland
9147918	SUPPRESS CORN EARWORM AND FALL ARMYWORM WITH STEINERNEMA RIOBRAVIS/CARPOCAPSAE	W	OC	bc-i	ARS	TX	corn/soybeans
9147927	ENHANCEMENT OF CROP INSECT PEST CONTROL WITH PARASITOIDS	W	OC	bc-i	ARS	FL	vegetables
9147978	STABILITY/MATURITY/SAFETY OF COMPOSTS AND ORGANIC RESIDUALS: CRITERIA AND TESTS FOR AGRICULTURE	W	OC	co-t	ARS	MD	vegetables
9147984	BIOLOGICAL CONTROL OF FIRE BLIGHT OF APPLE IN MONTANA	W	OC	bc-i	ARS	MT	fruit/apples
9147988	DECIDUOUS FRUIT CROP DISEASES	W	OC	bc-i	ARS	WV	fruit/apples
9148090	FACTORS INFLUENCING FORAGING BEHAVIOR OF LEPIDOPTERAN PARASITOIDS	W	OC	bs-e	ARS	FL	mixed
9148145	IDENTIFICATION AND DEVELOPMENT OF NEW MATERIALS FOR THE MANIPULATION OF INSECT BEHAVIOR	W	OC	bs-e	ARS	MD	mixed
9148172	BIOLOGICAL CONTROL OF TEPHRITID FRUIT FLIES IN FRUIT ORCHARDS AS A PEST MANAGEMENT TOOL	W	OC	bc-i	ARS	HA	coffee
9148274	ALTERNATIVE METHODS TO CONTROL POSTHARVEST DISEASES	W	OC	bc-i	ARS	WV	fruit/apples
9148389	PRODUCTION AND STABILIZATION OF MICROBIAL BIOHERBICIDES	W	OC	bc-i	ARS	IL	vegetables
9148428	INTEGRATED MANAGEMENT OF SOILBORNE PESTS OF TOMATO AS AN ALTERNATIVE	W	OC	sm-p	ARS	FL	vegetables
9148520	BIOCONTROL OF PLANT NEMATODES WITH FUNGI AND BIOREGULATORS FOR USE IN SUSTAINABLE AGRICULTURE	W	OC	bc-i	ARS	MD	vegetables
9148538	INTEGRATED SOIL/CROP/BIOCONTROL MANAGEMENT SYSTEM: SUSTAINABLE ALTERN ATIVES TO METHYL BROMIDE	W	OC	sm-b	ARS	MD	vegetables
9148569	BACULOVIRUS BASED INSECT CONTROL PRODUCTS FOR USE IN VEGETABLE INSECT MANAGEMENT	W	OC	bc-i	ARS	MD	vegetables
9148609	METHYL BROMIDE ALTERNATIVES FOR MANAGEMENT OF SOILBORNE PATHOGENS IN ORNAMENTAL CROPS	W	OC	bc-i	ARS	DC	ornamentals
9148620	INTEGRATED SOIL-NUTRIENT-CROP-MICROBIAL-PEST-WASTE MANAGEMENT STRATEGIES FOR SUSTAINABLE AGRICULTURE	W	OC	sm-s	ARS	MD	grains
9148660	SOIL QUALITY AND SOIL ECOLOGY IN SUSTAINABLE AGRICULTURE	W	OC	sm-s	ARS	MD	grains
9148818	DEVELOPMENT OF PELLET AND FOLIAR FORMULATIONS FOR INSECT PARASITIC NE MATODES	W	OC	bc-i	ARS	MD	mixed
9148844	NATURAL PRODUCTS FOR BIOLOGICAL CONTROL OF PLANT PESTS	W	OC	bc-s	ARS	FL	corn/soybeans
9148853	BIOLOGICAL CONTROL OF LEAFY SPURGE	W	OC	bc-i	ARS	MT	rangeland
9148855	BIOLOGICAL CONTROL OF STORED-PRODUCT INSECTS WITH PARASITES, PREDATORS, AND ENTOMOPATHOGENS	W	OC	bc-i	ARS	KS	grains
9148931	PRODUCTION AND USE OF RURAL/URBAN WASTE CO-COMPOST: MICROBIAL PROCESSES	W	OC	co-e	ARS	MD	compost
9148943	THE INFLUENCE OF EXTRAFLORAL NECTARIES ON PARASITOID FORAGING FOR PLANT PESTS	W	OC	bc-i	ARS	FL	cotton
9149121	BIOLOGICALLY BASED MANAGEMENT SYSTEMS FOR THE RUSSIAN WHEAT APHID AND OTHER CEREAL APHIDS	W	OC	bc-i	ARS	OK	wheat
9149156	BIOLOGICAL CONTROL OF SPOTTED KNAPWEED WITH INSECTS	W	OC	bc-i	ARS	MT	field crops
9149167	EFFECT OF BT TREATMENTS AND HARVEST DATE ON DEFOLIATION OF POTATO AND OVERWINTERING SURVIVA	W	OC	bc-i	ARS	NC	potatoes
9149419	MATING DISRUPTION OF MIDWESTERN APPLE PESTS	W	OC	bc-i	ARS	MI	fruit/apples
9149441	INFLUENCE OF HOST QUALITY ON TRICHOGRAMMA AUGMENTATION AGAINST CODLING MOTH	W	OC	bc-i	ARS	CA	fruit/apples
9149513	BIOCONTROL OF SOILBORNE PLANT PATHOGENS USING NATURAL ATTRIBUTES OF M ICROBES AND THEIR ENVIRONS	W	OC	bc-i	ARS	MD	vegetables
9149534	UNDERSTANDING AND IMPROVING TRICHOGRAMMA TECHNOLOGY FOR CODLING MOTH AND LEAFROLLER CONTRO	W	OC	bc-i	ARS	WA	fruit/apples
9149597	BIOL. & CUL. CONTROL OF WEEDS & SOILBORNE PLT.PATHCAUSED ROOT DIS. OF VEG. AS ALT. TO METHYL BROMID	W	OC	bc-s	ARS	FL	vegetables
9149697	BIOCONTROL OF INVASIVE WEEDS	W	OC	bc-i	ARS	CA	rangeland
9149726	BIOLOGICAL MANAGEMENT OF DECIDUOUS TREE FRUIT INSECT PESTS	W	OC	bc-s	ARS	WV	fruit&nuts/misc.
9150248	BIOLOGICAL AND CULTURAL MANAGEMENT OF PLANT-PARASITIC NEMATODES	W	OC	bc-s	CSRS	NY	vegetables
9150292	DISCOVERY AND DEVELOPMENT OF PLANT PATHOGENS FOR BIOLOGICAL CONTROL OF WEEDS	W	OC	bc-i	CSRS	NC	field crops
9150348	DISCOVERY AND DEVELOPMENT OF PLANT PATHOGENS FOR BIOLOGICAL CONTROL OF WEEDS	W	OC	bc-i	CSRS	FL	fruit&nuts/misc.
9150349	DISCOVERY AND DEVELOPMENT OF PLANT PATHOGENS FOR BIOLOGICAL CONTROL OF WEEDS	W	OC	bc-i	CSRS	FL	mixed
9150802	BIOLOGICAL CONTROL OF SELECTED ANTHROPOD PESTS AND WEEDS THROUGH INTRODUCTION OF NATURAL ENEMIES	W	OC	bc-i	CSRS	FL	vegetables
9151245	TRI-TROPHIC INTERACTIONS OF THE RUSSIAN WHEAT APHID ON ALTERNATE HOSTS	W	OC	bc-i	CSRS	UT	wheat
9151406	DISCOVERY AND DEVELOPMENT OF PLANT PATHOGENS FOR BIOLOGICAL CONTROL OF WEEDS	W	OC	bc-i	CSRS	CA	cotton
9151846	MANAGEMENT OF RHIZOSPHERE DYNAMICS TO CONTROL SOILBORNE PATHOGENS AND PROMOTE PLANT PRODUCTIVITY	W	OC	sm-b	CSRS	KY	corn/soybeans
9152006	SUSTAINABLE STRATEGIES FOR MANAGING SOILBORNE DISEASES OF FORAGES AND SMALL GRAINS	W	OC	bc-i	CSRS	AL	wheat
9152030	INSECT MANAGEMENT: AN ECOSYSTEM ANALYSIS APPROACH FOR PREVENTIVE PEST MANAGEMENT	W	OC	bc-s	CSRS	MI	vegetables

