Going Forward In Agricultural Extension: Problems and Alternatives in Diffusing Sustainable Agricultural Practices in Sri Lanka

K. S. U. Jayaratne
Program Evaluation Specialist, Cooperative Extension Service
226 Hoke Smith Annex
University of Georgia
Athens, GA 30602 USA
Telephone: (706) 542-8413
Fax: (706) 542-1799
E-mail: sunil@arches.uga.edu

David G. Acker
Professor, Agricultural Education and Studies
Assistant Dean, College of Agriculture
104 Curtiss Hall
Iowa State University
Ames, IA 50011 USA
Telephone: (515) 294-8454
Fax: (515) 294-9477
E-mail: dacker@iastate.edu

Abstract

Sustainable agricultural concepts were introduced by the Department of Agriculture in Sri Lanka as an alternative approach in response to problems associated with conventional agriculture. However, the diffusion of sustainable agriculture practices in Sri Lanka has been limited in spite of nearly two decades of extension interventions. The main purpose of this study was to identify extension educators' perceptions regarding the barriers and alternatives in diffusing sustainable agricultural practices in Sri Lanka. The respondents were 30 agricultural extension educators randomly selected from the North-central Province of Sri Lanka. Likert-type scales were used to record extension educators' perceptions regarding barriers and alternatives in diffusing sustainable agriculture. The majority of extension educators were middle-aged males with a mean of 21 years in extension. The respondents perceived inadequacy in available training materials, research information, and resources to conduct demonstrations, and farmers' unwillingness to compromise short-term gains of conventional agricultural practices for the long-term benefits associated with sustainable agricultural practices as a main barrier in diffusing sustainable agricultural practices. National agricultural policy is the most important driving force in diffusing sustainable agriculture in Sri Lanka. Provision of research-based information and adequate in-service training programs are important elements in a strategy for overcoming barriers to the diffusion of sustainable agriculture practices. Giving priority to sustainable agricultural practices such as Integrated Pest Management (IPM) and soil conservation, educating women farmers on sustainable agriculture, and introducing sustainable agricultural concepts into school curricula are other important steps in diffusing sustainable agricultural practices in Sri Lanka.

Introduction

High cost, external input-based conventional agriculture has contributed to increased food and fiber production throughout the world. However, many writers contend that this increased agricultural production has been achieved at the expense of society and environment. For instance, Hallberg (1986) mentioned that the excessive use of agro-chemicals have accounted for some of the serious health problems such as leukemia, multiple myeloma, and nonhodgkin's lymphoma. Many researchers have reported the presence of harmful pesticides and fertilizers in waterways and aquifers (Hallberg, 1986, Nielsen & Lee, 1987). Environmental damage associated with excessive use of pesticides is significantly high in developing countries due to the lack of pesticide control regulations and enforcement.

Increased soil erosion has contributed to diminishing farm productivity in many parts of the world. For example, McNairn and Mitchell (1992) reported that soil erosion has reduced Canadian farm productivity. This depletion of fertile farmlands has compelled farmers to increase the use of external inputs such as fertilizer to maintain their farm productivity levels. According to the World Commission on Environment and Development (1987), the incremental grain-to-fertilizer response ratio dropped from 14.8 in 1934-38 to 11.5 in 1948-52 and to 5.8 in 1979-81.

This information clearly indicates the trend of diminishing agricultural productivity per unit of external input. This increasing dependency on nonrenewable, external resources for farm productivity has become a serious sustainability issue for conventional agriculture. The National Research Council (1989) has reported that more people are now reluctant to accept the negative externalities of conventional agriculture such as ground water contamination, and eroded top soils, because these factors detract from the sustainability of the agro-ecosystem and serve only to shift costs among different sectors of society. Conventional agriculture is now widely criticized for its adverse environmental, social, and economic impacts (Bultena, 1991). Now there is a growing concern about the environment among the agriculturists as a result of the realization that intensive, high chemical and energy input agriculture is neither always full of promise nor of profit (National Research Council, 1989). "There is need for reduced use of pesticides, control of soil erosion and conservation of water" (Mohammed, 1999, p. 5). It is becoming increasingly clear that agriculture, as an industry, must move toward sustainability for long-term viability (Marshall & Herring, 1991). Sustainable agriculture approaches may help producers respond to some of the problems associated with conventional agriculture. Extension can have a role in guiding production agriculture toward sustainable farming systems through assisting producers in developing and implementing sustainable practices (Harrison, 2002).

