Factors affecting adoption and level of information of sustainable agriculture practices by farmers in central Iowa

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Factors affecting adoption and level of information of sustainable agriculture practices
by farmers in central Iowa

by

Naomi Kay Harrold

A Thesis Submitted to the
Graduate Faculty in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE

Department: Agricultural Education and Studies
Major: Agricultural Education
(Agricultural Extension Education)

Signatures have been redacted for privacy

Iowa State University
Ames, Iowa
1992
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CHAPTER I. INTRODUCTION

Background

Thomas Malthus, in the late 1700s, wrote that scarcity and eventual famine are inevitable given our predilection to reproduce. This idea states that the human population grows geometrically as the food supply increases arithmetically; therefore, it is impossible to keep pace with the increasing demands by man. Fortunately, time seems to have proven Malthus wrong. This fortunate outcome did not arise without hard work and some tribulation. The first recorded instance of attempts to increase the food supply was in ancient Egypt. As far back as 3000 B.C. inhabitants of Egypt were struggling to maintain their existence by intensively farming marginal lands through the application of silt from the Nile for fertilizer and the maintenance of an intensive irrigation system. Romans (3000-31 B.C.), however, did not share the insight of the Egyptians. Roman emphasis on wealth and its benefits gave way to over-cropping and the deforestation of hills, thereby depleting the topsoil of its fertile richness. Declining land fertility paved the way for a decline in grain farming. Small farmers were forced to convert to less intensive land uses such as raising cattle, but this proved to be of low profitability. Thus, small farmers were forced to surrender their land holdings to large land-owners (Ferguson, 1958).

Not only was there an economic decline in agriculture, but also the development of new technology, the supply of competent help, and the quality of the environment also declined. The deforestation and over-cropping of marginal lands in Italy and North Africa exhausted the soil. The advancement of scientific technology in the area of agriculture ceased. Slave labor became scarce; therefore, land was rented to poor tenants who
lacked the skills and resources necessary to farm in the most efficient and conservative manner (Ferguson, 1958).

With the Middle Ages came improvements in sustaining the productivity of agriculture throughout Europe. The Middle Ages were dominated by the Feudal System. This system established the manor "as the economic unit of feudalism" (Ferguson, 1958, p. 161). The manor was essentially an estate owned by a landlord and managed by a bailiff. Land was divided into a small village, areas for living quarters, cultivated fields, pastures and woodland. Fields were divided into three cropping sections consisting of a variety of small grains and fallow land. These fields were rotated through a three year cycle of cropping and lying fallow and livestock were allowed to graze the stubble. This system helped sustain their agricultural system, for it provided a means for preserving the fertility of the land (Ferguson, 1958).

Improving and sustaining agriculture also became important in the New World, America. Colonists settled on the East coast and began to push West, as the need for space and resources increased. War and the advances in science and industry (1871-1914) brought forth changes in people’s attitudes toward agriculture. These changes were a long time coming, for in the nation’s search for space, resources, and riches the new land was misused to provide what seemed to be an endless supply of these. As Aldo Leopold (1948) stated, the land became a commodity. Land was seen as something to be owned and treated in any manner. All the while people were experimenting with using fertilizers, growing more nutritious crops, and inventing more efficient farm machinery. The result was a rapid increase in the food supply. Man was on the verge of overcoming his fears of hunger prophesied by Malthus. This constant high level of productivity could not
continue though without paying something in return. How then could the land's productivity and beauty be maintained for future generations? Aldo Leopold had the answer. "When we see land as a community to which we belong, we may begin to use it with love and respect...our bigger-and-better society is now like a hypochondriac, so obsessed with its own economic health as to have lost the capacity to remain healthy" (Leopold, 1948, p. ix). These words were written in 1948 just shortly after World War II. At that time the U.S. was in a position of superiority in comparison to the rest of the world. The United States began to take on a more responsible nature both globally and at home. The war had made many aware of how important a strong and profitable farming system could be. Americans began to identify with Leopold's idea of belonging to the land as a community and therefore the need to ensure a supply of food and natural resources. As a result, the U.S. embarked on a track to conserve the eroding soil, protect the forests, and conserve and develop substitutes for natural resources.