INSTITUTION	DEPT.	INVESTIGATORS	NOTES
ARS Byron GA		AP Nyczepir/TG Beckman/BW Wood	nematode-resistant rootstocks; weak organic context
Agr Res Serv, Fresno		JL Smilanick	hot water post-harvest treatments
Agr Res Serv, Washington		JC Locke/HG Larew	neem products
West Reg Res Cntr, Albany	ARS	CE Turner	insects vs. weeds
Agr Res Srv-Yakima		AL Knight	Bt efficacy
Agr Res Serv, Weslaco		DA Nordlund/WA Jones/SP Wraight	shotgun
ARS Byron GA		AP Nyczepir/TG Beckman	ground covers and nematode suppression
Agr Res Serv, Brookings		JJ Jackson/RW Kieckhefer/MM Ellsbur	bioinsecticides
ARS Ithaca		BB Brodie	resistant varieties
Agr Res Service, Bozeman		PC Quimby Jr	bioherbicide
BARC		BY Endo/RM Sayre	bioinsecticides
Stoneville		MT Smith/DE Hendricks	pheromones & trap crops
Agr Res Serv., Yakima		AL Knight	Bt efficacy
Agr Res Serv, Savannah		JH Brower/JG Leesch/JE Baker	beneficial insects in stored grains
Agr Res Serv, Washington		JC Locke	biofungicide
Agr Res Serv., Yakima		AL Knight	*pheromone efficacy
Agr Res Serv, Orlando		WJ Schroeder/WR Martin	beneficial nematodes
Agr Res Service, Weslaco		JR Raulston/TJ Henneberry/K Smith	beneficial nematodes
Agr Res Serv, Wenatchee		PL Pusey	antagonistic bacteria
Ga. Coastal Plain Exp. St		WJ Lewis/GA Herzog	*transition to natural enemy pest management
Corvallis		LF Elliott/Hashimoto AG	*low-tech composting techniques
Rodale RC	Horticulture	PD Millner/LDrinkwater	broad range of compost technique analysis
Agr Res Serv., Yakima		AL Knight	pheromone efficacy
Agr Res Serv, Orlando		WJ Schroeder	*beneficial nematodes; formulation w surfactants
Agr Res Cntr Beltsville		ME Schauff	whitefly taxonomy
Agr Res Srv-Yakima		AL Knight	Bt & pheromone efficacy
Agr Res Serv., Yakima		AL Knight	*pheromone efficacy
Agr Res Serv., Yakima		AL Knight	pheromone efficacy
U of Wyoming, Laramie	Plant & Soil Science	DR Porter/MJ Brewer	natural enemies of wheat aphid
Rodale		DD Douds/RR Janke	management of VAM
Agr Res Service, Phoenix		TJ Henneberry/JR Raulston/PV Vail	beneficial nematodes
U of Idaho, Aberdeen	Plant & Soil Science	DR Fravel/JC Davis	green manures and disease suppression
Colorado S U, Ft. Collins	Entomology	KR Hopper/T Holtzer	natural enemies introduced
Montana S U, Bozeman	Entomology	DA Streett	biopesticide efficacy
Agr Res Service, Weslaco		JR Raulston	biopesticide efficacy
U of Florida, Gainesville	Entomology	ER Mitchell/JL Capinera	biopesticide efficacy
BARC		PD Millner/LJ Sikora	compost quality
Montana S U, Corvallis	ARS	JE Loper/N Callan	beneficial bacteria
Agr Res Serv, Kearneysvil		DM Glenn/WJ Janisiewica/CL Wilson	biocontrol shotgun
Agr Res Serv Gainesville		James Tumlinson III	pheromone biology of beneficial wasps
Beltsville AGR Res Center		JR Aldrich/JE Oliver	pheromone biology of general predators
U of Hawaii, Honolulu	Entomology	EJ Harris/R Mow	natural enemies
Agr Res Serv, Kearneysvil		CL Wilson/A ElGhaouth	biofungicide
N Reg Res Cntr, Peoria		RJ Bothast/MA Jackson/DA Schisler	bioherbicide
U of Fla	Food & Agricultural Sci	DT Kaplan	solarization
Beltsville Ag Res Cntr		SL Meyer	bioinsecticides from fungi
Beltsville Agr Cntr		PD Millner/SE Wright/LL Lengnick	composts & pest management effects; implies organic transition
Agr Res Cntr Beltsville		RL Ridgway	shotgun biocontrol
ARS		JC Locke	shotgun biocontrol
BARC		LJ Sikora/LL Legnick	comparative; organic not reported in current CRIS but is part of study; very complex design
BARC		JS Buyer/LJ Sikora/SE Wright	companion to 9148620 above - organic comparison begun in 95
Agr Res Cntr Beltsville		DJ Chitwood/SL Meyer	beneficial nematodes formulation
U of Florida-Gainesville	Entomology	JH Tumlinson, III	predator enhancement with extra habitat
Agr Research Serv, Sidney		NR Spencer	insects vs. weeds
Agricultural Res Manhatta		FH Brower/DE Johnson/WH McGaughey	beneficials in stored grains
BARC		PD Millner/LJ Sikora	compost quality
Agr Res Serv, Gainesville		J Tumlinson III/WJ Lewis	predator enhancement with extra habitat
Agr Res Serv, Stillwater		NC Elliott/MH Greenstone/JD Burd	natural enemies introduced
Montana S U, Corvallis	Agr Rsch Ctr	PC Quimby, Jr/JM Story	insects vs. weeds
N Carolina S U, Raleigh	Entomology	CO Calkins/GG Kennedy	Bt efficacy
Michigan S U, E. Lansing		MW Brown/JW Johnson	pheromone efficacy
U of California, Berkeley	Entomology	CO Calkins/NJ Mills	trich. efficacy
Beltsville Agr Cntr		DR Fravel/J Lewis/RD Lumsden	microbial antagonist of Verticilium
Agr Res Serv., Yakima		TR Unruh	trich. efficacy
U of Florida-Gainesville	Agricultural Science	DT Patterson/S Nemec Jr/PJ Stoffell	shotgun biocontrol & cultural management
W Reg. Res Cntr, Albany		JK Balciunas	insects vs. weeds
Ag Res Serv Kearneysville		MW Brown/GJ Puterka	beneficial insects in orchard systems
NY Ag Exp Sta	Plant Pathology	GS Abawi	parasitic fungus & cover crop management
NCSU-Raleigh	Botany	CG Vandyke	bioherbicide
U of Florida-Gainesville	Veg Crops	TA Bewick	*bioherbicide
U of Florida-Gainesville	Plant Pathology	R Charudattan, TE Freeman	bioherbicide
U of Florida Gainesville	Plant Pathology	R Charudattan	discovery of exotic enemies
Utah S U, Logan	Biology	FJ Messina	natural enemies
U of California, Berkeley	Plant Pathology	SE Lindow	bioherbicide efficacy
U of Kentucky, Lexington	Plant Pathology	JW Hendrix/J Hendrix	weak organic context (strip mine reclamation) good research
Auburn U	Plant Pathology	DJ Collins	*weak organic context; suppressive bacteria
Michigan State	Entomology	DL Haynes	CPB ecology & management