However, the term sustainable agriculture gives different meanings to different people (Hess, 1991). Various groups have defined the term with various meanings making it difficult to provide a singular definition for sustainable agriculture. A review of these different perceptions regarding the meaning of sustainable agriculture indicates that there is a general consensus regarding the essential components of sustainable agriculture (Benbrook, 1991). "Economically sound, environmentally protective, and socially acceptable are the three widely advocated components of sustainable agriculture" (Williams, 2000, p.19). Therefore, any agricultural practice or technology, which has these three basic qualities, can be considered to be a sustainable agricultural practice or technology. However, there are different views about the relative importance of these three factors in a sustainable agricultural context. For instance, some ecologists advocated the need for more emphasis on

environmental preservation than social and economic aspects of sustainable agriculture (Thomas & Kevan, 1993). Benbrook (1991) indicated that physical, biological, and socioeconomic components are the main elements of a comprehensive definition of sustainable agriculture. Benbrook's (1991) definition for sustainable agriculture captures physical, biological, and socioeconomic components. According to his definition (1991, p.4)

> …sustainable agriculture is the production of food and fiber using a system that increases the inherent productive capacity of natural and biological resources in step with demand. At the same time, it must allow farmers to earn adequate profits, provide consumers with wholesome, safe food, and minimize adverse impacts on the environment.

An important case example is found in Sri Lanka, an agricultural country with over 18 million people. Rice, the staple food crop, has been cultivated for thousands of years. Until the 1960s, farmers used traditional rice varieties that were pest and disease resistant. However, the yields were very low. With the Green Revolution high yielding new rice varieties were introduced. These new varieties were responsive to chemical fertilizers and farmers were taught to apply these fertilizers at relatively high levels. These high yielding rice varieties were not as resistant as traditional varieties to pests and diseases. Consequently, farmers were taught to apply agrochemicals to control pests and diseases. It has been reported that much of the applied pesticide never reaches the target pests, contributing to environmental degradation (Pimentel & Levitan, 1986). As rice yields increased so did both production costs and environmental pollution. Many farmers were at the subsistence level and were not able to afford the increased production cost.

With the realization of the significance of sustainable agriculture in achieving desired social, economic, and environmental goals, many countries began to introduce sustainable agricultural concepts. In Sri Lanka, the Department of Agriculture started to introduce sustainable agricultural concepts such as integrated pest management (IPM) in the early 1980s. Extension agents were trained to carryout farmer training programs on sustainable agriculture. The sustainable agricultural concepts were taught to farmers through extension programs throughout the country utilizing the modified training and visit extension system operated by the Department of Agriculture. Despite two decades of extension intervention, diffusion of sustainable agricultural practices is not at a satisfactory level. Still many farmers use pesticides without paying due attention to IPM practices.

Several questions of interest arise: What are the barriers in diffusing sustainable agricultural practices? What are the possible alternatives for those barriers? Extension educators' perceptions of barriers and alternatives in diffusing sustainable agricultural practices provide us with a guideline to move forward with agricultural extension toward a better future.

Purpose and Objectives

The purpose of this study was to identify agricultural extension educators' perceptions regarding barriers and possible solutions in diffusing sustainable agriculture practices in Sri Lanka. The study aimed to fulfill the following objectives:

1. To identify the extension educators' demographic characteristics;

2. To identify the potential barriers in diffusing sustainable agricultural practices; and,
3. To identify possible alternative strategies in diffusing sustainable agricultural practices.

