

2000

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Published in *American Journal of Alternative Agriculture*, Vol. 15 No. 4 (2000) at doi: [10.1017/S0889189300008742](https://doi.org/10.1017/S0889189300008742).

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## Recommended Citation

Larson, K.L. and Duram, Leslie. "Information Dissemination in Alternative Agricultural Research: An Analysis of Researchers in the North Central Region." (Jan 2000).

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# **Information dissemination in alternative agriculture research: An analysis of researchers in the North Central region**

K.L. Larson and L.A. Duram

*Abstract. Agricultural research and education significantly influence the direction of U.S. agriculture by improving the practices available to farmers and by decreasing uncertainties associated with adopting new farming practices. Because sustainable agriculture is management-intensive, access to information is particularly important in adopting and implementing sustainable farming practices. Given that relatively little funding is allocated to sustainable agriculture research by the federal government, successful dissemination of these research results is critical. This paper presents an analysis of the dissemination efforts of 42 researchers funded through the USDA's North Central Region Sustainable Agriculture Research and Education (SARE) program. Results show that these SARE researchers purposefully consider the effectiveness of various dissemination methods in reaching targeted audiences and attempt to involve farmers in their dissemination efforts. Overall, researchers note that information dissemination is limited by farmer interest. Additional barriers exist, most notably insufficient resources and institutional biases. In the future, the ways in which information is compiled and made available must be improved, and responsibility for farmer outreach should be better coordinated.*

**Key words:** Cooperative Extension Service, land-grant universities, sustainable agriculture, USDA agricultural research

## **Introduction**

Research significantly affects the future of U.S. agriculture "because the direction in which research and education dollars are invested determines which farming system[s] will enjoy full development, refinement, economic competitiveness, and eventual adoption by farmers"

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(Hassebrook et al., 1995). Given the relatively low level of funding for sustainable agriculture research, successful dissemination of research results is critical. Indeed, the information generated through publicly funded research should be readily available to farmers (Parr et al., 1990), which requires responsiveness to farmers' information preferences and usage. Research and education are key components of agricultural decision-making, yet few studies have evaluated the dissemination of publicly funded agricultural research.

This paper describes an analysis of the dissemination of information gained

through publicly funded sustainable agriculture research, drawing from the example of the U.S. Department of Agriculture's (USDA) North Central Sustainable Agriculture Research and Education (SARE) program. First, we briefly review relevant literature on research and education in sustainable agriculture: farmers' information needs, government agencies involved with agricultural research and education, and potential barriers to information dissemination. Second, we describe the research methods employed for this study, including the design and analysis of a mail questionnaire. Third, we present the results of our analysis of SARE-funded researchers and their dissemination efforts. Fourth, we discuss the implications of our findings for the SARE program specifically, and for U.S. agricultural research and education in general.

## **Sustainable Agriculture: Information, Agencies, and Barriers**

Given the management-intensive nature of sustainable farming practices (Allen et al., 1991; Batie and Taylor, 1989; Francis et al., 1988; Gabriel, 1995; Kirschenmann, 1989; Saltiel et al., 1994; Stinner and House, 1987), the availability and usefulness of production information is important for the adoption of sustainable agricultural practices (Northwest Area Foundation, 1994; OFRF, 1996). Agricultural research influences adoption by ex-

panding and improving the sustainable technological options available to farmers (Batie and Taylor, 1991; Roberts and Lighthall, 1991). Research also provides information that can ease management uncertainties and reduce the financial risks associated with adopting new farming techniques.

Sustainable farmers in particular note that information plays an important role in decision-making. Studies conducted to better understand adoption behavior have found that unavailability of reliable information sources is a key barrier to adoption of sustainable farming practices (Northwest Area Foundation, 1994; OFRF, 1996). In these surveys, farmers note that public sources of information do not adequately address sustainable agricultural practices.

Several studies have sought to better understand farmers' use of agricultural information sources. Sustainable farmers cite their own on-farm research, other farmers, sustainable agriculture organizations, and farm magazines as most useful (Keeney, 1989; Northwest Area Foundation, 1994; Parr et al., 1990). While the majority of sustainable farmers surveyed in one study do not rely on Cooperative Extension Service (CES) agents, university researchers, or government agencies for sustainable agriculture information (Hoiberg and Bultena, 1995), another survey of a more general population of farmers found that the USDA's Natural Resources Conservation Service (NRCS) is the third most often used source of conservation information (Korsching and Hoban, 1990). However, in the latter study, farm magazines and other farmers were the top two sources used, which is consistent with other research findings. Traditionally, farmers in general have used the following sources to obtain agricultural information: (1) other farmers, (2) local farm product dealers, and (3) local government agencies (Korsching and Hoban, 1990). Here, differences in information usage can be seen based on the type of information sought (e.g., sustainable/conservation versus conventional) and/or the type of farmer seeking it (e.g., sustainable versus conventional). These findings suggest that information dissemination must be tailored to the preferences of specific farmer groups.

