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Staff Paper

**Institutional Issues and Strategies:
Views from Within the Land-Grant University**

**by
Sandra S. Batie and Scott M. Swinton**

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Abstract

Sustainable agricultural research and education have gained acceptability within the land-grant system in less than a decade, an impressive change. Attitudes were changed by a set of forces which include lobbying by sustainable agriculture advocates, requests from farmers as a result of the cost-price squeeze of the early 1980's, changing demands for both environmental quality and less pesticide residues from food consumers, and the availability of new funding sources. Despite its hard-won acceptability, there are tensions with respect to sustainable agriculture within the land-grant system. Sustainable agricultural issues are not yet integrated into the fabric of the land-grant institution. In order to integrate it fully, challenges remain in three key areas: knowledge generation, research and education, and funding.

The challenge to generate new knowledge embraces not only biological and ecological systems, but also the socioeconomic systems of the humans who manage agriculture. We must move beyond anecdotal evidence of biological integration efficiencies to scientific understanding of the underlying processes and opportunities for human intervention. The biological research agenda covers a plethora of plant-animal-environment interactions from the microbial level on upward. Socioeconomic research must grapple with human motivations to change farming methods, as well as the likely impacts of change on farmers, consumers, other species, and the quality of the environment in which we live. One important area for such knowledge-generation is the relative merits of government policy tools, which have been and will continue to be central to environmental quality assurance.

Attempts to generate new sustainable agriculture knowledge have already begun to raise new challenges for the integration of research and education. Research trials conducted off the research station pose new quandaries for scientific analysis and validation. Having farmers set the research and outreach agenda can be threatening to land-grant personnel as the old distinction between research and extension begins to dissolve. This situation is complicated by the budgetary stress on land-grant institutions and uncertainty about the dividing line between public and private responsibilities in a rapidly changing agricultural business environment.

Funding is the third area where more integration into the land-grant university is needed. Earmarked funding for sustainable agriculture has helped to legitimize it in the land-grant university. But earmarked funding is a two-edged sword. If sustainable agriculture fails to become integrated into the routine land-grant agenda for research and education, it will lose its newly gained momentum if those funds disappear. It needs to gain full acceptance as legitimate science that will allow its researchers to compete for "mainline" funding sources such as the USDA National Research Initiative grants.

Sustainable agriculture has made strong gains within the land-grant university system. But it can easily slip from the land-grant agenda or become co-opted if sustainable agriculture research and education are not integrated further into the system while retaining a clear focus on its original goals.

Institutional Issues and Strategies for
Sustainable Agriculture: View From
Within the Land Grant University

Sandra S. Batie and Scott M. Swinton

When considering the land-grant universities' contribution to sustainable agriculture research, extension, and education, one cannot help but be impressed with how different the situation today is from a decade ago. A decade ago sustainable agriculture in many universities, was an unacceptable activity. Those who chose to pursue such a mission were often considered part of a fringe element doing nonscientific or irrelevant work.

Those attitudes began to change as a result of several external forces. First, in the late 1970s and early 1980s sustainable agriculture advocates and populists worked to place sustainable agriculture issues on the land-grant agenda. Groups such as the Land Institute in Salina, Kansas, and the Center for Rural Affairs in Walthill, Nebraska, became identified with the advocacy of these issues. Their efforts were accelerated by the "farm crisis" of this period when many farmers' incomes were exceptionally low and the future of the family farm appeared in jeopardy. Farm groups and political leaders began to approach the land-grant universities asking that some of the research directed at enhancing yields be redirected to reducing costs. In addition, farmer stewardship groups and key farmer leaders who were experimenting with more environmentally friendly practices, were also approaching their land-grant universities with requests for scientific analysis of their farming systems. Still other farm groups were concerned that lower pesticide levels were needed to enhance farmworker safety and reduce residue levels in consumer foods, a demand increasingly being reflected in the market. These growers wanted land-grant assistance

in meeting these needs in a profitable manner. The need to change agricultural practices received a further prod in the late 1980s from studies detecting the presence of agricultural chemicals in wellwater (Hallberg, 1989).