Methods and Procedures

Population and Sample

Survey research methods were employed to examine the study population of agricultural extension officers in the North-central Province of Sri Lanka. There were 80 agricultural extension educators in the target population. A random sample of 30 agricultural extension officers was selected for the study due to time limitation. Therefore, caution should be exercised in generalizing the results of this study beyond the sample.

Instrumentation

The researchers developed the survey instrument and had it reviewed by a panel of experts from a land grant university in the USA to establish content validity. The instrument included two Likert-type scales to record extension educators' perceptions regarding barriers and alternatives in diffusing sustainable agriculture in Sri Lanka. The scale used to record perceptions about barriers contained 11 statements related to diffusing sustainable agriculture. The respondents' perceptions about each of the 11 statements were recorded on a five-point Likert-type scale ranging from 1 being "strongly disagree" to 5 being "strongly agree". The scale used to record perceptions about alternatives in diffusing sustainable agriculture contained 9 statements and responses were recorded on a five-point Likert-type scale ranging from 1 being "strongly disagree" to 5 being "strongly agree". The reliability Alfa of the instruments used to identify barriers and alternatives in diffusing sustainable agriculture were .64 and .80, respectively.

Data Collection and Analysis

Data were collected by conducting personal interviews with each of the extension educators in the sample. The original questionnaire developed in English was used to guide the interview. Questions were asked in the local language and responses were recorded on the instrument. One of the researchers who is fluent in both English and the local language conducted all the interviews to minimize potential translation errors. Data were coded and entered into the SPSS program for analysis. Descriptive statistics were used to summarize and interpret data.

Results

Respondents were overwhelmingly male (80%) with a mean age of 47 years. Almost 93% of the respondents were two-year agriculture diploma holders and 7% were bachelor's degree holders. The mean of the respondents' experience in the extension service was 21years. The respondents had participated in an average of two in-service training courses related to sustainable agriculture during the last two years.

Barriers in Diffusing Sustainable Agricultural Practices

Table 1 reports the means, standard deviations, and percentages for each of the potential 11 barriers in the instrument. The data show that the most common barrier perceived by extension educators was the inadequacy of training materials on sustainable agriculture (a mean value of 3.87 on a five-point scale). The second highest mean value (3.80) was recorded for the farmers' unwillingness to compromise short-term gains of conventional agricultural practices for the long-term benefits associated with sustainable agricultural practices. Inadequacy in research information (3.70) and resources to conduct demonstrations (3.67) were identified as other important barriers for the diffusion of sustainable agricultural practices. Extension educators perceived that farmers' time constraints in attending training courses (3.43) and production focused agricultural policies (3.31) as moderately significant barriers in diffusing sustainable agricultural practices. The assignment of a low priority in extension programming to sustainable agricultural practices such as IPM (3.27), inadequate sustainable agriculture related in-service training (3.17), lack of cost-benefit information (3.17), and difficulty in changing farmers' attitudes (3.13) were identified as other important barriers to the diffusion of sustainable agricultural practices. The lowest mean score (2.30) was reported for the extension educators' lack of interest in sustainable agriculture.

Alternatives in Diffusing Sustainable Agriculture

According to the data the highest mean value (4.30) on five-point scale was recorded for both the introduction of agricultural policies focused on production as well as conservation, and the dissemination of research-based information as the most important alternatives in diffusing sustainable agricultural practices (Table 2). Extension agents perceived the need for more in-service training programs related to sustainable agriculture as the next most important alternative (4.23) to overcome barriers in diffusing sustainable agriculture. The inclusion of sustainable agriculture concepts in school curricula, giving priority for IPM and IPNM in extension programs, and educating women farmers on sustainable agricultural practices such as IPM recorded the mean value of 4.20 indicating the significance of these alternatives in diffusing sustainable agriculture. Available literature also supports the notion that sustainable agricultural concepts should be integrated into the school curricula to meet the needs of students preparing to enter the work force of 21st century (Marshall and Herring, 1991; National Council for Agricultural Education, 1995; and Williams, 2000). Finally, the extension agents identified the availability of instructional materials, cost-benefit data of sustainable agricultural practices and in-service programs to prepare teaching aids as important alternatives for the existing barriers in diffusing sustainable agriculture.