The traditional adoption-diffusion literature also describes differences in information usage based on relative innovativeness and stage of the adoption process. More specifically, farmers can be categorized as innovators, early adopters, early majority, late adopters, and laggards (Kraft et al., 1986). Based on homogeneous characteristics within these groups (including relative time of adoption), farmers differ significantly with regard to their information needs and usage. Information usage also varies by stage of the adoption process (Bultena and Hoiberg, 1986; Rogers, 1962; Ryan and Gross, 1943). The five adoption stages are: (1) awareness, (2) interest, (3) evaluation, (4) trial, and (5) adoption (Rogers, 1962). While mass media and farm magazines are often employed in the early stages of adoption (e.g., awareness), personal contact with friends and neighbors, government agencies, and personal experience have greater influence in later stages (e.g., evaluation and trial) (Bultena and Hoiberg, 1986). Farmers' information usage differs by farm operation type, innovativeness, and stage of adoption, therefore effective distribution of agricultural information must be tailored to specific farmer groups.

The U.S. government attempts to allocate research funds according to public interest. In regard to agricultural research and extension, government expenditure is primarily through the land-grant university (LGU) system and the USDA. Although publicly funded agricultural research has historically focused on economic goals, social and environmental problems have broadened public concerns. Private agribusinesses stand to profit from research and education activities, thus information on purchased agri-products will be produced and disseminated regardless of government support. On the other hand, alternative farming practices rely less on purchased inputs and more on management of biological, on-farm interactions. Thus, alternative research is less likely to be conducted unless public funds are specifically allocated to these efforts. Consequently, the government plays a unique role in sustainable agriculture research, compared with private interests involved with traditional agricultural research.

The main program through which pub-

lic funds are channeled to sustainable agriculture research is the USDA's SARE program. The USDA was authorized under the 1985 Food Security Act to undertake research and promote education in low-input sustainable agriculture (U.S. Congress, 1985). Initially called the Low-Input/Sustainable Agriculture (LISA) program, it was renamed the Sustainable Agriculture Research and Education program under the 1990 Farm Bill (U.S. Congress, 1990). Before funding was allocated to the program in 1988, little initiative was taken by the USDA to develop SARE. When funds were appropriated to the program, they accounted for a very small portion of federal expenditures on agricultural research (Smith, 1995).

According to Smith (1995), the \$3.9 million first allocated to the program accounted for less than 2% of the total funds allocated to agricultural research by the USDA. Other sources report that the SARE program has accounted for a mere 0.5% of the federal government's commitment to agricultural research and education (Hassebrook and Kroese, 1990; Hassebrook et al., 1995; NRC, 1989). The USDA's Agricultural Research Service (ARS) identified only 21 of its 1,177 research projects as "sustainable agriculture," the funds for which amounted to only 1% of the ARS budget (Hassebrook et al., 1995).

Critics have suggested that land-grant universities and Extension, which are largely responsible for publicly funded agricultural research and extension, have been slow to embrace sustainable agriculture (Auburn and Baker, 1992; Francis et al., 1988; Rossman, 1994; Watkins, 1990). While biases alone are a barrier to sustainable agriculture research and education, other barriers exist. Much agricultural research is imbedded in old paradigms that are inappropriate for sustainable farming systems. Specifically, a holistic, multidisciplinary, agroecological approach must replace the components, disciplinary, reductionist approach common in conventional agricultural research (Anderson, 1995; Batie and Swinton, 1994; Bezdicek and DePhelps, 1994; Duram, 1998; Gabriel, 1995; Keeney, 1989; Lockeretz, 1988; Madden and Dobbs, 1990). Because of the biological and socioeconomic interactions occurring on the farm at various

scales, controlled experiments viewed in isolation from the rest of the farm are not truly representative of a whole farm operation (Walter et al., 1997).

The lack of on-farm, participatory research is another potential barrier to producing sustainable agriculture information that is relevant to producers. A significant challenge posed by on-farm, participatory research is establishing means to collect and evaluate information in ways that are pertinent to both farmers and the scientific research community (Bezdicsek and De-Phelps, 1994). While farmers need practical, applicable information, researchers tend to focus on information that can be quantified and tested for statistical significance (Batie and Swinton, 1994). Problems such as these illustrate how research that is responsive to farmers' information needs is sometimes incompatible with researchers' disciplinary interests or goals. The latter difficulty relates in part to the institutional constraints embedded in academic reward structures (e.g., adherence to established research approaches) and has been a growing concern among individuals interested in improving sustainable agriculture research (Madden and Dobbs, 1990; Schaller, 1990; Thornley, 1990; Walter et al., 1997).

The "top-down" dissemination of information alone may be insufficient to develop the two-way flow of information that can both incorporate farmers' site-specific knowledge into the generation of information, as well as heighten the relevance of research to farmers (Phillips, 1997). Thus, the conventional top-down model of information transfer should be revised to better incorporate new, cooperative approaches to research advocated throughout the sustainable agriculture literature (Francis et al., 1988). Given the need for alternative approaches to sustainable agriculture research and extension, as well as differences in information usage by different types of farmers, the relevance of current methods of agricultural research and extension to alternative farmers must be considered.