The Present

Today Americans as well as other nations are still on the track to conserve, but conservation has been renamed with such terms as sustainable, alternative, low-input, maximum economic yield, best management practices, and holistic. Farmers, researchers, and the rest of the agricultural community are trying to decipher the glut of information, policies, and programs being handed to them associated with these terms. Congress has devoted millions of dollars to investigate how agricultural productivity can be enhanced and land and water degradation reduced. It is hoped that long-term studies will supply scientific knowledge and foster educational programs which will help ensure an abundance of food and fiber. To attain this goal many farmers have adopted farm management
practices such as conservation tillage, integrated pest management, soil testing to estimate fertilizer needs, or pasture farrowing of livestock. All of these practices and many more can be identified by the afore mentioned terms. Adoption of these practices is not as widespread as it could be. Stenholm and Waggoner (1990) state that the lack of widespread adoption of these management practices and ideals results from the lack of clear and reliable information being disseminated.

This profusion of terms has created a sense of confusion among many as to what terms such as sustainable, low-input, alternative, and holistic mean and what practices they include. These terms may be considered alternative means for expressing the same idea. This being the case, it may be better to identify them all under the term of sustainable agriculture and concentrate more on what the term means to different organizations. For instance, the Cooperative Extension Service views sustainable agriculture as "a systems approach to crop production that optimizes the effectiveness of inputs including producer management. It is characterized by high yield and low unit costs" (Johnsrud, 1988-1989, p. 4). Robert Rodale views sustainable agriculture as a systems approach to farming which is dependent upon the region, farm, and year (Rodale, 1990, p. 275-276). The Potash and Phosphate Institute, as expressed by Robert E. Wagner (1990, p. 279), envisions sustainable agriculture as a systems approach that "gives highest return per acre through low unit costs, consistent with a quality environment" concentrating on nutrient balancing rather than complete elimination of chemical inputs. The Leopold Center, in 1987, defined sustainable agriculture as the appropriate use of crop and livestock systems and agricultural inputs supporting those activities which maintain economic and social viability while preserving the high
productivity and quality of Iowa's land" (Keeney, 1990, p. 281). Finally, the National Research Council (1989) gave meaning to the term in its report entitled Alternative Agriculture. Their definition viewed it as a "system of food and fiber" that meets criteria they set forth. All of these sources recognize it as a system. The system is dependent upon the site specific circumstances which determine what practices go into making up the system.

Oberle and Keeney (1991) stated agricultural research should be viewed with a systems approach. They recognized that research can effectively solve the wide range of agricultural problems by integrating information and using deductive and inductive reasoning to reach sustainable goals. Cooper and Gamon (1991) concurred that farming is a system. Farming requires a variety of management methods to effectively manage all the subsystems it consists of such as soil factors, cropping systems, livestock, and bookkeeping. Thus, a systems approach to transferring knowledge on sustainable agriculture is necessary.

The United States Department of Agriculture Extension System with its goal of giving unbiased advice is working to make people aware of the need to seek out alternative methods and provide the public with the how-to-knowledge to change farming practices. The Leopold Center in its 1990 sustainable agriculture conference brought forward a set of ideals for Extension to use as it attempts to transfer knowledge. These ideals include: Extension should make an earnest attempt to stress that economics and the environment should be considered when selecting management options, meetings and publications should promote information on alternative systems that are more dependent "on renewable, internal production resources" (Francis, 1990, p. 23) meetings should not
consist only of lectures, but also of open forums for discussion and participation to provide hands on learning; government farm commodity programs should be scrutinized per farm before adopting; and extension should develop a "set of tools" (Francis, 1990, p. 27) designed to help facilitate the adoption process of sustainable agriculture management practices rather than specific answers which have little flexibility in different years or on different farms or with varying crops.

These are simply suggestions which warrant trial. Trial should not only be by Extension, but other organizations may also find these suggestions useful. Trial does not complete the task though in this world of changing needs and practices. Evaluation will also have to be done in order to get an accurate assessment of how effective Extension and other organizations are in facilitating management changes and helping people obtain sustainability goals. It is essential to assess the level of adoption of sustainable agriculture practices in relation to the programs, publications, and people, like the Extension Service, who facilitate sustainable agriculture knowledge and change.

Extension of Information and Evaluation

Central Iowa Area Extension, which includes the counties of Greene, Polk, Story, Marshall, Guthrie, Boone, Jasper, Warren, and Dallas, in 1989 initiated a process to educate farmers and agriculturalists on sustainable agriculture practices. Extension's educational objective was to increase awareness and how-to-knowledge. With this educational basis it was hoped that farmers and agriculturalists would learn to adapt this knowledge to fit their circumstances. In December 1989, the area held its first day long sustainable agriculture seminar. Planned by a committee which included the area extension crop specialist, county crop agriculturalists, a representative of Practical Farmers
of Iowa, and an innovative farmer, the seminar's purpose was to promote awareness. It introduced the existence of sustainable agriculture and promoted alternative farming systems. Extension held a second seminar in December 1990. Realizing by this time what the interests and awareness level were of the nine counties, the planners provided seminar attendees with information on how to apply sustainable agriculture practices properly.

