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SUSTAINABLE AGRICULTURE RESEARCH AND EDUCATION IN THE FIELD

A PROCEEDINGS

NATIONAL RESEARCH COUNCIL

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Sustainable Agriculture Research and Education in the Northeast

James F. Parr

By most definitions, sustainable agriculture is viewed as a concept that comprises two major components: i.e. economic sustainability and environmental sustainability (some even emphasize the importance of social and political sustainability). For example, a farming system may be economically sustainable, but if it contributes to environmental degradation, it is not truly a sustainable system. By the same token, a farming system may be environmentally sustainable, but if it is not profitable, then, by definition, it is not a sustainable system.

Sustainability can also be thought of as a long-term goal that seeks to overcome the problems and constraints that afflict both U.S. agriculture and agriculture worldwide. How and whether this goal is achieved depends on the development of alternative management practices that are resource-conserving, energy-saving, economically viable, environmentally sound, and protecting of human and animal health.

Many have developed rather strong opinions on just what a sustainable farming system should be. However, the concept of sustainability involves a time dimension that will most certainly bring about changes that will test the sustainability of farming systems in the years ahead. What is judged to be a sustainable farming system today may not be sustainable in the future because of increased energy costs, global warming, increased soil salinization, and issues of food safety and quality.

As the world population increases and with the continuing decline in the per capita production of food in many developing countries, the natural resource base in the United States and throughout the world will come under greater pressure than ever before. Those farming systems that currently sustain the world's population may very likely be inadequate to do so in the future. There must begin to be a more futuristic attitude about what research and education programs for sustainable agriculture are needed now, so that entirely new and sustainable farming systems can be developed for the future.

LONG-TERM, LOW-INPUT CROPPING SYSTEMS RESEARCH

The long-term cropping systems research study, also referred to as a *conversion* or *transition experiment*, was implemented at the Rodale Research Center in 1981 when it became apparent that farmers experienced problems when shifting from chemical-intensive farming to low-input (or low-chemical) systems. According to the 1980 *USDA Report and Recommendations on Organic Farming* (U.S. Department of Agriculture, 1980) the first 3 years of such a transition were often critical and the most difficult to cope with. Weeds were often cited as the main problem, but other chemical and biological factors were also suggested as possible causes.

Good research begins by asking the right questions, and the transition experiment described by Rhonda R. Janke and colleagues was designed to do exactly that. There was also a need to study farming systems holistically so that the interactions of the components could be evaluated. The following farming systems are being studied:

1. low-input/sustainable, with animals;
2. low-input/sustainable, cash grain; and
3. conventional cash grain.

Long-term experiments such as these are essential because significant changes in the chemical, physical, and biological components may not be detectable over the short term. The systems approach that this study uses allows researchers to know not just what happens, but why it happens.

Herein is the very basis for controlling and manipulating the system to the best advantage. A thorough economic analysis of this study is anxiously awaited.

PERSPECTIVES FOR SUSTAINABLE AGRICULTURE FROM NUTRIENT MANAGEMENT EXPERIENCES IN PENNSYLVANIA

This chapter reported on the management practices of some dairy farms in the Northeast region where there has been a steady increase in nutrient levels on the farm because of a one-way flow of off-farm purchased inputs. According to the author, Les E. Lanyon, many of these farms now import all feed sources for the dairy cows, with little or no on-farm production of feed grains or forages. This has resulted in an excess of manure that is then applied back to the land as a disposal medium. Thus, over a period of time, nutrient-poor farms have become nutrient-rich farms or, indeed, eutrophic farms.

The chapter presents some strategies for dealing with this problem which, if it is not a real pollution problem, it is certainly a potential pollution hazard, especially to groundwater from excess nitrates. The chapter describes crop rotation scenarios that can help to utilize the accumulated nutrients while demonstrating economic benefits.

Agriculture is a system of inputs (some of which are purchased) and outputs (some of which are sold and removed from the farm). Generally, there is a net removal of nutrients during the production cycle. The dairy farms described in this chapter have a net gain of nutrients and a gross imbalance that must be managed properly to avoid a serious pollution problem. When excessive amounts of organic nitrogenous materials such as manure are applied to soil, serious water pollution problems can result, just as they can from improper use of chemical nitrogen fertilizers. These farms may be economically viable, but they definitely are not sustainable farming systems.

The question is, to what extent are these farms already polluting groundwater? Nitrate concentrations should be monitored in both soils and well water, and if they are excessive, remedial action should be taken to alleviate this situation.

USE OF FUNGAL PATHOGENS FOR BIOLOGICAL CONTROL OF INSECT PESTS

Raymond I. Carruthers and colleagues point out that certain fungal pathogens have the potential to control insect pests and can greatly enhance integrated pest management programs and reduce pesticide use. Such fungal pathogens must be environmentally acceptable, cost-effective, reliable, and dependable and must not attack other beneficial natural predators.

It may be necessary to manipulate fungal pathogens to achieve the most effective control measures. Strategies for biological manipulation and control include germplasm maintenance, disease dynamics, use of population genetics of pathogens and hosts, and integration with other control strategies such as integrated pest management.

The new biotechnologies should be useful tools in future efforts to enhance the reliability and effectiveness of this unique biological control strategy.

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Sustainable Agriculture Research and Education in the Field

Neil H. Pelsue, Jr.

I am impressed by the information presented in this volume. It is especially impressive to know that this work is representative of a much larger body of work going on throughout the United States.

I applaud the discussion by Michael Duffy presented in this volume. His comments were especially appropriate because system sustainability needs to receive much more attention than it has up to now. That is my bias in my assessment of the potential contributions of projects to sustainable agriculture goals.

In the following sections, I address the three projects in the Northeast described by Rhonda R. Janke and colleagues, Les E. Lanyon, and Raymond I. Carruthers and colleagues. I will not discuss project methodology, as that should have been well covered in the project evaluation and selection process. Rather, I will focus on four other aspects that I believe are important criteria for low-input sustainable agriculture (LISA):

1. whole-farm interactions,
2. economic performance,
3. environmental impact, and
4. information delivery.

To my way of thinking, the fourth essential aspect—delivery of project