Since access to information is a predictor of conservation behavior (Nowak, 1987), effective dissemination of information on sustainable agriculture is one means to encourage widespread adoption of sustainable farming systems. In order

to provide farmers with information that both encourages and facilitates adoption of sustainable practices, consideration must be given to the research and dissemination efforts of publicly funded researchers. Indeed, obstacles must be overcome by researchers who wish to provide information on sustainable farming systems. Because research improves and expands information and because information influences decision-making on the farm, both the dissemination of agricultural research and patterns of information usage by farmers are significant. While much research has been conducted on the latter, very little research has focused on the dissemination of agricultural information by researchers. Thus, the objective of this study was to assess the initial distribution of publicly funded sustainable agriculture research.

### **Research Methods**

In order to assess information dissemination efforts, a mail questionnaire was sent to researchers who had completed SARE-funded projects in the North Central Region since the program's inception in 1988. Focus of the survey was placed on publicly funded research, given the unique role of the federal government in encouraging alternative agriculture research for the public's interests. The North Central SARE region encompasses Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North and South Dakota, Ohio, and Wisconsin. A listing of researchers receiving funds, along with the year of funding and project titles, was obtained from program coordinators at the North Central SARE office.

SARE researchers were chosen primarily for two reasons: (1) the SARE program is the main source of federal funding for sustainable agricultural systems, and (2) SARE was created specifically to undertake both research and education endeavors. Since dissemination of information is an integral part of the program, researchers submitting proposals are asked to provide "an explicit statement of how findings will be made readily usable by the intended clientele" (USDA, 1998, p. 1). In addition, the form used to evaluate the "technical merit" of research proposals includes the following questions as one of its five eval-

uation criteria: "Has outreach been incorporated into the project? Will the results reach the designated audience in an effective way?" (USDA, 1998, p. 5).

Researchers funded through the North Central SARE program's Research and Education Grant Program or the joint USDA/U.S. Environmental Protection Agency's (EPA) Agriculture in Concert with the Environment (ACE) Grant Program (administered by SARE) from 1988 through 1996 were surveyed. Two types of SARE-grant recipients were irrelevant to this study, since our interest was in the dissemination of research results by non-farmer researchers. Specifically, farmers receiving SARE Producer Grants were omitted, along with those individuals funded to undertake educational activities specifically. The latter group was irrelevant since these projects neither conduct agricultural research nor distribute SARE-funded research results. Projects that received funding in 1997 were also omitted from both grant categories under the assumption that these projects were still underway at the time of the mailing and, therefore, efforts to disseminate results would have been minimal. Lastly, duplicate names were omitted for researchers who received funding for more than one funding term and/or more than one project. As a result, 92 agricultural scientists were sent the survey designed for this study.

Dillman's Total Design Method was partially employed for the survey research (Dillman, 1978). Specifically, questionnaires and cover letters were mailed with postage-paid return envelopes, and follow-up postcards were sent as a reminder (or as a token of gratitude if respondents had already completed and returned the survey) approximately 10 days after the survey was mailed. Financial resources and time constraints prohibited a second mailing. A response rate of 49% was obtained from the single mailing; thus, 42 returned surveys were analyzed.

The mail questionnaire incorporated both closed and open-ended questions. Data on various occupational characteristics of SARE-funded researchers provide insight into who receives funding from the SARE program. In addition, ordinal data were compiled to assess SARE researchers' use of 22 information dissemination methods, as well as their rationale for

choosing particular outreach methods. Ordinal data also focused on researchers' perceptions about responsibility for information dissemination and barriers to the dissemination process. All ordinal data were collected using five-point Likert scales, where "1" represented "not used" or "not significant," and "5" represented "frequently used" or "very significant." Open-ended questions were designed to support quantitative data and to provide additional insights into publicly funded agricultural research and education.

For the qualitative analysis of researchers' written responses, comments were read and recorded for each question. Next, key words representing the central focus of each comment were noted. For each question, the key words occurring multiple times were used to discover themes in written comments. Reported here are additional responses to specific, closed-ended questions (i.e., written responses that were not listed as "multiple-choice" options). All of these "other" responses which occurred at least three times are reported. In reporting these replies, the total sample size is reduced to the number of respondents who wrote additional comments for each question addressed. General themes in the overall responses of SARE researchers are also reported, since some responses did not address specific survey questions, but were in fact mentioned by multiple researchers. Relevant quotations are included in the following sections to provide analytical depth to the research findings.

## **Survey Results**

Mail questionnaire responses from the 42 SARE researchers are reported in 4 sections. First, we describe occupational characteristics of SARE researchers. Second, the methods of information dissemination employed by researchers are presented, along with their rationale for choosing these methods. Third, we present researchers' responses to three specific questions involving responsibility for, effectiveness of, and barriers to dissemination efforts. Finally, we report additional insights learned from SARE researchers' written comments.