Table 1. *Extension Educators' Perceptions About Barriers* (N=30)

Barriers in Diffusing Sustainable Agriculture	Mean	St. D	SA%*	A%*	N%*	D%*	SD%*
There is no adequate related training material to educate farmers about sustainable agricultural practices such as IPM, IPNM, and soil conservation.	3.87	.6288	10.0	70.0	16.7	3.3	0
Farmers are not willing to compromise short-term gains of conventional practices for the long-term benefits of sustainable agricultural practices	3.80	.4842	0	83.3	13.3	3.3	0
Extension agents do not receive adequate research information related to sustainable agricultural practices such as IPM, IPNM, and soil conservation practices.	3.70	.8367	13.3	53.3	23.3	10.0	0
Extension agents do not have adequate resources to conduct demonstrations related to sustainable agricultural practices.	3.67	.7581	3.3	73.3	10.0	13.3	0
Farmers do not have adequate time to attend farmer training programs.	3.43	.8584	3.3	56.7	20.0	20.0	0
Production focused agricultural policy	3.31	.9675	3.4	55.2	10.3	31.0	0
Sustainable agricultural practices such as IPM, IPNM, and soil conservation practices are not considered a priority area in agricultural extension programs	3.27	.9444	0	56.7	16.7	23.3	2.3
Extension agents do not have adequate training to conduct farmer training programs on sustainable agricultural practices such as IPM, IPNM, and soil conservation.	3.17	.9129	0	46.7	26.7	23.3	3.3
There is no cost-benefit information about sustainable agricultural practices such as IPM and IPNM in order to convince farmers.	3.17	1.0199	6.7	40.0	16.7	36.7	0
It is difficult to change farmers' attitudes toward sustainable agricultural practices.	3.13	1.0417	3.3	43.3	23.3	23.3	6.7
I am not interested on sustainable agricultural practices such as IPM, IPNM, and soil conservation practices.	2.30	.7944	0	10.0	20.0	60.0	10.0

*SA=Strongly Agree; A=Agree; N=Neutral; D=Disagree; SD=Strongly Disagree

Table 2. *Extension Educators' Perceptions About Alternatives in Diffusing Sustainable Agriculture* (N=30)

Alternatives in Diffusing Sustainable Agriculture	Mean	St. Deviation	SA%*	A%*	N%*	D%*	SD%*
Need more research information related to sustainable agricultural practices such as IPM, IPNM and soil conservation.	4.30	.4661	30.0	70.0	0	0	0
Agricultural policies should be focused on production as well as natural resource conservation.	4.30	.5940	36.7	56.7	6.7	0	0
Need more in-service training programs related to sustainable agricultural practices.	4.23	.6261	33.3	56.7	10.0	0	0
Sustainable agricultural concepts should be included in school curriculum to make younger generation aware.	4.20	.8469	40.0	46.7	6.7	6.7	0
Priority should be given for sustainable agricultural practices such as IPM, IPNM, and soil conservation in extension programs.	4.20	.5509	26.7	66.7	6.7	0	0
Educating farm women about the use of sustainable agricultural practices such as IPM, IPNM, and soil conservation is an effective way to diffuse sustainable agricultural practices.	4.20	.8052	36.7	53.3	3.3	6.7	0
Need to provide instructional materials related to sustainable agricultural practices.	4.13	.5714	20.0	76.7	3.3	0	0
Necessary to provide economic analysis of the benefits of sustainable agricultural practices such as IPM, IPNM, and soil conservation in order to change attitudes of farmers.	4.10	.6074	20.0	73.3	3.3	3.3	0
Necessary to educate extension agents to prepare teaching aids useful in farmer training.	4.10	.5477	20.0	70.0	10.0	0	0

*SA=Strongly Agree; A=Agree; N=Neutral; D=Disagree; SD=Strongly Disagree

Conclusions and Recommendations

The agricultural extension educators in the North-central Province of Sri Lanka can be characterized as experienced, middle-aged males who have a two-year agriculture diploma. The extension educators are interested in sustainable agriculture. Extension educators in this province believe that the inadequacies in related training materials, research based information, and resources to conduct farmer demonstrations are the major barriers in diffusing sustainable agriculture in Sri Lanka. Farmers' unwillingness to compromise short-term gains of conventional practices for long-term benefits associated with sustainable agricultural practices is also an important barrier.