ACC#	TITLE	S/W	RATING	TYPE	AGENCY	ST.	COMMODITY
9152435	BIOLOGICAL AND INTEGRATED MANAGEMENT OF PEANUT INSECT PESTS	W	OC	bc-i	CSRS	TX	field crops
9152513	TRITROPHIC INTERACTIONS IN NATURAL AND MANAGED ECOSYSTEMS	W	OC	bs-e	CSRS	CA	fruit/citrus
9152550	NUTRIENT CYCLING IN AGROECOSYSTEMS	W	OC	sm-m	CSRS	OR	grains
9153043	MARKETING AND DELIVERY OF QUALITY CEREALS AND OILSEEDS	W	OC	bc-i	CSRS	MT	oilseeds
9153575	INTEGRATED CROP MANAGEMENT EFFECTS ON STALK BORING LEPIDOPTERA	W	OC	bc-i	CSRS	MA	corn/soybeans
9153598	DEVELOPMENT OF ENTOMOPATHOGENS AS CONTROL AGENTS FOR INSECT PESTS	W	OC	bc-i	CSRS	MN	field crops
9153692	IMPROVING PARASITOID IMPACT ON PEST FRUIT FLIES IN HAWAII	W	OC	bc-i	CSRS	HA	mixed
9153880	ENHANCING BENEFICIAL MICROORGANISMS IN THE RHIZOSPHERE	W	OC	bc-i	CSRS	VA	cotton
9154376	OPTIMIZATION OF PROCESS VARIABLES FOR LEAF COMPOSTING ON FARMS	W	OC	co-t	SAES	NJ	compost
9154659	EARTHWORMS ON NITROGEN CYCLING PROCESSES & DECOMPOSER COMMUNITY STRUCTURE IN ORGANIC-BASED AND CONVE	W	OC	sm-s	SAES	OH	corn/soybeans
9154705	ECOLOGY OF MICROBES IN RELATION TO BIOCONTROL AND PLANT DISEASE	W	OC	bc-i	CSRS	MN	potatoes
9154845	BROAD SPECTRUM ENTOMOPATHOGENS FOR CONTROL OF LEPIDOPTEROUS PESTS	W	OC	bc-i	CSRS	AR	corn/soybeans
9154957	GUIDELINES FOR COMPOSTING AND CURING OF YARD WASTES	W	OC	co-e	SAES	OH	compost
9155217	BIOLOGICAL CONTROL OF POWDERY MILDEWS	W	OC	bc-i	CSRS	NY	fruit/grapes
9155531	HORTICULTURAL UTILIZATION OF ORGANIC RESIDUES	W	OC	co-e	CSRS	MO	vegetables
9155733	BIOCONTROL OF POTATO SCAB	W	OC	bc-i	CSRS	MN	potatoes
9156581	POTATO PEST MANAGEMENT	W	OC	bc-i	CSRS	WV	potatoes
9156900	COMPOST EXTRACTS AND THE BIOLOGICAL CONTROL OF FOLIAR PLANT DISEASE	W	OC	bc-s	SAES	WI	fruit/apples
9156910	INTEGRATED CROP MANAGEMENT EFFECTS ON STALK-BORING LEPIDOPTERA	W	OC	bc-i	CSRS	NE	corn/soybeans
9157312	BIOCONTROL OF DAMPING OFF WITH BACILLUS CEREUS UW 85	W	OC	bc-i	CSRS	WI	corn/soybeans
9157761	CROP ROTATION EFFECTS ON SOIL MICROBIAL ACTIVITY, NUTRIENT USE EFFICIENCY AND PRODUCTIVITY	W	OC	sm-s	CSRS	MI	field crops
9157781	PEST MANAGEMENT STRATEGIES FOR COTTON INSECTS	W	OC	bc-s	CSRS	TX	cotton
9157926	PHYSIOLOGICAL MECHANISM OF BIOLOGICAL CONTROL OF FIELD BINDWEED WITH PHOMA PROBOSCIS	W	OC	bc-i	CSRS	AR	field crops
9158184	SUSTAINABLE INTENSIVE VEGETABLE PRODUCTION USING LEGUMES, MANURES & MUNICIPAL COMPOST AS FERTILIZER	W	OC	sm-s	CSRS	KS	vegetables
9158605	ALTERNATIVE CONTROL MEASURES FOR PESTS OF VEGETABLES	W	OC	bc-i	CSRS	SC	vegetables
9158684	PATHOGENICITY TRANSMISSION AND INTRODUCTION OF A CYTOPLASMIC POLYHEDR OSIS VIRUS TO FALL WEBWORM	W	OC	bc-i	CSRS	KY	mixed
9159019	CHARACTERIZATION AND MANAGEMENT OF MICROBIAL SYSTEMS IN COMPOST SYSTE MS	W	OC	co-t	CSRS	NY	compost
9159151	USE OF BRASSICA SPP. IN BIOCONTROL STRATEGIES	W	OC	sm-b	CSRS	ID	oilseeds
9159380	INDUCTION OF SYSTEMIC DISEASE RESISTANCE BY RHIZOBACTERIA	W	OC	bc-i	CRGO	AL	vegetables
9160040	DETERMINATION OF MARKET VALUE AND MARKET CAPACITY ASSESSMENT FOR MIXED ORGANIC MATERIALS COMPOST	W	OC	co-t	OCI	WA	compost
9160073	NUTRITIONAL ECOLOGY OF APHYTIS PARASITOIDS: NON-HOST FOODS AND HOST FEEDING	W	OC	bs-e	CRGO	CA	fruit/apples
9160075	LANDSCAPE AND BIOLOGICAL CONTROL STRATEGIES TO PREVENT POCKET GOPHER DAMAGE IN ALFALFA	W	OC	bc-s	CRGO	CA	forage crops
9160090	HABITAT ENHANCEMENT FOR BENEFICIAL INSECTS IN VEGETABLE AND FRUIT FARMING SYSTEMS	W	OC	bc-s	CSRS	AR	vegetables
9160224	PROBING THE SCIENCE OF COMPOSTING - AN ENVIRONMENTAL PRIORITY	W	OC	co-t	CSRS	SC	vegetables
9160328	NEGATIVE INTERACTIONS BETWEEN MITES ON GRAPES	W	OC	bc-i	CRGO	CA	fruit/grapes
9160824	SPATIAL HETEROGENEITY AND PLANT-HERBIVORE-PREDATOR INTERACTIONS	W	OC	bs-e	CRGO	WI	forage crops
9160853	PATHOGEN POPULATION BIOLOGY AS A TOOL IN DEVELOPING IPM STRATEGIES	W	OC	bs-m	CSRS	MI	potatoes
9160967	BIOLOGICAL CONTROL IN PEST MANAGEMENT SYSTEMS OF PLANTS	W	OC	bc-i	CSRS	MT	rangeland
9161083	BIOLOGICAL CONTROL IN PEST MANAGEMENT SYSTEMS OF PLANTS	W	OC	bc-i	CSRS	OR	field crops
9161103	BIOLOGICAL CONTROL IN PEST MANAGEMENT SYSTEMS OF PLANTS	W	OC	bc-i	CSRS	CA	cotton
9161111	BIOLOGICAL CONTROL OF SOILBORNE PESTS WITH BRASSICA GREEN MANURE APPL ICATIONS	W	OC	sm-b	CSRS	NY	potatoes
9161122	BIOLOGICAL CONTROL IN PEST MANAGEMENT SYSTEMS OF PLANTS	W	OC	bc-i	CSRS	KS	field crops
9161160	DEVELOPMENT OF SUSTAINABLE IPM STRATEGIES FOR SOYBEAN ARTHROPOD PESTS	W	OC	bc-i	CSRS	KY	corn/soybeans
9161284	BIOLOGICAL CONTROL IN PEST MANAGEMENT SYSTEMS OF PLANTS	W	OC	bc-i	CSRS	CA	fruit&nuts/misc.
9161328	INFLUENCE OF VEGETATIONAL DIVERSITY ON INSECTS AFFECTING VEGETABLE CROPS	W	OC	bc-s	CSRS	IL	vegetables
9161485	BIOLOGICAL CONTROL IN PEST MANAGEMENT SYSTEMS OF PLANTS	W	OC	bc-i	CSRS	WY	rangeland
9161576	A BIOINTENSIVE IPM PROGRAM FOR CONTROL OF BACTERIAL WILT DISEASE	W	OC	bc-i	CSRS	AL	vegetables
9161592	NON-CHEMICAL QUALITY MANAGEMENT OF STORED CROPS	W	OC	bc-i	CSRS	IN	field crops
9161612	INVERTEBRATE PREDATORS: THEIR ROLE IN POST POPULATION SUPPRESSION AN D POTENTIAL FOR BIOLOGICAL CON	W	OC	bc-s	CSRS	MD	forage crops
9161659	BIOLOGICAL CONTROL IN PEST MANAGEMENT SYSTEMS OF PLANTS	W	OC	bc-i	CSRS	UT	forage crops
9161678	BIOLOGICAL CONTROL IN PEST MANAGMENT SYSTEMS OF PLANTS	W	OC	bc-i	CSRS	NM	fruit&nuts/misc.
9161683	ECOLOGICAL EVALUATION OF MECHANISMS CONTRIBUTING TO SUPPRESSION OF WEEDS BY PLANT PATHOGENS	W	OC	bc-i	CSRS	AK	rice
9161706	ESTABLISHMENT AND DISPERSAL OF ICHNEUMAN PROMISSORUS, EXOTIC PUPAL PARASITOID OF HELIOTHIS	W	OC	bc-i	CSRS	AR	corn/soybeans
9161825	BIOLOGICAL CONTROL IN PEST MANAGEMENT SYSTEMS OF PLANTS	W	OC	bc-i	CSRS	CA	fruit/citrus
9161826	BIOLOGICAL CONTROL IN PEST MANAGEMENT SYSTEMS OF PLANTS	W	OC	bc-i	CSRS	CA	fruit/citrus
9161829	BIOLOGICAL CONTROL IN PEST MANAGEMENT SYSTEMS OF PLANTS	W	OC	bc-i	CSRS	CA	field crops
9161837	EVALUATION OF TYTA LUCTUOSA FOR BIOLOGICAL CONTROL OF FIELD BINDWEED	W	OC	bc-i	CSRS	KS	field crops
9161896	BIOLOGY AND CONTROL OF SEVERAL WEED SPECIES IN HORTICULTURAL CROPS WITH NATIVE AND EXOTIC INSECTS	W	OC	bc-i	CSRS	WI	field crops
9161911	CASSIDA RUBIGINOSA (COLEOPTERA: CHRYSOMELIDAE) FOR BIOLOGICAL CONTROL OF CANADIAN THISTLE	W	OC	bc-i	CSRS	VA	rangeland
9162006	EFFECT OF SEMIOCHEMICALS ON THE BEHAVIOR OF RUSSIAN WHEAT APHID PARASITOIDS	W	OC	bc-i	CSRS	CO	wheat
9162062	ENTOMOPATHOGENIC NEMATODES AS BIO-CONTROL AGENTS FOR ALFALFA ROOT WEE VILS	W	OC	bc-i	CSRS	PA	forage crops
9162384	INTEGRATED PEST MANAGEMENT OF THE DIAMONDBACK MOTH WITH ENTOMOPATHOGE NIC NEMATODES	W	OC	bc-i	CSRS	CA	vegetables
9162392	BIOLOGICAL CONTROL OF ROOT FEEDING WEEVILS IN ALFALFA WITH ENTOMOPATH OGENIC NEMATODES	W	OC	bc-i	CSRS	NY	forage crops
9162399	PEST CONTROL ALTERNATIVES, SOUTH CAROLINA	W	OC	bc-i	CSRS	SC	vegetables
9162414	DEVELOPMENT OF NEW TECHNOLOGIES FOR SUSTAINABLE AGRICULTURE	W	OC	co-e	CSRS	PA	fruit/apples
9162726	MANAGING PLANT MICROBIAL INTERACTIONS IN SOIL TO PROMOTE SUSTAINABLE AGRICULTURE OF POTATO	W	OC	sm-b	CSRS	ID	corn/soybeans
9162744	SUSTAINED SUPPRESSION OF PYTHIUM DISEASES: INTERACTIONS BETWEEN COMPOST MATURITY AND NUTRITIONAL	W	OC	co-e	SAES	OH	compost
9162885	EVALUATION OF LOW CHEMICAL INPUT SUSTAINABLE PRODUCTION PRACTICES FOR VEGETABLE GROWERS	W	OC	sm-m	CSRS	NC	vegetables
9163058	IDENTIFYING COMPATIBLE RUSSIAN WHEAT APHID MANAGEMENT STRATEGIES UTILIZING BARLEY PLANT RESISTANCE	W	OC	bc-b	CRGO	WY	wheat
9163219	EVALUATION OF TWO NATURAL ENEMIES FOR BIOLOGICAL CONTROL OF FIELD BINDWEED	W	OC	bc-i	CSRS	KS	field crops
9163445	IMPACTS OF SPIDERS IN FOOD WEBS OF CROP AND FOREST FLOOR ECOSYSTEMS	W	OC	bc-s	CSRS	KY	vegetables
9163492	ENHANCED BIOLOGICAL CONTROL OF CUCURBIT PESTS IN FLORIDA AND THE CARRIBEAN	W	OC	bc-i	CSRS	FL	vegetables
9163501	MANAGING MYCORRHIZAL FUNGI FOR INCREASED CROP YIELDS AND NUTRIENT RETENTION	W	OC	sm-b	CRGO	PA	field crops
9163687	BIOLOGICAL CONTROL OF SCAPTERISCUS MOLE CRICKETS AND ITS ECONOMICS	W	OC	bc-i	CSRS	FL	mixed
9163849	USE OF TRAP CROPS TO IMPROVE EFFICIENCY OF BIOPESTICIDES FOR CONTROL OF DIAMONDBACK MOTH IN CABBAGE	W	OC	bc-s	CSRS	HI	vegetables
9163854	CROP ROTATION, TILLAGE, AND SEED PREDATION EFFECTS ON WEED DYNAMICS IN POTATOES	W	OC	sm-s	CSRS	ME	potatoes
9164093	ECOLOGY AND MANAGEMENT OF PLANT-PARASITIC NEMATODES	W	OC	sm-b	CSRS	FL	corn/soybeans