Response biases present an unavoidable caveat to survey research, and thus must be considered in relation to research

results. Characteristics that may inhibit survey completion include time constraints, as well as interest and participation in research activities. As a result, respondents may be more active researchers in terms of their agricultural outreach efforts, thereby positively influencing our survey results. Yet, these researchers provide a relevant example of the types of activities that make information available to farmers. Other potential biases are discussed where relevant throughout the remainder of this paper.

### **Characteristics of SARE researchers**

Mean age of SARE researchers is 49 years with a range of 35 to 63 years. The primary employer of research grantees is land-grant universities (88.1%), with the remaining employed by nonprofit organizations (7.1%) or other institutions (4.8%). Of the researchers who are university professors (83.3%), the majority are either full (54.3%) or associate (28.6%) professors. The remaining researchers in faculty positions are either assistant (8.6%) or emeritus (2.9%) professors, or hold some other position within their departments (4.8%). Thus, research funded through SARE Research and Education and ACE Grant Programs is largely conducted by established faculty at land-grant institutions in the North Central SARE Region.

Researchers report a range of 7 to 38 years of experience in agricultural research and education, with a mean of 22 years. At the same time, researchers claim to have 3 to 26 years of experience in sustainable agriculture research and education. Average experience in sustainable agriculture research is 13 years. Thus, SARE researchers have significant experience in conducting agricultural research, particularly with regard to conventional agricultural production.

### **Information dissemination by SARE researchers**

The 22 information sources analyzed in this study were ranked by mean response (Table 1). The three information sources most frequently used by researchers in dissemination of SARE-funded project results are: (1) one-on-one contact with pro-

ducers, (2) on-farm, participatory research, and (3) group activities. The three sources least employed by researchers are: (1) non-Internet computerized sources, (2) the USDA Farm Service Agency, and (3) visual media.

To better understand the process of dissemination of publicly funded research, SARE researchers were asked to explain their rationale for choosing dissemination methods (Table 2). The most influential factor in choosing dissemination methods is perceived effectiveness of the method(s), specifically with regard to targeting the intended audience. Researchers' focus on the intended audience is uniquely captured by written comments that supplemented the closed-ended question, such as the comment below:

- "dissemination chosen with audience in mind: other researchers—peer-reviewed publications; farmers—workshops, one-on-one, Extension publications, farm magazines; general public—mass media"

No evidence was found in the written responses of researchers that they consider differences among farmers in selection of their dissemination methods.

Suggestions from colleagues and government agencies are ranked as less important factors in choosing dissemination methods. Personal preference, monetary resources, and time constraints are ranked as moderately important factors. Many researchers (14.3%) also indicate that the ready availability of particular methods of dissemination is important, as is suggested by the following responses:

- "most [employed dissemination methods] were responses to invitations for information"
- "we put the information out on our Web page—this was due, in large measure, to the computer competence of one of the researchers involved"

### **SARE researchers' views of information dissemination**

SARE researchers' responses were solicited for three additional questions: (1) Are the results of publicly funded sustainable agriculture research reaching farmers?, (2) What barriers exist to the distribution of information learned through publicly funded sustainable agriculture re-

search?, and (3) What is the relative degree of responsibility for the distribution of publicly funded research among personnel involved with sustainable agriculture research and education?

To the first question, about half of the researchers replied affirmatively while about one-fifth replied negatively (Table 3). One-fourth of respondents indicated that research only partially or sometimes reaches farmers. Written comments describe researchers' experiences and opinions. Nearly 30% of the researchers stated that only farmers who actively and/or philosophically pursue sustainable agriculture receive information produced through research. Likewise, researchers noted that information reaches farmers only when individual researchers are committed to dissemination (12.9%). Several researchers' comments (19.4%) also indicated that institutional biases inhibit distribution of sustainable agriculture research. Response examples include:

- "I see resistance and blockage from conventional interests in the land-grant university (LGU) system; most info gets out through our alternative system—person to person, group to group, Internet; not all LGUs are the same on this; some more/less supportive"
- "farmers seeking answers or information can normally get information from the good projects; researchers [who] do good work are likewise highly motivated to deliver the information to the users"
- "it reaches those who philosophically are pursuing sustainability"

The second question specifically investigated barriers to dissemination of sustainable agriculture information. Researchers' note that research and education endeavors are greatly inhibited by limited resources for sustainable agriculture research in general, and for dissemination efforts specifically (Table 4). Insufficient communication between researchers and farmers is another barrier to extension of agricultural research. Lastly, researchers' suggest that inadequacies of government agencies and the lack of clearly established responsibilities for farmer outreach are moderately important barriers to dissemination. Written responses indicate that additional barriers include institutional bi-