Without evaluation there was no way to know how effective the Extension conferences were in facilitating the adoption process of sustainable agriculture practices. A follow-up evaluation is needed in order to judge if Extension met their objectives and how valuable the seminars were overall in relation to increased adoption of sustainable agriculture practices. It would be valuable to have the evaluation conducted by a source external to extension in order to obtain unbiased information. Worthen and Sanders (1987) state that external evaluation adds to the objectivity and importance of the evaluation. Conducting an evaluation at the product stage via a mailed follow-up survey as opposed to extension's norm of conducting evaluations by circulating surveys prior to adjournment of a meeting would provide greater insight as to the extent of adoption. Worthen and Sanders (1987) indicate that a survey conducted at the product stage can determine whether or not terminal objectives of the seminars have been met. This study therefore indicates more than the feelings of attendees at the end of a program. It seeks to determine if sustainable agriculture innovations have been accepted or rejected and to what extent the innovations have been applied or tried.
Purpose and Objectives

The purpose of this study was to assess the level of adoption of sustainable agriculture practices. The research objectives of this study were as follows:

1. To compare management practices of farmers before and after a set of Extension programs on sustainable agriculture.
2. To compare the adoption and the level of information of sustainable agriculture practices of farmers who did attend to those who did not attend Extension programs.
3. To determine the factors that influence use of management practices.
4. To identify sources of information that influence adoption of sustainable agriculture practices.

Definitions

1. **Adoption**: Farmers' ratings as to awareness and use of selected practices.
2. **Level of information**: Farmers' ratings of the extent to which they are informed of the benefits and usage of each practice.
3. **Soil testing**: A means of estimating nitrogen fertilizer needs and calibrating nitrogen fertilizer applications by use of soil samples.
4. **Leaf testing**: A means of estimating nitrogen fertilizer needs and calibrating nitrogen fertilizer applications by use of leaf tissue samples.
5. **Green manure**: Plowing under legume crops to add nitrogen and organic matter to the soil.
6. **Banded herbicide application**: Applying herbicides in bands rather than by spraying.
7. **Intensive grazing**: A pasture grazing rotation which maximizes nutritional return for livestock while maintaining high pasture quality over the entire season.

8. **All-in, all-out, and vacant buying and selling of livestock**: A livestock system in which all livestock are purchased at the same growth stage, fed for a period of time, and sold at the same growth stage. Selling is followed by a period of vacancy in livestock facilities to break the life cycle of harmful microorganisms.

9. **Cover crop**: The growing of crops which provide ground cover for soil conservation and improvement of soil characteristics.

10. **Strip cropping**: The practice of growing two or more crops in alternating contiguous strips.

**Assumptions**

1. The selected practices adequately represented practices contributing to the sustainability of agriculture in central Iowa.

2. The methods used to collect and evaluate data yielded valid information and results.

3. The respondents gave valid and reliable information.

**Limitations**

1. The results of this study were generalizable to farmers in the central Iowa area.

2. Because sustainable agriculture practices are fairly complex and may require several years of trial before practices become a permanent part of farm management, long-term objectives were not identified by this study.

3. Collection of information was limited to that which could be obtained by mailed questionnaire.
4. The population of non-attendees was limited to selection of names from mailing lists provided by each county.

5. The establishment of a cause and effect relationship between Extension programs and adoption of sustainable agriculture practices was limited to answers obtained in this survey.

Summary

This study demonstrated the need to compare management practices of farmers attending Extension programs on sustainable agriculture before and after the programs. It was also evident that a comparison of the adoption and level of information of program attendees and non-attendees needed to be made. This survey also sought to identify factors that most influenced what management practices were used and what sources of information influenced adoption of sustainable agriculture practices. Finally, the study allowed for demographic information to be related to the extent of adoption and how well informed farmers were as well as what sources they relied on to obtain their information. The results of this study would provide valuable information to the Central Iowa Area Extension Service. From this information Extension would be able to determine to what extent they had been successful in helping clients accept, apply, and try sustainable agriculture innovations.
CHAPTER II. LITERATURE REVIEW