The cost-price squeeze was probably what most raised the legitimacy of addressing sustainable agriculture problems. However, the availability of funds also was a crucial legitimizing factor. When funds began to be available through the Low Input Sustainable Agriculture (LISA) program of the U.S. Department of Agriculture (USDA), many faculty and university administrators decided that sustainable agriculture was an acceptable pursuit. However, the funding was not really available until 1988 and was (and remains) modest.

Despite these legitimizing events, however, there remains a tension in the land-grant system with respect to sustainable agriculture issues. For example, a chorus of critical comments accompanied the release of the National Academy of Sciences report on Alternative Agriculture (National Research Council, 1989). Notwithstanding the validity of either the report or its critics, the intensity and the speed of the response suggests that while sustainable agriculture has achieved some acceptability in the land-grant system, it is far from being integrated into it. This lack of integration also was evident in the strategic plan for the 1990s issued by the Experiment Station Committee on Organization and Policy (ESCOP, 1990). The plan designates food safety and water quality as the top priority research areas, but nowhere does the report specifically mention "sustainable agriculture." Clearly, sustainable agriculture is not treated like any other research or extension issue.

While sustainable agriculture appears to have gained acceptability in research circles, it has less acceptability in extension. Many extension agents still seem to regard sustainable agriculture as irrelevant or even in conflict with their expertise. Although this impression can be tested empirically, unfortunately we know of no definitive research addressing our hypothesized distinction between the acceptability of sustainable agriculture in research and extension agendas. If our generalization is

correct, however, it is understandable. If sustainable agriculture means anything, it means change, and change tends to devalue older expertise. Also, the increasing role of farmer participation in and the multidisciplinary nature of sustainable agriculture extension can erode existing power and support relationships developed over a career. Finally, although scientific knowledge about sustainable agriculture issues is increasing, it remains limited in scope. Thus academics—including extension academics—may be both motivated to resist sustainable agriculture and also may have legitimate scientific concerns.

On one hand, therefore, sustainable agriculture issues have made impressive inroads within the land-grant system in less than a decade, having gone from unacceptable to acceptable. Nevertheless, they are far from being integrated into the fabric of research and extension institutions. Unless such integration occurs, the sustainable agriculture component within the land-grant colleges will remain fragile and could easily lose momentum if earmarked funding is no longer available. Without funds specifically allocated for sustainable agriculture research, will experiment station and extension directors view sustainable agriculture as worthy of hard funding and positions?

The remainder of this paper will address this challenge of integration within the land-grant system. Specifically, we will examine: goals for integrating knowledge generation, the process of integrating extension and research, and the need for integrating funding sources.

Integration of Knowledge Generation

Sustainable agriculture is systems-oriented, applied, and multidisciplinary. As such, it provides challenges to the disciplinary basis on which universities are organized. Not just biological-ecological systems but also economic-social systems must be understood in an integrated fashion.

Over the past two decades, evidence has accumulated that sustainable agricultural practices can be preferable to conventional ones according to a variety of criteria including stability of yields,

profitability, soil conservation, and chemical leaching and runoff (Lockeretz et al., 1981; Harwood, 1985). But our observations remain largely anecdotal. They tend to be based on comparisons of different farms (under different managers) or the same farm over different periods of time. The paired comparisons usually fail to delve into the underlying processes that are responsible for the observed differences in outputs. This drawback has been an impediment both to increased adoption of sustainable agricultural practices by farmers and to their widespread endorsement by academics in the land-grant community. Scientists know the precise biochemical mode of action that makes sulfonyl urea herbicides kill weeds in wheat, but they do not know why crop rotations raise yields higher than can be explained solely by leguminous nitrogen fixation (Crookston, 1984).

The challenge in generating sustainable agriculture knowledge is to integrate our understanding of various biological and social system components and to comprehend better the behavior of the systems themselves. The goal is to be able to manage plant and animal communities in a way that can be sustained both biologically in the natural environment and socio-economically in the human environment.