**Table 1. Methods of information dissemination used by SARE researchers<sup>1</sup>.**

Information channel	Mean response <sup>2</sup>
Agricultural producers	4.26
On-farm, participatory research	3.95
"Handout" reading materials	3.91
USDA's Cooperative Extension Service	3.52
Nonprofit, non-governmental organizations	3.36
Farm magazines	3.26
University faculty or researchers (non-Extension)	3.24
Peer-reviewed, scholarly journals	3.2
Farm managers/consultants	2.93
Newspapers	2.90
Local Soil and Water Conservation District	2.83
USDA research program coordinators	2.6
USDA's Natural Resources Conservation Service	2.55
Agribusiness personnel and/or agri-product dealers	2.24
State Departments of Agriculture	2.19
"Online"/Internet sources	2.15
Books	2.12
USDA publications	1.93
Visual media (videos, etc.)	1.9
USDA's Farm Service Agency	1.64
Non-Internet computerized sources	1.54

<sup>1</sup>n = 42.

<sup>2</sup>1 represents "not used"; 5 represents "frequently used."

**Table 2. SARE-funded researchers' rationales for choosing information dissemination methods<sup>1</sup>.**

Specified response options	Mean response <sup>2</sup>
Farmer-perceived effectiveness (i.e., as determined by previous research or personal contact with farmers)	4.20
Time requirements/constraints	3.88
Your [researcher's] personal preference	3.67
Financial resources available to you [researcher]	3.62
Advocation or suggestion from peers/colleagues	3.05
Advocation or suggestion from government agency	2.10
"Other" frequently reported responses	Response (%)
Ready availability of method	14.28

<sup>1</sup>n = 42.

<sup>2</sup>1 represents "not used"; 5 represents "frequently used."

ases, time constraints, poor format and/or availability of information, limited farmer interest, and academic reward structures (Table 4). Representative responses include the following:

- "LGU [is] set up to support conventional agriculture; those who do sustainable agriculture see LGU as not working [in] their interest . . . links of LGU to chemical companies and agribusiness hinder dissemination"
- "(1) resources available are inadequate to conduct the research and to do the most

effective dissemination of results; (2) researchers advance professionally by doing research, not extension"

- "responsible agencies not doing their jobs"
- "biggest barriers are money and personnel—agencies would like to develop programs or expand them but are already overloaded; additional staff are needed for direct delivery and for development of materials"

The third question captures researchers' perceptions regarding responsibility

**Table 3. Researchers' replies to the question: Are farmers receiving information learned through publicly funded sustainable agriculture research?<sup>1</sup>**

Response	Response (%)
Yes	54.8
Some/partially	25.8
No	19.4
Frequently noted explanations	Response (%)
Only farmers who are interested in sustainable practices receive information.	29.0
Distribution of information is inhibited by inadequacies/biases of public agencies.	19.4
Information reaches farmers when researcher is committed to dissemination.	12.9

<sup>1</sup>n = 31.

**Table 4. Researcher-perceived barriers to the distribution of sustainable agriculture information<sup>1</sup>.**

Potential barriers to farmer outreach	Mean response <sup>2</sup>
Inadequate governmental resources are directed to sustainable agriculture research, in general.	4.10
Not enough money is allocated to the dissemination of research results.	3.90
Direct communication lines between researchers and farmers are insufficient.	3.44
Government agencies responsible for getting information/research to farmers are insufficient.	3.17
Responsibility for farmer outreach is not clearly established.	3.07
"Other" potential barriers to farmer outreach	Response (%)
Institutional biases/barriers	26.2
Time constraints	9.5
Insufficient form and/or availability of information	7.1
Limited farmer interest in sustainable agriculture	7.1
Academic reward structure	7.1

<sup>1</sup>n = 42.

<sup>2</sup>1 represents "not used"; 5 represents "frequently used."

for information dissemination. Researchers rank land-grant universities and Extension as the top two parties responsible for extension of agricultural research (Table 5). SARE researchers also indicated that individual researchers and farmers are largely responsible for information dissemination. In order of descending rank, the following institutions were also viewed as responsible for farmer outreach: USDA research program coordinators, local Soil and Water Conservation Districts, other nonprofit/governmental organizations, and State Departments of Agriculture. Finally, researchers' responses suggest that the USDA's Farm Service Agency and non-land-grant universities had relatively little responsibility to dis-

seminate information obtained through publicly funded research.

While the question of responsibility may appear to provide obvious "answers," it cannot be overlooked. Our analysis of researchers' written responses provides further insight into sustainable agriculture research and education activities. From this analysis, we discovered themes that emphasize the importance of consolidating responsibility for farmer outreach.

### **Additional insights from SARE researchers**

Three additional insights were discovered from our analysis of written responses from SARE researchers in the North Central Region. First, an alternative extension

system exists for sustainable agriculture compared to conventional agriculture. Second, there is a great need for better organization and presentation of information gained through research. Third, the outreach activities of the Cooperative Extension Service are highly variable and often inadequate.