Introduction

There is always a need to obtain useful, timely, unbiased information on agricultural practices by farmers. Recently this has been the case with farmers trying to bring some sort of order to the wealth of information on sustainable agriculture practices. The Cooperative Extension Service as well as other change agents have been called upon to aid in the diffusion of sustainable agriculture. Clearly, from the efforts of the CES and other change agents, it is obvious that if agriculture is to become more sustainable individuals must first gain an understanding of the terminology and processes behind sustainable management practices and also be aware of the attributes of the practices and how well these match with their own personal characteristics. Knowledge of what new practices exist or how to make changes in existing management systems is not always inherent. Thus, it may be necessary for the farmer to call upon the expertise of various sources of information. Sources, like the CES, not only provide information, but they also monitor or evaluate the progression of practice adoption. Evaluation should be considered a key component in the adoption or practices, for it is through evaluation of practice attributes, oneself, the sources of information used, and the process through which adoption occurs that the success or failure of a practice is determined. To completely understand the adoption of sustainable agriculture practices it is necessary to understand what sustainable agriculture means to individuals, to investigate what sources of information farmers call upon to understand the practices they use, and also to
examine what change agents like Extension can do to improve the diffusion of information and adoption of practices.

Sustainable Agriculture, the Process and Terminology

With the wealth of definitions and opinions floating around concerning the terminology it is no wonder the agricultural community and the non-agricultural community are confused as to which practices are sustainable, which are conventional, and why specific practices fall into certain categories. Buttel as quoted in a private conversation with Lockeretz (1988), sums up the confusion best: "Sustainable agriculture remains a solution in search of problems" (p. 175). It searches for new or forgotten ways to conduct agriculture in an environmentally sound manner, and yet remain profitable and productive, and sustain the rural community.

Adopting a sustainable form of agriculture therefore demands making management decisions that require man to cooperate with nature and abandon tendencies to control or change the environment. Kirschenmann (1989) suggests that this can be accomplished by realizing farming is a process. It involves living and non-living components that must be investigated, adapted to the site for which they are intended, and tried on an experimental basis. As a process and not an individual technique, sustainability does not occur immediately. It is a continual searching for new strategies to manage all the sub-systems of the farm, such as the livestock, crop rotations, and pest management schemes. Sustainable agriculture may also be approached as a hierarchical system (Lowrance et al., 1986). This perspective suggests that a hierarchy of sustainable management systems exists that include agronomic sustainability, microeconomic
sustainability, ecological sustainability, and macroeconomic sustainability. The latter would be the uppermost level of the hierarchy. The bottom level, agronomic sustainability, involves management decisions selected for one particular field within a farm. These allow for the field to maintain acceptable levels of productivity in the long run by diversifying the cropping system beyond a corn soybean rotation or reducing erosion by converting row crop fields to cover crops. A field may then be successful, but this sustainability is not enough to ensure the sustainability of the farm.

Ensuring sustainability beyond the field scale requires economic factors to also be considered. Consideration of agronomic and economic factors constitutes the second level, microeconomic sustainability. Just as a field is not independent from the farm of which it is a part, a farm is not independent from the rest of the agricultural and non-agricultural community of which it is a part. Farmers must consider what possible effects the fertilizers and pesticides they apply have on the landscape and biota surrounding them. A farmer applying a pesticide to control a pathogen, insect, or weed must understand whether or not the pesticide has the ability to kill the targeted pest and also the natural predator of a more serious pest that has been kept in check. Thus, agronomic and economic practices affect a higher level of sustainability, ecological sustainability. This encompasses a much larger area over a longer time period. It includes the quality of the air, water, and soil over many farms and cities (Lowrance et al., 1986).

Sustainability also extends beyond a particular agricultural landscape. It reaches national and international scales for agricultural systems feed populations beyond their regional scale. The extent and quality of the agricultural productivity of a nation therefore
depends on the resources they have, such as oil, mineral deposits, and economic ability to provide for themselves and others around the world for the long-term. This long-term global sustainability is referred to as macroeconomic sustainability (Lowrance et al., 1986).

The hierarchical levels suggested by Lowrance et al. are basically interrelated systems consisting of sub-systems that working together determine the sustainability of agriculture. Lowrance et al. and Kirschenmann are therefore in accordance that farming requires a systems approach. Farming must be regarded as a series of complex systems involving the soils, the climate, the crops or livestock that can be produced under the given conditions and the socioeconomic factors which affect the farm family (Hildebrand, 1990). The world, however, is ever being influenced and changed and so it is with the sub-systems that constitute a farming system. Thus, creating sustainability within a farming system may include livestock for a few years and then the system may change gears, do away with the livestock, and emphasize alternative crops to increase sustainability.