The biological and ecological research agenda covers the myriad plant-animal-human-environment interactions from the microbial level on upward. What are the integration efficiencies present in complex plant systems (Harwood 1985, 1993), and how do they work? How is nitrogen transformed, and how does it move in the soil, plants, water and air? How do agricultural chemicals metabolize in the environment, how toxic are the metabolites, how stable and leachable are they? Under what conditions is conservation tillage compatible with zero or low herbicide use? What determines how long it takes to convert a conventional, energy-intensive farming system to a more sustainable one that greatly reduces imported energy sources?

Frequently forgotten in sustainable agriculture systems research is the fact that human behavior is the key to change (Nowak, 1992). A fundamental question that must be answered if change is to take

place is: "Why do farmers farm the way they do?" What is the barrier to the adoption of alternative farming systems? Is it ignorance, time or financial constraints, technology limitations, ownership arrangements, community preferences, structural issues, public policy incentives, or family reasons? If behavior is to be changed through education, regulation, or incentives, the complex interactions among the factors that influence human behavior must be understood.

As with biological processes, system interactions are at the heart of the socioeconomic research agenda for sustainable agriculture. Few would dispute that people have multiple goals, but how do farmers manage them? How could they manage them better? Profitability is clearly a key to the adoption of sustainable agriculture practices, but other goals matter too. How do people, and farmers in particular, value environmental benefits? What determines how consumers respond to products that differ from one another in *how* they were produced rather than in *what* they contain (toxic residues or nutrients, for example)?

Furthermore, the desirability of alternative systems will require information on their ultimate impacts: on comparative advantage; on trade; on prices; on profits; on communities; on the scale, ownership, and composition of the agriculture sector; on technology innovation and choices; on environmental quality; and on ecosystem, wildlife, and human health risks (Fox et al., 1991). A question always relevant in policy formulation is: Who are the beneficiaries and who bears the costs? If changed policy is needed to obtain changed farming systems, we will need more insight on the ultimate impacts of a successful change. These impacts may be far-reaching, touching not just how we produce farm products and what that means for agricultural ecosystems, but also the kinds of jobs in the input-supply industry, the future of rural towns, how much consumers pay for food, how well we can feed the earth's burgeoning human population, and the balance of agricultural trade.

Building the systems-oriented knowledge needed to advance sustainable agriculture will require close collaboration among many different kinds of scientist and practitioner. But this requirement does

not necessarily imply a need for a new breed of generalist. Greater promise for scientific advance continues to lie in traditional disciplinary excellence leavened with strong communication abilities and broad interests. The gains from specialization, as all economists know, are only captured with trade. Thus disciplinarians must trade their knowledge if society is to gain all the benefits of knowledge generation. For the teaching agenda of the land-grant university, this means continuing to train specialized scientists, but acquainting them with a systems perspective, involving them in applied problems early, and paying attention to the listening and collaboration skills necessary for team problem-solving.

Integration of Extension and Research

If interdisciplinary collaboration includes only scientists, it will be not be adequate for the challenges of integrating knowledge in the way just described. Research and extension need to be integrated too. The pursuit of disciplinary excellence by researchers too often has meant that the research problems of farmers are ignored. Ironically, after a decade of prescribing integrated, farmer-driven research and extension as part of farming systems international aid projects (Shaner et al., 1982), land-grant faculty members are discovering that we scarcely have been practicing what we preached. This is changing, however, with the emergence of a participatory on-farm research and education, including a growing number of farmer-initiated research and demonstration trials (Clement, 1992). The land-grant universities vary considerably in their level of involvement, with a few leading the rest. Two that stand out are Iowa State University's state-funded Leopold Center for Sustainable Agriculture and the University of Wisconsin, with that state's numerous local sustainable agriculture networks and well-established integrated cropping systems trials (Lakeland, 1992).

The need for continuing this integrated research and extension is acute. Many sustainable agricultural practices involve ecological systems that cannot be confined to an experimental plot.

Instead, they require whole fields or field-length strips, which may be difficult to obtain on agricultural experiment stations. Even where the land is available on-station, there is ample evidence that technology adoption is more rapid where potential adopters are allowed to do their own on-farm experimentation and demonstrations. This integration is occurring with increasing frequency under the auspices of sustainable agriculture farmer associations around the country.