INSTITUTION	DEPT.	INVESTIGATORS	NOTES
Texas A&M U, College Sta	Entomology	JW Smith Jr/FL Forrest	natural enemy efficacy
U of Calif., Riverside	Entomology	JD Hare	natural enemy & Bt efficacy
Oregon State Corvallis	Crop Science	RP Dick	"simulated transition from inorganic-N to organic-N sources"; "SA resource guide for growers"
Montana SU, Bozeman	Entomology	FV Dunkel/K Tilley/R Newman	botanical biopesticide for stored grains
U of Mass., Amherst	Entomology	DN Ferro	trich. efficacy
U of Minnesota, St Paul	Entomology	TJ Kurtti	biopesticides - microsporidia
U of Hawaii, Honolulu	Entomology	RH Messing	natural enemy efficacy
Virginia Polytech	Agronomy	C Hagedorn	suppressive bacteria
Rutgers	Agricultural Engineering	TF Hess	optimize leaf composting w/ manures — no biological emphasis
Ohio State	Entomology	BR Stinner/CA Edwards	comparison inc. "organic fertility system"; electroshocking earthworms!
U of Minnesota-St Paul	Plant Pathology	LL Kinkel/NA Anderson/KJ Leonard	antagonistic bacteria
U of Arkansas, Fayettevil	Entomology	DC Steinkraus	viral enemy
Ohio State	Plant Pathology	HA Hoitink	disease suppressive properties
NY Agr Exp Sta, Geneva	Plant Pathology	RC Pearson/DM Gadoury/RC Seem	mycoparasite of powdery mildew
U of Missouri Columbia	Plant Science	CJ Starbuck	testing effects of diff. organic residues
U of MInnesota	Plant Pathology	LL Kinkel/AN Anderson/RK Jones	antagonistic bacteria
W. Virgina U,Morgantown	Plant & Soil Science	RJ Young	mycoparasite of rhizoctonia
U. of Wisc.	Plant Pathology	JH Andrews/RF Harris	compost tea for disease control
U of Nebraska, Lincoln	Rsch & Ext Ctr	JF Witkowski	natural enemies
U of Wisconsin-Madison	Plant Pathology	J Handelsman	natural enemy
Michigan State	Crop & Soil Science	RR Harwood	*microbial and environmental effects of rotations and cover crops; input efficiency
Texas A&M U, College Sta.		JE Slosser	relay strip cropping
U of Ark, Fayetteville	Plant Pathology	GE Templeton/GE Templeton	bioherbicide
Kansas State Manhattan	Horticulture	WJ Lamont	cover crop in veg. system
Clemson	Horticulture	DR Decoteau/AP Keinath/G Carner	microbial enemies; shotgun
U of Kentucky, Lexington	Entomology	GL Nordin	bioinsecticide virus
Cornell U	Biology	L.P. Walker	closed vessels for studying microbial actions in composting
U of Idaho	Plant Science	M.J. Morra	cover-crop pest suppression
Auburn U	Plant Pathology	JW Kloepper/S Tuzun	microbial disease resistance
U of Washington	Forest Resources	CL Henry/RB Harrison	marketing & compost quality
U of California, Davis	Entomology	JA Rosenheim	*predator feeding habits
UC-Davis	Agronomy	S Geng	ecology of gophers
Fayetteville, Arkansas	Rodale Institut	JB Bachmann/B Cartwright/GL Kuepper	*beneficial insect habitat; organic identity inferred
SC State	Engineering	AK Satipathy	closed vessel technology
U of California, Davis	Entomology	R Karban/D Hougen-Eitzman	natural enemies
U of Wisconsin, Madison	Zoology	AR Ives	aphid predator ecology
Michigan St-E. Lansing	Bot & Plant Pat	A Jarosz	modeling pest-pathogen dynamics
Montana SU, Bozeman	Agr Rsch Ctr	JM Story	natural enemies, shotgun
Oregon S U, Corvallis	Entomology	MT Aliniazee/PR Mcevoy/JG Miller	natural enemies - shotgun
U of California, Davis	Entomology	JA Rosenheim	natural enemy efficacy
Cornell U, Ithaca	Plant Pathology	R Loria/PJ Mt/D Halseth	green manure disease suppression
Kansas S U, Manhattan	Entomology	JR Nechols	natural enemy efficacy
U of Kentucky, Lexington	Entomology	KV Yeargan	weak organic context; predator behavior in conventional system
U of California, Berkeley	Biology	NJ Mils/MA Altieri/LE Caltagirone	natural enemies - shotgun
U of Illinois, Urbana	Entomology	CE Eastman	weak context, but studying effect of ecological parameters on pest problems
U of Wyoming, Laramie	Plant & Soil Science	RJ Lavigne/JK Wangberg	insects vs. weeds
Auburn U	Entomology	GW Zehnder/JW Kloepper/O Chambliss	disease suppression by rhizobacteria
Purdue	Agricultural Engineering	DE Maier	stored grain environmental controls
U of Maryland, College Pk	Entomology	RF Denno	synergistic effects of predator complexes and habitat management
Utah S U, Logan	Biology	T Evans	natural enemies
New Mexico SU, Las Cruces	Plant Pathology	JJ Ellington	natural enemies
U of Ark, Fayetteville		DO Tebeest	bioherbicide
U of Arkansas, Fayettevil	Entomology	TJ Kring/JE Carpentar/SD Pair	exotic enemy
U of Calif., Riverside	Entomology	RF Luck	*natural enemies
U of Calif., Riverside	Entomology	JA Mcmurtry	natural enemies
U of California, Riversid	Entomology	RD Goeden	fruit fly behaviors
Kansas SU, Manhattan	Entomology	JF Nechols/MJ Horak	insects vs. weeds
U of Wisconsin, Madison	Horticulture	JH Hopen	insects vs. weeds
VA Polytech, Blacksburg	Entomology	LT Kok	natural enemies; intercropping (supported by Organic Growers Association!)
Colorado State Fort Colli	Biology	MF Antolin/LB Bjostad	pheromone and natural enemy
Penn St U, University Prk	Entomology	AA Hower	predatory nematodes
U of California-Davis	Nematology	HK Kaya/BE Tabashnik/R Gaugler	predatory nematodes
Cornell U, Ithaca	Entomology	EJ Shields	natural enemy efficacy
Clemson U	Horticulture	DR Decoteau/AP Koinath/C Moore	biopesticides and cultural controls
Penn. State	Experiment Station	H Cole	yields and mineral cycle effects of composts
U of Idaho, Aberdeen		JR Davis	green manures and disease suppression
Ohio St U-Wooster	Plant Pathology	HA Hoitink/LV Madden	compost quality
NC A&T State Greensboro	Plant Science	MR Reddy	green manure & manure effects; weak organic context
U of Wyoming, Laramie	Plant & Soil Science	MJ Brewer	Russian wheat aphid resistance
Kansas S U, Manhattan	Entomology	JR Nechols/JM Horak/W Noble	insects vs. weeds SARE
U of Kentucky, Lexington	Entomology	DH Wise	*predator ecology
U of Florida, Gainesville	Entomology	JL Capinera	natural enemies
Slippery Rock	Biology	DH Yocom	soil mgt for VAM
U of Florida, Gainesville	Entomology	JH Frank/J Walker	natural enemy
U of Hawaii, Honolulu	Horticulture	J Defrank/H Valenzuela	enhancing biopesticde
U of Maine Orono	Agriculture	M Liebman/F Drummond	effects of cultural controls, inputs, predators on weed mgt.
U of Florida Gainesville	Nematology	RT McSorley	effects of crop rotations and inputs on nematodes