National agricultural policy is the most important driving force in diffusing sustainable agriculture in Sri Lanka. Provision of research-based information, and adequate in-service training programs are important alternatives to overcome barriers in diffusing sustainable agriculture. Giving priority for sustainable agricultural practices such as IPM and soil conservation, educating women farmers on sustainable agriculture, and introducing sustainable agriculture concepts into school curricula are other important steps in diffusing sustainable agriculture practices in Sri Lanka.

Conservation friendly agricultural policies should be adopted in order to ensure the adequacy of resources for generating research-based information, training extension educators, and giving priority for sustainable agricultural practices in extension programs. These three steps are essential in generation and dissemination of sustainable agricultural practices. Sustainable agricultural concepts should be integrated into the school curriculum for making future agricultural producers and consumers aware of alternative farming approaches and conservation of natural resources. Since women in Sri Lanka play an important role in the household decision making process, sustainable agricultural extension programs should be focused on both farm men and women as a step toward overcoming farmers' resistance to sustainable agriculture and to integrate conservation concepts into production practices.

List of References

Benbrook, C. M. (1991). Introduction. Sustainable agriculture research and education in the field workshop proceedings. Board on Agriculture, National Research Council. Washington, D.C.: National Academy Press.

Bultena, G. L. (1991). A comparison of conventional and sustainable farmers in Iowa. In E. F. Weber (Eds.) Leopold Center for Sustainable Agriculture 1991 conference proceedings. Ames: Iowa State University.

Hallberg, G. R. (1986). From hoes to herbicides: Agriculture and ground water quality. Journal of Soil and Water Conservation, 41 (6), 357-364.

Harrison, J.D. (2002). Managing for sustainable agriculture. Journal of Extension, (40). 4, http://www.joe.org/joe/2002august/a5.shtml

Hess, C. E. (1991). The U. S. Department of Agriculture commitment to sustainable agriculture. Sustainable agriculture research and education in the field workshop proceedings. Board on Agriculture, National Research Council. Washington, D.C.: National Academy Press.

Marshall, T. A. & Herring, D. R. (1991). Sustainable agriculture: An essential part of the agriculture curriculum. The Agricultural Education Magazine, 64(1), 10- 12.

McNairn, H. E., & Mitchell, B. (1992). Locus of control and farmer orientation: Effects on conservation adoption. Journal of Agricultural and Environmental Ethics. 5 (1): 87-101.

Mohammed, R. (1999). Agriculture in Trinidad and Tobago. Journal of International Agricultural and Extension Education, 6 (2): 5-7.

National Council for Agricultural Education. (1995). Reinventing agricultural education for the year 2020. Executive Summary.

National Research Council. (1989). Alternative Agriculture. Washington, D.C.: National Academy Press.

Nielsen, E. G., & Lee, L. K. (1987). The magnitude and costs of ground water contamination from agricultural chemicals: A national perspective. Agriculture Economic Report 576. Washington D.C.: Economic Research Service.

Pimentel, D., & Levitan, L. (1986). Pesticides: Amounts applied and amounts reaching pests. Bioscience (36). 86-91.

Thomas, V. G., & Kevan, P. G. (1993). Basic principles of agroecology and sustainable agriculture. Journal of Agricultural and Environmental Ethics, 120, 1-19.

Williams, D. L. (2000). Students' knowledge of and expected impact from sustainable agriculture. Journal of Agricultural Education, 41(2), 19-24.

World Commission on Environment and Development. (1987). Food 2000: Global policies for sustainable agriculture. London: Zed Books.