The justification for using a practice may simply be a matter of semantics. Lockeretz (1988) provided a detailed list of meanings and implications for terms that so often confuse those wishing to know what sustainable agriculture really is. Lockeretz indicated that those farmers stating they are conducting "sustainable" practices are implying their management practices are such that their soil, biota, and economic viability are able to endure the test of time. This indicates a farmer who reduces fall plowing is conducting a practice that will conserve soil depth and productivity for years to come. A
farmer may also be farming "sustainably" by conducting "low-input" agriculture practices. This implies a reduction in the use of inputs external to the farming system, particularly those such as synthetic pesticides and highly soluble inorganic fertilizers. Simply cutting back the use of an insecticide does not make the entire farming system low-input, for a reduction of the insecticide input factor creates an increase in the input of crop scouts needed to determine when, if, and how much insecticide should be applied (Lockeretz, 1988).

Another term a farmer may use to imply agriculture is being conducted sustainably is "ecological". Ecological indicates the use of principles and practices which complement the natural environment. Poincelot (1990, p. 18) points out "agriculture is the most widespread cause of nonpoint-source water pollution." These pollutants include sediment, fertilizer leachings, pesticide run-off, and animal waste contamination. Farmers who test for nitrogen, phosphorus, and potassium fertility needs, use soil conserving practices, and manage animal wastes effectively are thereby farming in a more sustainable manner.

"Regenerative" is another term farmers use to indicate they are farming sustainably. Regenerative indicates an ability to renew resources by making the most of the farm's internal versus external resources. For example, using available animal or green manure on the farm as fertilizer in place of commercial fertilizer would be making use of an internal resource to renew the productivity of the soil by replacing the deficiencies (Lockeretz, 1988).

Finally, Lockeretz (1988) investigated the term "alternative." It is a term implying a form of agricultural management different from that conducted in the conventional manner.
The term "alternative" can be used to describe a variety of situations such as the use of the rotary hoe for weed control as opposed to commercial herbicide application, the use of pasture farrowing to reduce energy costs as opposed to a confinement operation, or the use of all-in, all-out, vacant buying and selling of livestock to reduce exposure to disease and dependence on antibiotics as opposed to continual raising of livestock for economic gain. The literature indicates a broad range of possibilities which are alternatives. If "alternative" includes conducting practices other than those used in the conventional situation, then practices that are "sustainable," "low-input," "ecological," and "regenerative" should be designated as "alternative" agriculture practices.

Sustainable agriculture has many aspects to it and those practices that one particular farmer chooses to incorporate depends on the particular farming system involved (Keeney, 1990). In fact, many farms have been sustainable for years and yet the practices these farms incorporate seem quite conventional, that is, they do not differ from those used in previous generations. "Farmers who are using their internal resources, including soil fertility, labor and management skills, to the fullest extent are probably practicing the kind of land stewardship that will help define sustainable agriculture" (Keeney, 1990, p.102).

Attributes Influencing the Adoption of Innovations

Farmers adopting alternative practices strive for profitable and ecologically sound ways to use the particular physical, chemical, and biological potentials of their farms' resources. To these ends, they make choices to diversify their operations, make the fullest use of available on-farm resources, protect
themselves and their communities from the potential hazards of agricultural chemicals, and reduce off-farm input expenses (National Research Council, 1989, pp. 8-9).

Such choices may be difficult to make depending on the attributes of the practice. Farmers must weigh all the features that make the practice they are considering adopting either beneficial or injurious to their farming system. The attributes most generally taken into consideration in the adoption of innovations are the relative advantage, compatibility, complexity, trialability, and observability.

The relative advantage of an innovation refers to how much more desirable an innovation is recognized to be as opposed to an existing innovation (Rogers and Shoemaker, 1971; Lionberger and Gwin, 1982; Rogers, 1983; Lamble, 1984). Relative advantage is positively related to the rate of adoption and the determined desirability is dependent upon the innovation under scrutinization. Farmers must ask, what sacrifices will have to be made and what kind of remuneration can be expected in return for modifying or abandoning a more conventional farming system. Depending on what the innovation is, potential adopters of sustainable agriculture practices may then be curious to know the short and long-term profitability of a practice, the initial and maintenance costs included in using the innovation, the immediacy of rewards for time and effort invested, and the risks associated with adoption of the innovation (Fliegel and Kivlin, 1962; Rogers and Shoemaker, 1971; Rogers, 1983).