ACC#	TITLE	S/W	RATING	TYPE	AGENCY	ST.	COMMODITY
9164202	TECHNOLOGY AND ENVIRONMENTAL ASSESSMENT OF COMPOSTING SYSTEMS	W	OC	co-t	SAES	NY	compost
9164565	CROP INSECT PEST MANAGEMENT IN NEBRASKA: BIOLOGICAL CONTROL AND SAMPLING	W	OC	bc-i	CSRS	NE	corn/soybeans
9164606	BIOLOGICAL PEST MANAGEMENT FOR SUNFLOWER INSECTS	W	OC	bc-i	CSRS	ND	oilseeds
9164690	RECYCLYING GREEN WASTES IN HAWAII	W	OC	co-t	SBIR	HI	coffee
9164766	INTEGRATION OF BRASSICA SPP. RESIDUES AND MICROBIAL BIOLOGICAL CONTRO L AGENTS	W	OC	bc-i	CSRS	ID	mixed
9164787	WASTE MANAGEMENT FOR ON-FARM SUSTAINABILITY	W	OC	co-e	CSRS	UT	wheat
9164790	IMPROVING MANAGEMENT OF AGRICULTURAL RESIDUES AND FOOD BY-PRODUCTS VIA COMPOSTING	W	OC	co-t	CSRS	ID	compost
9164831	BIOLOGICAL CONTROL IN PEST MANAGEMENT SYSTEMS OF PLANTS	W	OC	bc-i	CSRS	WA	mixed
9164943	BIOLOGICAL CONTROL OF COTTON APHIDS BY NEOZYGITES FRESENII, A FUNGAL PATHOGEN	W	OC	bc-i	CSRS	AR	cotton
9164985	PLANT DISEASE RESISTANCE AND PLANT GROWTH RESPONSES TO COMPOSTS AND C OMPOST EXTRACTS	W	OC	co-e	SAES	OH	vegetables
9165319	BIOLOGICAL CONTROL OF THE NORTHERN ROOT-KNOT NEMATODE ON VEGETABLES GROWN ON ORGANIC CELLS	W	OC	bc-i	CSRS	NY	vegetables
9165362	ASSIMILATION, EXCRETION AND FLUX OF NITROGEN BY EARTHWORMS IN AGROECOSYSTEMS	W	OC	sm-s	CRGO	OH	corn/soybeans
9165433	BIOLOGICAL CONTROL OF STALKBORERS IN CROP AND NON-CROP HABITATS	W	OC	bc-i	CSRS	IL	corn/soybeans
9165559	A BIOLOGICAL CONTROL NETWORK FOR THE SWEETCLOVER WEEVIL AND CLOVER RO	W	OC	bc-i	SAES	WI	forage crops
9165805	POULTRY MANURE AND SOYBEAN PRODUCTION: INFLUENCE ON SOYBEAN CYST NEMATODE AND SOILBORNE	W	OC	sm-b	SAES	MD	corn/soybeans
9165838	ECOLOGY AND MANAGEMENT OF NEMATODES IN SUSTAINABLE CROPPING SYSTEMS	W	OC	bc-s	SAES	NC	cotton
9165868	BIOLOGICAL CONTROL OF HELIOTHINES	W	OC	bc-i	CSRS	AR	cotton
9166158	DEVELOPMENT OF BIOHERBICIDES FOR PIGWEEDS AND AMARANTHS AND NUTSEDGES	W	OC	bc-i	CSRS	FL	vegetables
9166223	BIOLOGICAL AND CULTURAL MANAGEMENT OF PLANT-PARASITIC NEMATODES	W	OC	bc-s	CSRS	PA	fruit&nuts/misc.
9166291	SEMIOCHEMICALS FOR MANAGEMENT OF DIAPREPES ABBREVIATUS IN FLORIDA AND THE CARIBBEAN	W	OC	bs-e	CSRS	FL	fruit/citrus
9166300	SUBSTAINABLE MANAGEMENT OF NEZARA VIRIDULA WITH BIOLOGICAL AND CULTURAL CONTROLS	W	OC	bc-s	CSRS	HI	fruit&nuts/misc.
9166306	COMPOSTING AND VERMICULTURE-BENEFICIAL PRACTICES FOR MANAGING FISH MANURE	W	OC	co-t	CSRS	ID	compost
9166418	BIOLOGICAL CONTROL OF THE NORTHERN ROOT-KNOT NEMATODE ON VEGETABLES GROWN ON ORGANIC SOILS	W	OC	bc-i	CSRS	MA	vegetables
9166819	A BIOLOGICAL CONTROL SYSTEM FOR ROOT NND FOLIAR PESTS OF VEGETABLES	W	OC	bc-s	CRGO	AL	vegetables
9166866	KAIROMONE-MEDIATED HOST RECOGNITION BY A PARASITIC WASP: ROLE OF HOST PLANTS	W	OC	bc-i	CRGO	CA	fruit/citrus
9166888	NEMATODES FOR BIOLOGICAL CONTROL OF BLUETONGUE VIRUS VECTORS	W	OC	bc-i	CRGO	CA	cattle
9166969	THE INFLUENCE OF EXTRAFLORAL NECTARIES ON PARASITOID FORAGING FOR PLANT PESTS	W	OC	bc-i	CRGO	FL	cotton
9167132	ROLE OF LABILE SOIL ORGANIC MATTER AND SOIL ORGANISMS IN NITROGEN CYCLING PROCESSES	W	OC	sm-m	CRGO	OH	corn/soybeans
9167320	BIOLOGICAL INTERACTIONS AND INTEGRATED MANAGEMENT OF ARTHROPOD PESTS OF GRAPES AND SMALL FRUITS	W	OC	bc-i	CSRS	NY	fruit/grapes
9167342	ENTOMOPATHOGENIC NEMATODES AS BIOLOGICAL CONTROL AGENTS OF THE CARIBB EAN FRUIT FLY	W	OC	bc-i	CSRS	FL	fruit/citrus
9167450	ORGANIC AMENDMENTS TO SOIL FOR THE MANAGEMENT OF PHYTONEMATODES: MODE OF ACTION AND MICROBIAL	W	OC	bc-i	CSRS	AL	mixed
9167738	PRUNE REFUGES AND COVER CROPS TO FACILIATE LOW-INPUT PRODUCTION OF CLIFORNIA'S GRAPES	W	OC	bc-s	CSRS	CA	fruit/grapes
9167782	BIOLOGIC ASSESSMENT OF DRYACIDE, A NONCHEMICAL ALTERNATIVE FOR CONTROLLING STORED GRAIN INSECT PESTS	W	OC	bc-i	CSRS	MN	grains
9167887	A COST-EFFECTIVE BACTERIAL SEED TREATMENT FOR SEED ROT	W	OC	bc-i	SBIR	MT	vegetables
9167937	COMMERCIALIZATION OF A BIOCONTROL METHOD TO MANAGE TAKE-ALL DISEASE I N PNW WHEAT FIELDS	W	OC	bc-i	SBIR	WA	wheat
9167939	MICROBIAL CONTROL OF POSTHARVEST DECAY IN TROPICAL FRUITS	W	OC	bc-i	SBIR	MA	fruit&nuts/misc.
9168042	EFFICACY & PERSISTANCE OF AN ENTOMOPATHOGENIC NEMATODE FOR MANAGING R OOTWORMS	W	OC	bc-i	CSRS	NY	corn/soybeans
9168281	INTEGRATION OF BIOCONTROL AND CROP ROTATION FOR SOILBORNE PEST MANAGEMENT	W	OC	bc-s	CSRS	MN	potatoes
9168282	INTEGRATED PEST MANAGEMENT/FRUIT	W	OC	bc-i	SAES	NY	fruit&nuts/misc.