Consideration must be given to the alternative information channels used by sustainable farmers. Since information usage has been shown to vary between different farmer groups (e.g., sustainable versus conventional), previous research findings alone indicate the existence of an alternative extension system. Institutional biases against sustainable agriculture, including those of agribusinesses, certainly contribute to this alternative system of information dissemination. The explicit comments of several researchers' also indicate that an alternative extension system exists for sustainable farmers compared to conventional farmers. Moreover, researchers' comments suggest that institutional biases influence this alternative extension system for sustainable agriculture. Example responses include:

- "I see resistance and blockage from conventional interests in LGU systems . . . not all LGUs are the same on this; some more/less supportive; most info gets out through our alternative system—person to person, group to group, Internet"
- "[alternative agricultural information is] not [distributed] through the normal channels . . . [it is distributed] more through farm publications than extension or universities; there are very good, proactive people in both, but they have to achieve outreach through special conferences, field days, and other special events rather than the customary channels of the institutions"
- ". . . private information channels—farm press, etc.—are largely closed to sustainable agriculture info; public channels are not much better"

The second overall finding in SARE researchers' written comments relates to the form and availability of information. Specifically, information must be compiled and synthesized in ways that are useful to farmers; it must be organized so that it is easily referenced. Nearly 17% of the researchers surveyed express this need in

regard to SARE research specifically and/or sustainable agriculture information in general. A few specific comments follow:

- “there needs to be more synthesis and integration of SARE and non-SARE research towards a “unified” picture establishing universal principles related to specific cultural practices”
- “the information is not centralized; every researcher has it in his/her file; the regional SARE office cannot profile it, even on request; the information doesn’t flow adequately from each individual researcher; it is too diffuse; a flood of bits and pieces of partly described or “untranslated” scientific findings really does little good for extension workers or farmers; it needs indexing and ready access, and then summarization to be of use”
- “[information] needs to be put into condensed form as a farmer only has so much time to use in looking for information”

The last theme in SARE researchers’ written comments pertains to the activities of the Cooperative Extension Service (CES). That is, Extension activities focused on farmer outreach and dissemination of sustainable agriculture information are highly variable. While no conclusion can be drawn about the overall quality of the CES, the variable responses among the researchers surveyed suggest that an evaluation of Extension activities in sustainable agriculture is warranted. Representative responses include:

- “Extension Service is okay—they make the most one-on-one contacts; they interact with LGUs; they know the farmer-rancher language”
- “competition among agencies is non-productive; CES has the capability to disseminate information in many states but other agencies [that] lack the staff, training, and skills to do so want that job for self-preservation reasons; competition results which hurts the overall performance; support CES, give them money and the responsibility and it will happen”
- “I think that the USDA—which funds much of the research and is a public agency—should disseminate knowledge; I think that the Cooperative Extension Service has a mission-oriented obligation to disseminate knowledge about alternative pest/weed management and other farming

**Table 5. Responsibility for farmer outreach as perceived by SARE researchers<sup>1</sup>.**

Parties involved with agricultural research and education	Mean response <sup>2</sup>
Land-grant universities	4.64
USDA’s Cooperative Extension Service	4.48
Individual researchers receiving funding	4.38
Farmers/ranchers (i.e., producers are responsible for their own information needs)	4.12
USDA research program coordinators (e.g., for SARE program)	3.74
Local Soil and Water Conservation District	3.50
Nonprofit/non-governmental organizations	3.41
State Departments of Agriculture	3.14
USDA’s Farm Service Agency	2.81
Non-land-grant universities	2.48

<sup>1</sup>n = 42.

<sup>2</sup>1 represents “not used”; 5 represents “frequently used.”

practices and is not doing so in most cases, especially for insect pests and weeds”

- “the Extension Service has had no role in the research or dissemination of results, despite our invitations and requests for collaboration”

These additional findings illustrate the need for establishing responsibility for farmer outreach. Indeed, our research findings have implications for the SARE program and U.S. agricultural research and education.

## Discussion

The survey data analyzed for this study provide important information on the dissemination of publicly funded sustainable agriculture research. Our research findings translate into practical concerns and recommendations for the SARE program, as well as for agricultural research and education in general.

SARE-funded researchers in the North Central Region are generally employed by land-grant universities and hold higher-level tenure-track positions. The latter finding may be partly influenced by a response bias, as assistant professors may have less time to complete mail questionnaires. SARE researchers also have significant experience in both conventional and sustainable agriculture research. Since these researchers have a high level of experience in conventional agricultural research, future evaluations should focus on the degree to which this experience influences information on sustainable agriculture produced through the SARE program. Specifically, research projects can be as-

sessed for incorporation of alternative research approaches, such as on-farm analyses and more holistic, rather than “components,” research.