We conducted an informal survey of sustainable agriculture farmer organizations and their supporters in six midwestern states to find out how many farmer-initiated on-farm research and demonstration trials have been conducted each year since 1989. We found that they doubled over those five years in Illinois, Indiana, Iowa, Michigan, Minnesota and Wisconsin (Table 1). These data certainly *underestimate* the true numbers, since they include only trials that were formally registered with an organization, in most cases to receive cost sharing funds. Moreover, they exclude federal cost sharing programs, such as for practices that improve water quality, as authorized under the Food, Agriculture, Conservation and Trade Act of 1990.

Farmer-initiated research and demonstrations raise new challenges for land-grant extension and research staff. Comparing one integrated system with another does not allow the kind of statistical comparison that most researchers were trained to conduct. Field-scale experiments may not be sufficiently replicated to offer the number of degrees of freedom needed for certain statistical tests. Especially where replications are few, uncontrolled variability in management and resource quality may confound comparisons between systems used on different farms. These can seem to be daunting problems at first, but experience such as that of the Michigan Agricultural Stewardship Association indicates that farmers engaged in their own research quickly realize the value of replicated trials and careful experimental design. When this happened, they came to the local land-grant university for assistance. One result has been the initiation of on-farm, farmer-managed experiments that have external validity comparable to some experiment station research. But such experience is common in only a few

states. In most, researchers and extension specialists still need to accept the challenge of collaborating with farmers in the design of farmer-managed experiments.

Perfect integration of extension and research occurs when researchers extend their own work and extension specialists conduct their own research. There are many notable examples of such arrangements, but to expect everyone to be successful at both missions is overly optimistic and denies most people's comparative advantages. Specialization raises the issue of incentives. Researchers may fear that the results of on-farm trials may not be accepted in the scientific community (read "not publishable"). Extension specialists may fear losing control of their programs because of the multidisciplinary aspects of the issue. But these potential threats can become opportunities: the farmer who turns to the university for assistance in research design allows academics to counter the widening public distrust of scientists and the suspicion that land-grant scientists are too strongly committed to industrial agriculture (Batie, 1992). By helping to design on-farm trials, the issues-oriented extension specialist can overturn the stereotype of extension agent as an "agriculture industry apologist." Farmer/scientist focus sessions at Oregon State offer an innovative model for future farmer-initiated collaboration with land-grant universities, with farmers setting meeting agendas and discussing priorities for land-grant research with extension and research personnel (McGrath, et al., 1992). The sessions provide a forum for direct communication of what different participants are doing and an opportunity to debate short- and long-term priorities. Farmers do not necessarily have more answers or vision than researchers or extension specialists (or vice versa), but each group can learn from the other.

The spread of sustainable agricultural practices that replace physical inputs (such as pesticides or fertilizers) with knowledge about the state of the biological system (Lockeretz, 1991) raises a related set of questions about the division between public and private responsibilities in information delivery. Knowledge-intensive technology requires data specific to a given farm operation. Although extension offices occasionally offer soil testing, pest scouting, and related services, such tailored services overreach

the traditional purview of extension specialists, and increasingly are being offered by private consultants. On the research side, land-grant faculty have made significant contributions to decision-support software that relies on this kind of detailed data, but the professional incentives to maintain such software are weak (King et al., 1993). As land-grant faculties grapple with how to apply old roles to new tasks, the need to redefine the public-private boundary becomes clear. With that need comes a set of new questions: How can cash-starved extension programs train farmers to use knowledge-intensive systems? Should land-grant extension programs redefine their mission to become intermediaries who focus on training consultants who will teach farmers? Should land-grant researchers divorce themselves from maintaining the software they develop? If so, how can they protect the integrity of the original product?

The research-extension linkage advocated here will be needed for exploring a host of additional issues. An important one is the off-farm social and economic effects of sustainable agriculture practices, which Anderson and Lockeretz (1992) recently found to be only lightly researched. Others include the effects of less trade regulation on the adoption of sustainable agricultural systems.