Poincelot (1990) pointed out several examples of how the relative advantage of a practice determined its desirability as an adopted practice. When using legume crops for
fertilizer credit versus the application of commercial fertilizers farmers were curious as to
the costs of producing the legume crop, the market returns for the crop, the amount of
savings on fertilizer costs, and the degree to which current management efforts and time
spent increase or decrease. Similar questions arose for those considering adoption of
biological controls for insect pests. Questions that arose on biological control involved
what time commitment as far as effort spent to apply the control would be required and
how long would it be before this long-term planning for control pays off (van Lenteren,
1988). Similarly, the adoption of conservation tillage practices were questioned. Farmers
were concerned that conservation tillage would decrease the yield (Dickey et al., 1991a),
but they were interested in those factors which would increase profitability due to
decreased labor and fuel costs. Labor and fuel cost savings could be observed
immediately whereas the benefits reaped from the installation of terrace systems yielded
profit in the long-term and any soil savings in the short-term was just an added bonus.
Farmers and other agriculturalists were therefore more likely to adopt those practices

Adoption therefore often hinges on the immediacy of reward (Rogers and
Shoemaker, 1971). Farmers did not mind bearing the costs for immediate profitable
results, but bearing the costs for vague, long-term productivity goals was intimidating
(Nowak, 1987). Long-term goal oriented innovations such as sustainable agriculture
practices are often referred to as preventive innovations. Preventive innovations are
concepts and methods a farmer or agriculturalist adopts to reduce the chances of some
undesirable event happening in the future (Rogers and Shoemaker, 1971; Rogers, 1983;
Korschning et al., 1983). These innovations may require making alterations in values, beliefs, behavior and attitudes in order to enact change. The characteristics of preventive innovations may involve high beginning costs, minimal or delayed economic returns, high perceived risks, and extra time and effort requirements (Rogers and Shoemaker, 1971). Sustainable agriculture practices may be perceived as preventive practices designed to deal with undesirable future situations by bearing the costs in the present. This perception may lead to decreased motivation to adopt these practices because of reduced relative advantage (Malia and Korschning, 1989). With sustainable agriculture practices, such as the use of multiple cropping systems, the relative advantage may not be immediate, but rather becomes more evident in the future. In order to help farmers realize all the relative advantages a practice has besides its profitability, Extension must work hard at proclaiming these advantages. Some innovations included under sustainable agriculture may be difficult to deal with, but in these cases change agents such as Extension can help improve the perceptions held by farmers and agriculturalists by placing greater emphasis on other characteristics of the innovation if immediacy of economic profit seems to be low (Lionberger and Gwin, 1982). Emphasis could be turned to other concerns such as immediate time savings and the better use of resources on hand at the present.

When investigating sustainable agriculture practices it is also important to evaluate how compatible the new practices are with the existing situation, the values a farmer holds, and the knowledge the farmer or agriculturalist has of practices and technologies that work well in a given situation (Lionberger and Gwin, 1982; Rogers, 1983; Lamble,
Rogers (1983) stated that there is a positive relationship between the compatibility of an innovation and the rate at which it is adopted. Alonge (1990) investigated farmers' perceptions of the compatibility of a low-input practice in relation to its adoption. Results suggested that increasing compatibility was an excellent predictor of the adoption of low-input sustainable agriculture practices. Similarly, Tolchinsky (1989) reported compatibility to be of utmost importance in determining the adoption of integrated pest management in corn production. In order for innovations to be considered compatible certain criteria must be met. The innovation must be in keeping with what is appropriate for the whole farming system, it must be in harmony with what the farmer has done in the past, it must to some degree use familiar techniques and knowledge, and it must agree with what is generally considered an acceptable practice by peers (Lionberger and Gwin, 1982). Kirschenmann (1989) investigated sustainable agriculture farming systems and how they work. This work revealed that practices such as diversified cropping rotations and the addition of livestock with the possibility of using the manure for fertilizer were desirable in reference to attaining sustainability. However, unless additional storage space and harvesting equipment for the new crops were available the practice was not very compatible. Similarly, unless the barn space was available for housing and feeding livestock a sizable investment in such facilities would have to be made. Having to acquire additional supplies and technology necessary to implement the practice might represent too much of a disadvantage due to lack of compatibility, thereby inhibiting adoption. Studies concerning the implementation of biological controls provided similar evidence of the
importance of compatibility. This form of pest control might not be quickly adopted because the knowledge required to use such an innovation was not compatible with the farmer's present knowledge (van Lenteren, 1988).