The top three information sources employed by researchers to distribute their research findings involve personal contact with farmers, while the least-often used sources are non-Internet computerized sources, the USDA’s Farm Service Agency, and visual media. Researchers’ incorporation of farmers into dissemination activities suggests that SARE researchers recognize the importance and utility of personal communication with farmers. This conclusion may be overstated as a result of a response bias, since more active and interested researchers may have completed and returned the questionnaire. Still, the data indicate a significant attempt to include farmers in SARE researchers’ research and extension efforts.

SARE researcher’s principal reasons for choosing specific dissemination methods are perceived effectiveness, and money and time constraints. SARE researchers’ primary considerations are perceived effectiveness in reaching the targeted audience. These findings raise the question of whether researchers (or the agricultural community, more generally) truly understand which information sources are most effective. Responses indicate that researchers are following recent suggestions in the sustainable agriculture literature for greater farmer-involvement in research and extension efforts. At the same time, no evidence was found that researchers consider differences among



farmers in their dissemination efforts. Since information usage varies among different types of farmers, the following questions must be raised: Who is the intended audience of SARE research? and What is the intended purpose of SARE education activities (e.g., promotion of sustainable farming techniques, assistance in implementation of specific practices, aiding refinement of practices to site-specific fields, etc.)? Once these questions are addressed, dissemination efforts can be better directed to distinct farmer groups for specific policy purposes.

Given the research findings presented here, along with the fact that information usage differs across distinct farmer groups, consideration must be given to information channels used by the SARE program. The "top-down, trickle down" approach traditionally employed in the U.S. agricultural research and extension system must be reconsidered if nonconventional farmers are the target of this information. In particular, reliance on farmer-to-farmer contact as a means of information dissemination may be less effective for information on sustainable agriculture. For example, alternative farmers may be too few and diffuse to effectively disseminate information through these channels. Moreover, if conventional and alternative farmers do not interact, as noted in much of the agricultural literature, then dissemination of information is constrained by heavy reliance on the "trickle down" approach. Although SARE researchers are utilizing the participatory research and/or dissemination efforts advocated in the literature, the effectiveness of distributing information by these means may be restricted by involvement of limited numbers and select types of farmers.

Based on the traditional adoption-diffusion model, reliance on farmers in information dissemination suggests that farmers who have already adopted alternative farming practices are most likely to receive this information. However, just as the relevance of traditional extension models to sustainable agriculture is uncertain, the application of the adoption-diffusion model to alternative farmers must also be questioned. This is particularly true in view of the differences in information usage found among farmers.

Only half of SARE researchers sur-

veyed believe that publicly funded information on sustainable agriculture is reaching farmers. The majority of researchers suggest that receipt of information is dependent on many factors, including researchers' commitment to dissemination and individual farmers' interest in alternative agriculture. Thus, whether farmers receive SARE-funded research depends on the degree to which they actively pursue this information specifically and information on alternative farming practices more generally. This finding has important implications for farmer outreach, particularly as a means of encouraging adoption of sustainable methods. Since farmer interest limits the widespread distribution of research results, active methods of farmer outreach must be employed to reach farmers who are not actively pursuing sustainable methods of production. Indeed, we must more actively seek to promote agricultural sustainability through education and awareness.

Our research also illustrates how SARE program coordinators (and other agencies involved with information dissemination) can best influence researchers' dissemination methods. Program coordinators and government personnel can influence dissemination by providing forums for research and education activities (e.g., organizing field days, making special calls for information, and developing handout materials) rather than by simply recommending particular outreach activities. This is particularly important since temporal and monetary resources significantly influence the information dissemination efforts of SARE researchers.

Given the biases present in traditional agricultural institutions, special attention must be given to the fact that the majority of SARE-funded researchers (88%) are employed at land-grant universities. These findings suggest that SARE researchers are the "exception to the rule" at these institutions. Thus, these select researchers are confronting ingrained institutional norms and should be commended for their efforts. But the implication follows that institutional pressures have likely discouraged many qualified researchers from conducting work involving sustainable farming practices. In addition, only 8.6% of the SARE respondents are assistant professors in faculty positions, which suggests that

researchers who are under pressure to earn tenure may be less likely to confront institutional barriers associated with conducting sustainable agriculture research.

Institutional biases, along with other barriers, are significant enough that an alternative extension system has evolved for sustainable as compared to conventional agriculture. This finding is particularly worrisome, given that government funds should be allocated to activities that reflect the interests of the general public. In the case of agriculture, a clear distinction can be seen in the private interests tied to conventional agriculture versus the public interests represented by sustainable agriculture. Until these divergent interests are directly addressed in the U.S. agricultural research and extension system, barriers to research and education in sustainable agriculture will remain, and the distribution of information on sustainable farming systems will continue to flow through alternative channels.