9168372	ECONOMIC AND ECOLOGICAL ANALYSES OF FARMS AND THEIR COMPONENT PRACTICES TO PROMOTE CROP ROTATION AND	W	OC	bc-s	SAES	OH	mixed
9168473	ECOLOGY AND MANAGEMENT OF EUROPEAN CORN BORER AND OTHER STALK-BORING LEPIDOPTERA	W	OC	bc-i	CSRS	NY	corn/soybeans
9168579	MODELLING SUPPRESSIVE SOILS BY THE USE OF MULTIPLE STRAIN BIOCONTROL STRATEGY	W	OC	bc-i	CRGO	MN	potatoes
9168702	DO AUTOPARASITOIDS IN THE GENUS ENCARSIA DISRUPT BIOLOGICAL CONTROL O F WHITEFLY	W	OC	bc-i	CRGO	TX	cotton
9168821	MICROBIAL ASPECTS OF SOIL QUALITY	W	OC	sm-b	CSRS	WA	wheat
9168848	TRICHOGRAMMA NOT-TARGET IMPACTS: A MODEL FOR BIOLOGICAL CONTROL RISK ASSESSMENT	W	OC	bs-e	CRGO	MI	corn/soybeans
9168960	DIVERSITY AND INTERACTIONS OF BENEFICIAL BACTERIA AND FUNGI IN THE RHIZOSPHERE	W	OC	bs-m	CSRS	FL	field crops
9168978	DIVERSITY AND INTERACTIONS OF BENEFICIAL BACTERIAL AND FUNGI IN THE RHIZOSPHERE	W	OC	bs-m	CSRS	WV	field crops
9169145	FUNGAL CONTRIBUTIONS TO SOIL ORGANIC MATTER FORMATION	W	OC	bs-m	CRGO	CO	wheat
9169500	INTEGRATED PEST MANAGEMENT AS AN ALTERNATIVE FOR CONTROL OF SOILBORNE PESTS OF VEGETABLE CROPS	W	OC	co-e	CSRS	FL	vegetables
9169600	ECOLOGY & MANAGEMENT OF EUROPEAN CORN BORER & OTHER STALK-BORING LEPI DOPTERA	W	OC	bc-i	CSRS	TX	corn/soybeans
9169675	BIOLOGICAL CONTROL OF THE COLORADO POTATO BEETLE IN THE RED RIVER VAL LEY OF NORTH DAKOTA AND	W	OC	bc-i	CSRS	ND	potatoes
9169718	NON-CHEMICAL MANAGEMENT OPTIONS FOR PLANT PARASITIC NEMATODES	W	OC	bc-s	CSRS	GA	mixed
9169831	NATURAL PRODUCTS FOR BIOLOGICAL CONTROL OF PLANT PESTS	W	OC	bc-s	SAES	FL	corn/soybeans
9169902	MICROBIOLOGY OF COMPOST-AMENDED SOILS SUPPRESSIVE TO SOILBORNE PLANT DISEASES	W	OC	co-e	CSRS	NY	compost
9170007	DEVELOPMENT AND INTEGRATION OF ENTOMOPATHOGENS INTO PEST MANAGEMENT S YSTEMS	W	OC	bc-i	CSRS	KY	vegetables
9170122	AN ECOLOGICALLY-BASED DRYLAND CROPPING SYSTEM: IMPACTS ON PEST MANAGEMENT	W	OC	bc-s	CRGO	MT	wheat
9170124	BEHAVIORAL FEVER AND MICROBIAL CONTROL OF MORMON CRICKETS	W	OC	bc-i	CRGO	MT	rangeland
9170170	DISCOVERY AND DEVELOPMENT OF PLANT PATHOGENS FOR BIOLOGICAL CONTROL OF WEEDS	W	OC	bc-i	CSRS	AR	field crops
9170317	A MULTIDISCIPLINARY ASSESSMENT OF THE USE OF COVER CROPS FOR PEST CONTROL	W	OC	bc-s	CRGO	CA	fruit/grapes
9170324	INTEGRATED PEST MANAGEMENT OF THE DIAMONDBACK MOTH WITH ENTOMOPATHOGENIC NEMATODES	W	OC	bc-i	CSRS	HI	vegetables
9170485	EVALUATION AND DEVELOPMENT OF PLANT PATHOGENS FOR BIOLOGICAL CONTROL OF WEEDS	W	OC	bc-i	CSRS	WI	fruit&nuts/misc.
9170547	DIVERSITY AND INTERACTIONS OF BENEFICIAL BACTERIA AND FUNGI IN THE RHIZOSPHERE	W	OC	bs-m	CSRS	AL	mixed
9170555	BIOLOGICAL CONTROL OF SELECTED ARTHROPOD PESTS AND WEEDS	W	OC	bc-i	CSRS	FL	mixed
9170557	BIOLOGICAL CONTROL OF SELECTED ARTHROPOD PESTS AND WEEDS	W	OC	bc-i	CSRS	FL	vegetables
9170559	BIOLOGICAL CONTROL IF SELECTED ARTHROPOD PESTS AND WEEDS	W	OC	bc-i	CSRS	FL	fruit/citrus
9170828	INTEGRATION AND PATHOGENS AND PARASITOIDS TO MANAGE THE SILVERLEAF WHITEFLY	W	OC	bc-i	CRGO	TX	vegetables
9170844	MANAGING PLANT-MICROBE INTERACTIONS IN SOIL TO PROMOTE SUSTAINABLE AGRICULTURE	W	OC	bc-i	CSRS	CA	fruit/citrus
9170927	MULTISPECIES INTERACTIONS AND BIOLOGICAL CONTROL OF APHIDS	W	OC	bc-i	CRGO	WI	field crops
9170957	DEVELOPMENT AND INTEGRATION OF ENTOMOPATHOGENS INTO PEST MANAGEMENT SYSTEMS	W	OC	bc-i	CSRS	CA	mixed
9170990	BIOLOGICAL CONTROL AND MANAGEMENT OF SOILBORNE PLANT PATHOGENS FOR SUSTAINABLE CROP PRODUCTION	W	OC	bc-s	CSRS	IN	wheat
9171017	BIOLOGICAL CONTROL AND MANAGEMENT OF SOILBORNE PLANT PATHOGENS FOR SUSTAINABLE CROP PRODUCTION	W	OC	bc-s	CSRS	AR	cotton
9171031	DEVELOPMENT OF BIOHERBICIDES FOR PIGWEEDS AND AMARANTHS AND NUTSEDGES	W	OC	bc-i	CSRS	FL	vegetables
9171108	EFFECTS OF PREDATORY ARACHNIDS AND COVER CROPPING ON ARTHROPOD PESTS IN VINEYARDS	W	OC	bc-s	CRGO	CA	fruit/grapes
9171344	BIOLOGICAL AND CULTURAL CONTROL OF WEEDS AND SOILBORNE PLANTPATHOGEN-CAUSED ROOT DISEASES OF VEGETAB	W	OC	bc-s	SAES	FL	vegetables
9171380	CONTROL OF CUCUMBER BEETLE AND BACTERIAL WILT OF CUCURBITS WITH BENEFICIAL BACTERIA	W	OC	bc-i	CSRS	AL	vegetables
9171509	ACTINOMYCETES AS BIOCONTROL AGENTS FOR PROTECTION OF CROPS FROM FUNGAL DISEASES	W	OC	bc-i	SBIR	ID	vegetables
9171553	AERIAL APPLICATION OF TRICHOGRAMMA TO CONTROL CODLING MOTH IN WALNUTS	W	OC	bc-i	SBIR	CA	fruit&nuts/misc.