Because an innovation's compatibility is so important, change agents are interested in making sustainable agriculture innovations more compatible so as to increase the adoption of these practices. To be more successful in bringing about change it is suggested that change agents need to become more aware of three concepts: the needs of the client, the situational constraints of the client, and the attributes of the new innovation. Assessing the client's needs, making clients aware of their needs, and pointing out those sustainable innovations which are most compatible with those needs is a positive step toward enhancing the adoption of an innovation (Rogers, 1983). Change agents should also be aware of the current farming system and based upon it make recommendations for change. Suggesting technology which is too costly or inappropriate for facilities present on the farm is not likely to further the adoption process (Lionberger and Gwin, 1982). A Nebraska study on the adoption of minimum tillage practices indicated that educating farmers about inexpensive equipment modifications that could be made and making them aware that a labor force would not be needed created a greater sense of interest in the adoption of minimum tillage practices (Dickey et al., 1991b).

Finally, the change agent needs to be aware of all the characteristics of an innovation. Knowing this the change agent can disseminate advice that is timely, understandable, and appropriate for the farming situation and thereby increase the farmers' and agriculturalists' perceptions of how compatible is the innovation (Lionberger and Gwin, 1982).
Complexity is another attribute that may determine an innovation’s rate of adoption. Complexity refers to the extent to which new technology and practices are perceived as being relatively complicated in terms of an individual’s ability to understand and implement. The rate of adoption may hinge on the clarity in the meaning of the innovation or the ease of implementing it. The more difficult the innovation is to understand and use the less readily it will be adopted (Fliegel and Kivlin, 1962; Rogers and Shoemaker, 1971; Lionberger and Gwin, 1982; Rogers, 1983; Lamble, 1984).

Kirschenmann (1989) described the incorporation of sustainable agriculture practices into an existing farm system as complex, for a sustainable farming system consists of an intricate set of interconnections. Creating a sustainable farming system required that all the sub-systems within the farming system, such as the livestock, crop species, fertility resources, and tillage practices, become intertwined and aid each other in order to make the farm as a whole successful. In order for this to happen, management decisions cannot be made that would reduce soil erosion and increase fertility while retaining profitability without also considering cropping systems that would aid in this. Some sustainable agriculture practices may also be very complex within themselves without considering how they interact with other sub-systems. The implementation of a variety of insect controls rather than sole reliance on chemicals is one of these. The spraying of insecticides has become a simple and almost effortless task, but in an effort to preserve the environment and reduce purchased inputs farmers and agriculturalists have had to acquire knowledge on what other control measures exist, how to monitor fields and then
with this information make wise choices on what controls to apply whether they be cultural, chemical, or biological (van Lenteren, 1988).

To minimize the complexity of various sustainable practices it is helpful for change agents to gain an understanding of these practices and to what extent they may make a farming situation more complicated and difficult to manage. If change agents have this background they can simplify the adoption of sustainable agriculture practices by making clear suggestions to farmers as to which sustainable agriculture practices would be most appropriate and attainable for their specific farming situation (Lionberger and Gwin, 1982). Adoption is not secure and not all of the complexity will be removed simply by a change agent making a suggestion. Removal of complexity might require educating the clients in order to add clarity to the suggested practices and to provide farmers with the skills of how to change (Lionberger and Gwin, 1982). The Extension Service in Nebraska delivered educational programs to decrease the complexity and increase the adoption of conservation tillage practices. They found that conducting educational programs in targeted areas resulted in increased adoption of these practices and thus a decrease in fuel usage and erosion (Dickey et al., 1991a).

Another attribute which is thought to contribute significantly to the adoption of innovations is trialability. The trialability of an innovation refers to the ability to test an innovation on a limited scale (Rogers and Shoemaker, 1971; Lionberger and Gwin, 1982; Rogers, 1983; Lamble, 1984). This attribute, unlike relative advantage and compatibility, does not necessarily show as strong a positive relationship to the rate of adoption (Fliegel and Kivlin, 1962; Tolchinsky, 1989). Yet, trialability does have a positive relationship and
the adoption of the innovation is thought to harbor less risk if it may be used on an experimental basis at first (Rogers and Shoemaker, 1971; Lionberger and Gwin, 1982; Lamble, 1984).

Some innovations, however, may not appear easily divisible for trial. One such innovation may be the use of a no-till planting system. The limiting factor to trial may be that to try the practice a farmer must purchase a no-till planter and that sacrifice may not make a trial run worth it. A change agent such as a machinery dealer or farm organization could volunteer to loan the farmer the planter to use on a trial basis, thereby providing the farmer with the counsel and direction to make a low risk attempt at no-till planting. This example is in concert with ideas expressed on trialability by Lionberger and Gwin (1982).