Given the barriers to sustainable agriculture research, publicly funded sources for such research are critical. Several researchers' comments illustrate the fundamental role that the SARE program has had in conducting alternative agriculture research:

- "the SARE program was a very good idea because it allowed funding of research which otherwise would not have been done; funding has always been inadequate for the program from its inception; the requirement that each project have an adjoining outreach program was one of the best parts of the program; the evolution toward requiring end-user participation through the whole planning, execution, and outreach process [has] been very positive"
- "without SARE support, sustainable agriculture research would not be conducted at this university"

The development of the SARE program in the late 1980s has done much in terms of channeling funds to sustainable agriculture research within established institutions. Unfortunately, the program comprises only a very small portion of federal expenditures on agricultural research. Additional funds for the program should be granted, given its essential role in conducting research and education in sustainable

agriculture, as well as its unique role in addressing public interests in U.S. agriculture. Increased attention must be placed, however, on targeting specific sectors of the farmer population for different purposes, so that information is distributed as effectively as possible.

The ways in which research is presented, summarized, and catalogued must also be improved, so that information obtained through research is readily available and understood by farmers. This task is essential for translating scientific research findings into forms that are useful to farm managers, as well as for decreasing the time and effort required to locate and utilize information produced through scientific research. Moreover, sustainable agriculture information should be organized or catalogued separately, in order to avoid losing such information in the numerous conventional projects that have been conducted. This task of compiling and tailoring information to specific farmer audiences extends beyond the responsibilities of individual researchers and is more appropriate for agencies responsible for farmer outreach as a whole.

The above issue raises the question: Who is responsible for farmer outreach in sustainable agriculture? Surveyed researchers perceive the following parties as highly responsible for sustainable agriculture research and education: land-grant universities, USDA's Cooperative Extension Service, and individual researchers and farmers. The familiarity that regional SARE offices have with SARE-funded projects and the contact that program coordinators could consistently have with all SARE researchers necessitates at least some organizational effort by regional SARE offices. Indeed, SARE's recent efforts on the World Wide Web indicate that it is beginning a new chapter in information accessibility (SARE, 1999). At the same time, however, cataloguing both SARE and non-SARE research is a task that extends beyond the duties of SARE program coordinators.

A "middle" agency (i.e., between researchers and farmers) must be held responsible for these larger organizational tasks. The mission of the Cooperative Extension Service includes farmer outreach and dissemination of findings from agricultural research. Thus, it may be the

most appropriate agency to undertake these activities. Indeed, the hierarchical organization of the Extension Service, as well as its proximity to researchers, farmers, and other USDA personnel, makes it a logical agency to engage in this task. Yet the results of this survey as well as the agricultural literature indicate that Extension efforts to disseminate information on sustainable agriculture are highly variable. Reasons for this variability among Extension activities should be assessed, and lessons learned from successful outreach programs should be transferred to all Extension offices.

This issue of responsibility for farmer outreach must be addressed, so that a single agency (or select agencies) can be held responsible for the necessary task of information dissemination. Indeed, improvements needed in the distribution of sustainable agriculture information extend beyond the responsibilities of individual researchers and SARE program coordinators. Historically, the LGU system and Extension Service have been responsible for agricultural research and education. A review of these responsibilities must be at the forefront of pressing issues in U.S. agricultural research and extension, if we wish to provide producers with practical information regarding sound sustainable agricultural practices in the future.

### Conclusions

The federal government should continue to allocate public funds specifically to research and education in sustainable agriculture, due to the important role that information plays in alternative farm management and the public interests involved with sustainable agriculture. The latter reason is critical in view of organizational biases against sustainable agriculture. Overall, barriers to sustainable agriculture research and extension contribute to an alternative extension system for alternative information. In order to successfully disseminate publicly funded information on sustainable production methods to farmers, the SARE program must recognize this alternative extension system for disseminating information on such methods, along with other differences in information usage among farmers. In addition, the SARE program can improve informa-

tion dissemination by packaging information for specific purposes to distinct farmer groups. By these means, the SARE program can encourage adoption, ease implementation, and aid refinement of sustainable agricultural practices to diverse groups of farmers.

While individual SARE researchers can be commended for resisting institutional biases and striving to incorporate farmers into their outreach efforts, the implications of such biases and reliance on traditional research and extension models for sustainable agriculture as a whole must not be overlooked. These implications, along with other findings presented here, must be addressed within both the SARE program specifically and the U.S. agricultural research and extension system in general. Only then can sustainable agriculture become mainstream through effective agricultural research and education efforts and begin to receive the government support justified by public interests.

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### **USDA Creates Four Regional Pest Management Centers**

The USDA has announced the creation of four Regional Pest Management Centers, which will "help focus research and extension efforts on developing and delivering alternative and safer pest management strategies to farmers and ranchers." The centers will bring together university research and extension specialists to focus on pest management issues common to agricultural production within that region.

These cooperative partnerships will involve colleges, universities, and crop production experts from states within the region. The centers will focus their efforts on pest management issues that are common to agricultural production within a region and across state boundaries.

In the North Central region, Michigan State University and the University of Illinois will lead a multi-state coalition. The lead institutions in the other regions are: Northeast, Pennsylvania State University and Cornell University; South, University of Florida; and West, University of California at Davis.