The kind of funding available to research and extension programs will be critical in answering these questions. If operating funds to visit farms are unavailable, if no new staff can be hired to replace retiring staff and to take on newly defined priorities, there will be few ways for land-grant universities to respond to the needs of sustainable agriculture. It would be a pity to let availability of funds shape the agenda for sustainable agriculture extension and research, rather than doing it the other way around.

Integration of Funding

The legitimacy that federal funding has conferred on sustainable agriculture is clearly a boon in the short run, with earmarked funds catalyzing change in the land-grant research and extension agendas. The LISA/SARE program and state energy overcharge monies have led the way, and now are being augmented by fertilizer taxes in Iowa. New funds from private sources such as W. K. Kellogg

Foundation's Integrated Food and Farming Systems program may push the change farther and faster into the realm of local initiatives. But unless sustainable agriculture becomes integrated into mainstream agricultural research, that change will be short-lived. Perhaps a valid model is integrated pest management (IPM), which seems to have made the transition, and now is largely within the mainstream. However, a continuing danger is that administrators will adopt the rhetoric of sustainable agriculture without the substance. Many land-grant administrators and faculty resist focusing on the process of sustainable agriculture, instead asking narrowly once-and-for-all questions such as "Is it profitable?" or "Does it work?" Thus, if earmarking is lost, there is a high potential for becoming co-opted by conventional research.

In principle, there should be a continuum between the farmer participatory, multidisciplinary research funding such as the Sustainable Agriculture Research and Education program (SARE, as LISA was renamed) and the disciplinary, reductionist research funding exemplified by the USDA National Research Initiative (NRI) and National Science Foundation. Neither extreme is necessarily unscientific and it is false to contrast "doing research right" with "doing the right research." Still, it is a challenge to integrate sustainable agriculture with other kinds of research without becoming co-opted. To change the minds of those who control agricultural research and outreach funds may take more time than the land-grant universities can afford. A few leaders can make a difference, however. We continue to need entrepreneurs for sustainable agriculture both inside and outside the system.

Specific changes in funding could make current sustainable agriculture research and outreach efforts more appropriate. First, more LISA/SARE funds are needed. Congressional appropriations for SARE continue to lag far behind the authorization levels although it is encouraging that the former continue to rise, most recently from \$6.8 million in fiscal 1993 to \$7.4 million in fiscal 1994. Second, most agricultural research grants run for too little time. This weakness is especially surprising in the SARE program. With a maximum of two years, they fail to meet the need for longterm research inherent

in the dynamic nature of sustainable agriculture. Third, sustainable agriculture research needs to be allowed under mainstream competitive agricultural research programs. This has only just begun to happen. The NRI's 1994 call for proposals includes a new heading for "Agricultural Systems," under which Sally Rockey of USDA estimates that \$2 million will be allocated. But Congress did not appropriate funds for this; USDA is reallocating them internally. So while we see encouraging change, true integration into the mainstream of research funding is only just beginning.

Conclusion

Sustainable agriculture has come a long way in the land-grant system, but the gains are tenuous. The system can easily lose the sustainable agriculture issue from its agenda and its funding. This outcome would be a grave loss. Sustainable agriculture offers challenges to basic and applied science and education that the land-grant university is historically well-equipped to address. With land-grant universities reexamining their role in public education and research, sustainable agriculture provides an agenda for generating systems-oriented knowledge and integrating research with extension. The task ahead is for the land-grant universities to continue integrating sustainable agriculture into their mainstream agenda while remaining faithful to its principles.

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Table 1: Farmer-initiated on-farm trials reported by farmer associations and state programs, six midwestern states, 1989-93

State	Number of trials each year				
	1989	1990	1991	1992	1993
Illinois	12	20	38	45	70
Indiana	0	10	10	10	10
Iowa	59	61	68	60	60
Michigan	0	0	15	26	28
Minnesota	161	158	123	51	31
Wisconsin	20	27	117	149	253
Total	252	276	371	341	452

Source: See acknowledgements.