INSTITUTION	DEPT.	INVESTIGATORS	NOTES
Cornell	Agricultural Engineering	TL Richard	instruments for compost technology
U of Nebraska, Lincoln	S Cen Res Ext	RJ Wright	natural enemy efficacy
N. Dakota S U, Fargo	Entomology	G Brewer	biopesticide efficacy
Kona Cinder&Soil		C Harlan	*appropriate composting methods
U of Idaho, Moscow	Plant & Soil Science	JP Mccaffrey/GR Knudsen/SO Guy	enhancing microbial antagonists with crop residues
Utah State	Agricultural Technology	BE Miller	compost inputs and effects
U. of Idaho	Agricultural Engineering	RF Rynk/TF Hess/RR Tripepi	compost inputs and effects
Washington S U, Pullman	Entomology	GE Long/AA Berryman/L Tanigoshi	biocontrol research facility
U of Arkansas, Fayettevil	Entomology	DC Steinkraus/RG Hollingsworth	natural enemy efficacy
Ohio St U-Columbus	Natural Resources	WA Dick/HA Hoitink	disease suppression with compost
NY AES Geneva	Plant Pathology	GS Abawi/BM Zuckerman	*Bt efficacy
Ohio State Columbus	Entomology	RW Parmelee/S Subler/CA Edwards	earthworm processing of organic N inputs
U of Illinois, Urbana	Entomology	RN Wiedenmann	natural enemy efficacy
U of Wisconsin, Madison	Entomology	DB Hogg	*natural enemy efficacy
U of Maryland, E. Shore		MA Morant/CB Brooks	cover crop and input effects on pests
NC State Raleigh	Plant Pathology	KR Barker	
U of Arkansas Fayettevill	Entomology	SY Young/TJ Kring	microbial pesticide efficacy
U of Florida, Gainesville	Plant Pathology	R Charudattan	bioherbicide efficacy
Penn State	Plant Pathology	JM Halbrendt	green manure & rotation effects on nematodes
U of Florida Gainesville	Agr Res & Ed Ct	Giblin-Davisrm	pheromone ID & synthesis
U of Hawaii, Honolulu	Entomology	VP Jones/RK Nishmoto	ants & weeds - env. effects on pest
U of Idaho Moscow	Aqua Rsch Ctr	RF Rynk/G Fornshell/JC Foltz	*composting from aquaculture residue
U of Mass Amherst	Plant Pathology	BM Zuckerman	enemy behavior and physiology (NOTE "Organic Farming" keyword)
Auburn U	Plant Pathology	JW Kloepper, PA Backman, GW Zahuder	"multiple biocontrol components integrated" —Bt+enemies
U of California Riverside	Entomology	JD Hare/RF Luck/JG Millar	recognition biology of enemy
U of Calif, Riverside	Entomology	BA Mullens	natural enemy of livestock virus
Bio Res Lab, Gainesville		JH Tumlinson/WJ Lewis	predator habitat/behavior
Ohio State Wooster	Entomology	BR Stinner	*possible organic identity; cover crops & manure systems effects on soil qualities
NY Agr Exp Sta, Geneva	Entomology	English-Loebg	reduced-pesticide identity; efficacy of enemies & breeding traits; negative pesticide effects
U of Florida, Gainesville	Entomology	GC Smart	enemy efficacy
Auburn U, Auburn	Plant Pathology	R Rodriguez-Kabana	biopesticidal effects of organic wastes
UC Davis	Entomology	FG Zalom	beneficial insect habitat; organic identity inferred; green manure as fertilizer substitute SARE
U of Minn. St. Paul	Entomology	BH Subramanyam	Diatomaceous Earth for stored grain biocontrol
Bozeman Bio-Tech-Bozeman		WE Vinje	biologic substitute for seed treatment—anti-fungal
Ag Res & Cons,-alla Wall		JL Dewitt	*suppressive bacteria (isolated from organic soils??)
Ecosciences Corp-Worcest		JP Stack	biofungicide
Cornell U, Ithaca	Entomology	PM Davis/EJ Shields	enemy efficacy
U of Minnesota	Plant Pathology	LL Kinkell/NA Anderson/JL Schottel	rotational systems & antagonistic bacteria
NY AES, Geneva		J. Kovach/JP Tette	various biocntrols
Ohio State Columbus	Entomology	BR Stinner	*mgt. practices effects on nematode pest
Cornell U, Ithaca	Entomology	MP Hoffman	trich. efficacy
U of Minnesota-St Paul	Plant Pathology	LL Kinkel/NA Anderson/JL Schottel	suppressive bacteria (isolated from organic soils??)
Texas A&M U, College Sta	Entomology	MS Hunter/MJ Rose/JB Woolley	enemy efficacy
Washington State	Crop & Soil Science	DF Bezdicek/JL Smith/MF Fauci	microbial soil quality parameters; problematic compost sources
Michigan S U, E. Lansing	Entomology	D Landis/D Orr	trich. ecology
U of Florida Gainseville	Soil & Water Science	DM Sylvia	mycorrhizae biology
W. Virgina U. Morgantown	Plant & Soil Science	JB Morton	mycorrhizae biology
Colorado State Ft. Collin	Natural Resources	ET Elliott/Paustian KH	Carbon cycle and microbial effects of no-till; herbicide ground?
U of Florida, Gainesville	Homestead Ctr	RC Ploetz/HH Bryan	soil biocontrol effects of compost
Texas A&M U, College Sta.	Entomology	JW Smith	natural enemies introduced
N Dakota S U, Fargo	Entomology	GJ Brewer	CPB enemies
U of Georgia Athens	Plant Pathology	R Davis	organic inputs & soil pest effects
U of Florida Gainesville	Entomology	DG Boucias	various biocntrols
Cornell	Plant Pathology	EB Nelson	microbial effects of compost
U of Kentucky, Lexington	Entomology	GC Brown	enemy efficacy
Montana St U, Bozeman	Entomology	SL Blodgett	rotation and cover crops effect on pest complex
Montana S U, Bozeman	Entomology	KM O'Neill/DA Street	fungal pesticide efficacy
U of Ark, Fayetteville	Plant Pathology	GE Templeton	bioherbicide efficacy
U of California, Davis	Entomology	FG Zalom/CL Elmore/RO Miller	cover crop effects; great objectives, possible organic identity
U of Hawaii, Honolulu	Entomology	BE Tabashnik	enemy efficacy
U of Wisconsin, Madison	Horticulture	HJ Hopen	bioherbicide
Auburn	Agronomy	JA Entry	soil microbial ecology
U of Florida, Gainesville	Entomology	JH Frank/JL Capinera/DH Habeck	shotgun, natural enemies
U of Florida, Gainesville	Trop Res Center	RM Baranowski	shotgun, natural enemies
U of Florida, Gainesville	Citrus Res Ctr	HW Browning/CC Childers	shotgun, natural enemies
Agr Res Serv., Weslaco		WA Jones/TJ Poprawski	natural enemy efficacy
U of California, Riversid	Plant Pathology	JA Menge	microbial disease suppression; possible rDNA objective; organic source??
U of Wisconsin, Madison	Zoology	AR Ives	enemy efficacy
U of California, Berkeley	Nematology	HK Kaya	enemy efficacy
Purdue U-West Lafayette	Plant Pathology	DM Huber	systemic effects on biocontrol efficacy; shotgun
U of Arkansas, Fayettevil	Plant Pathology	C Rothrock	systemic effects on biocontrol efficacy; shotgun
U of Florida, Gainesville	Horticultural S	WM Stall	bioherbicide
U of California, Oakland	Coop Extension	MJ Costello	ecology of spiders & beneficial mites, weak organic identity
U of Florida-Gainesville		PJ Stoffella	disease suppression with organic inputs
Auburn U, Auburn	Plant Pathology	G Zehnder/J Kloepper	*beneficial bacteria and disease resistance
Innovative Biosys.,Moscow		MA Roberts	biofungicide
Arena Pesticide Mg, Davis		R Stocker	trich. efficacy

Appendix B. Example of a CRIS Project Report

(This example has been copied directly from the CRIS Internet Website in the "standard w/classification" format.)

ACCESSION NO: 9162489 SUBFILE: CRIS
PROJ NO: CA-D*-PPA-5762-CG AGENCY: CRGO CALB
PROJ TYPE: CRGO PROJ. STATUS: EXTENDED
CONTRACT/GRANT/AGREEMENT NO: 93-37101-8600
START: 01 AUG 93 TERM: 31 JUL 97 FY: 1995 GRANT YR: 1993

INVESTIGATOR: Van Bruggen, A. H.

PERFORMING INSTITUTION:
PLANT PATHOLOGY
UNIV OF CALIFORNIA
DAVIS, CALIFORNIA 95616

DECOMPOSITION OF PLANT RESIDUES AND SUPPRESSION OF ROOT DISEASES IN ORGANIC FARMS

CONTRACT/GRANT/AGREEMENT NO: 93-37101-8600
GRANT YEAR: 1993

PRIMARY CLASSIFICATION — GENERAL CLASSIFICATION

RPA	ACTVTY	CMMDTY	SCNCE	PRCNT	PRGM	JTC
R205	A4600	C1200	F0712	050%	P3.14	J2B
R205	A4600	C1200	F0714	050%	P3.14	J2B

PRIMARY HEADINGS: R205 . Disease Control-Fruit, Vegetables; A4600 . Protection Against Diseases, Parasites; C1200 . Vegetables; F0712 . Microbiology-Plant; F0714 . Microbiology-Soils

SPECIAL CLASSIFICATION AND HEADINGS

S1261 . Tomatoes 100% PST2 . Target II - Nonpesticidal Control 025% IPMB . Integrated Control-Basic Research 075%

BASIC 100% APPLIED 000% DEVELOPMENTAL 000%

OBJECTIVES: PROJ. #9300507. Characterize stages of decomposition of cover crops associated with suppression of root diseases of tomato; assess microbial activity and diversity in soil during decomposition of cover crops; identify indicators for disease suppression by relating measurements on cover crop decomposition and microbial activity and diversity to root disease severity.

APPROACH: The study will be carried out in research plots with cover crop treatments and in growth chambers. One legume (vetch) and one cereal corp (oat) will be used as cover crops. Stages of organic matter decomposition will be monitored by crude fiber analysis and C:N ratio of organic debris. Carbon components of intact soil will be analyzed by 13C solid state NMR spectroscopy. The microbial status will be monitored by measuring nitrogen mineralization potential, microbial activity, biomass and diversity. Soils with organic matter at progressive stages of decomposition will be tested for suppressiveness to damping-off and root rot diseases of tomato caused by Rhizoctoia solani, Pyrenochaeta lycopersici, and

Phytophthora parasitica in growth chambers, using soil from an experimental site infested with the pathogens. Suppressiveness will be related to all substrate and microbial indicators using multivariate analyses. Selected indicators will be validated for their ability to predict disease suppression in the field.

KEYWORDS: tomatoes; root diseases; plant diseases; plant disease control; cover crops; crop residue; decomposition; suppression; suppressive soils; organic farming; soil microorganisms; organic matter; carbon; damping off; root rot; pyrenochaeta lycopersici; rhizoctonia solani; phytophthora parasitica; chemical analysis

PROGRESS: 9601 TO 9612

We compared oat-vetch cover crop decomposition, carbon and nitrogen cycling, microbial activity and community dynamics in organically and conventionally managed soils in a field experiment and a laboratory incubation experiment. Next, we determined which variables describing soil microbial community dynamics, C and N cycling could be used as predictors of PYTHIUM APHANIDERMATUM damping-off severity and relative growth in IN VITRO tests. No significant differences were detected between the conventional and organic farming system with respect to relative growth or disease severities.

Stepwise discriminant analysis on three classes of disease severities or relative growth led to selection of qualitatively similar variables. Only one soil microbial variable was selected, namely total biomass of actinomycetes. Total C and N content of debris extracted from soil as well as ammonium content of soil were selected most consistently and show promise for assessment of potential damping-off severities by P. APHANIDERMATUM.

PUBLICATIONS: 9601 TO 9612

GRUNWALD, N. J., WORKNEH, F., HU, S., and VAN BRUGGEN, A. H. C. 1996. Comparison of an IN VITRO and a damping-off assay to test soils for suppressiveness to PYTHIUM APHANIDERMATUM. European J. Plant Pathol. In press. HU, S., and VAN BRUGGEN, A. H. C. 1996. Microbial dynamics associated with multiphasic decomposition of 14C-labeled cellulose in soil. 1996. Microbial Ecology. In press. HU, S., GRUNWALD, N. J., and VAN BRUGGEN, A. H. C. 1996. Short-term effects of cover crop incorporation on soil carbon pools and nitrogen availability. Soil Sci. Soc. America J. In press.

CRIS SUPPLEMENTARY DATA: INST CODE: 001313; ORG CODE: 001760; REG: 4; PROCESS DATE 931129; PROGRESS UPDATE: 970610; PROJECT STATUS: EXTENDED

SUBFILE: CRIS

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Organic Farming Research Foundation

Board of Directors, 1997

Raoul Adamchak: Raoul is President of the Board of California Certified Organic Farmers. He is farming specialty and seed crops at Rancho Pequeno, near Davis, California and is the market garden manager at the UC Davis Student Farm.

Kathy Aman: Kathy manages a small C.S.A. seven acre organic farm in New Hope, Kentucky. She also serves as certification program coordinator for the Kentucky Department of Agriculture.

Roger Blobaum: Roger serves as Associate Director of the World Sustainable Agriculture Association (Washington DC office) and as a consultant to a number of international organic development projects. Previously, Roger served as the organic program coordinator for the Center for Science in the Public Interest.

Bill Brammer: Bill produces certified organic vegetables, tomatoes, limes and avocados on 340 acres outside of San Diego, California. He markets his products to wholesale distributors, direct to consumers at local farmer's markets, and to 240 families through his C.S.A. subscription service.

Mel Coleman Sr.: Mel founded and currently serves as Chairman of the Board of Coleman Natural Products in Denver, Colorado. Coleman Natural Beef contains one of the few certified organic livestock divisions in the United States. Mel and his family raise livestock on over 250,000 acres.

Woody Deryckx: Woody operates a small certified organic mixed vegetable operation in Concrete, Washington. Woody also serves as Vice-President of OFRF.

Mary Jane Evans: Mary Jane is the General Manager and CEO of Veritable Vegetable, Inc., an organic produce distributor based in San Francisco, California.

Phil Foster: Phil farms 165 acres in Hollister, CA, and wholesale markets a wide variety of vegetables, melons, squash, corn, onions, garlic, wheat, under the name Pinnacle Brand. Phil also serves as Secretary/Treasurer of OFRF.

Lewis Grant: Lewis is president and co-manager (with his son Andy) of Piedmont Farms in Wellington, Colorado. Piedmont Farms produces and ships certified organic vegetables to all sections of the United States, Japan, Mexico and Canada.

Sibella Kraus: Sibella is the produce reporter for the San Francisco Chronicle. She also writes for a number of additional publications and serves as the Executive Director of the San Francisco Public Market Collaborative. She works out of an office in Berkeley, California.

Ingrid Lundberg: Ingrid is the Vice-president for Governmental Affairs for Lundberg Family Farms, and lives in Sacramento, California. The Lundbergs are the country's largest producer of organic rice and processed rice products.

Mark Mayse: Mark is Professor of Entomology in the Department of Plant Science at California State University-Fresno. Focusing research and teaching activities in agro-ecosystem management and agricultural sustainability, he also serves on the California Organic Foods Advisory Board, the Board of Directors for the Association of Applied Insect Ecologists, and the statewide Pest Science and Technology Screening Committee.

Tom Pavich: Tom farms (along with his brother Steve) 4,200 acres of organic table grapes, melons, cotton and other vegetable crops in Terre Bella, California and southwest Arizona. Pavich Family Farms ship their organic products worldwide. Tom also serves as President of OFRF.

Ron Rosmann: Ron has a 480 diversified farm in Harlan, Iowa, where he farms with his wife and sons. They produce corn, soybeans, rye, barley and hay, and have a small potted evergreen nursery, in addition to pasturing 60 sows in a 1,000 hogs per year in a farrow-to-finish operation. He is an active member of the Practical Farmers of Iowa.

Richard Smith: Richard is a Farm Advisor with the University of California Cooperative Extension based in San Benito County, California. He works in the area of vegetable crop production and has an active research program in pest management, soil fertility, and in the use of compost for crop production.