A period of trial on a small basis is an important step in the climb to full scale adoption. Extension or other change agents may educate farmers on all the characteristics of an innovation and encourage them to incorporate the practice on a trial basis into their farming system. Trial is an experimental process which may require several growing seasons before the extent of its impact on adoption can be assessed. In fact, trial may not mean trying it on one’s own farm, but the observance of trial on someone’s farm that is similar. Such was the case with conservation tillage factors. From research conducted in Nebraska by the Extension Service it was evident that those farmers, from farm neighborhoods in which the rate of trial was high, were in a superior situation in reference to complying with their conservation plans. No matter how the trial
was conducted either by oneself or by a viewing of a neighbor, it does relate positively to adoption of innovations (Dickey et al., 1991b).

Closely related to trialability is the final attribute, observability. Observability refers to the potential in a given innovation for the results to be visualized (Rogers and Shoemaker, 1971; Lionberger and Gwin, 1982; Rogers, 1983; Lamble, 1984). This attribute is strongly tied to trial of an innovation, for without trial there may not be substantial, physical, positive proof for adopting an innovation. Some innovations are not easy to describe or visualize or potential adopters may be limited in their ability to apply hypothetical ideas to their own situations. In these instances having tangible examples to convey the advantages of an innovation may help promote the adoption of an innovation (Lionberger and Gwin, 1982). Thus, as the observability of an innovation increases so does its rate of adoption (Rogers and Shoemaker, 1971; Rogers, 1983; Tolchinsky, 1989).

Because preventive innovations such as sustainable agriculture practices are often associated with abstract ideas that do not always produce observable results on the first trial, their rate of adoption may be deterred (Lamble, 1984). Richards (1983) in her study on the use of conservation tillage practices found farmers may observe their neighbor dealing with the drawbacks, cleaning tillage equipment plugged with crop residue or dealing with the incidence of poor weed control, and fail to observe the more important but possibly less visible goal of soil conservation. In cases such as these the lack of material, concrete evidence may slow the diffusion and subsequent adoption of such innovations. The variation of an innovation’s ability to be observed and related to clients
may therefore greatly influence the adoption of an innovation (Lionberger and Gwin, 1982).

Attributes of the Adopter Contributing to Innovativeness

Not only do the attributes of the innovation affect the rate of adoption, but the characteristics of the adopter do too. There are many personal characteristics used to estimate innovativeness, but two that are commonly relied upon are age of the farmer and size or scale of the farm operation. Farm size is an important consideration for it is often thought that small farms are at a disadvantage and thus are slower to adopt new technology. This was the case in rural South Carolina (Palmer et al., 1991). A survey to determine the production practices of small farmers was conducted. The results of this survey revealed that the small farmers were the ones not adopting the more refined soybean management practices. The reasoning behind their lack of adoption was that they lacked educational awareness or how-to-knowledge (Palmer et al., 1991). Lyson et al., (1983) also found that the adoption of innovations in relation to farm size showed that those farmers most likely to use the more intense management schemes such as soil testing and crop rotation were the larger farmers. This did not seem to be the overall trend though for practices labelled as conservation, alternative or sustainable. Nowak (1987), studying the factors affecting the adoption of conservation technologies, did not find that larger farms were more apt to adopt. Similarly, Bultena (1991) identified sustainable farmers as those farming a smaller amount of acres with typically lower gross incomes. Still other studies indicated that farm size was not significantly related to adoption of sustainable agriculture practices. A study investigating the use of sustainable
farming practices in Iowa revealed that farms of all sizes were considered to be sustainable systems (Malia and Korsching, 1989). Concurring with this study was Alonge's (1990), who found that farm size was not a reliable predictor of the adoption of low input sustainable agriculture practices in Iowa.

Age is another personal characteristic to consider in noting the factors which may affect the adoption of innovations. One learning theory suggested that young adults are capable of learning and changing at a more rapid pace that older adults (Griffith, 1984). This being the case one would expect the younger farmers to be more receptive to sustainable agriculture innovations and the incorporation of these practices into their farming system. Evidence to support such a notion lies in such studies as one conducted by Korsching et al. (1983) which found that younger farmers were more apt to adopt soil conserving practices. Concurring with this study was one conducted by Tolchinsky (1989) which revealed that younger farmers reported higher levels of adoption of some IPM (Integrated Pest Management) practices than older farmers. However, this study did not suggest that age was a significant factor in determining overall adoption of such practices. Other evidence exists to suggest that age might not be significantly related to the adoption of sustainable agriculture practices. Alonge (1990) in looking at factors influencing adoption of low-input sustainable practices did not detect a significant relationship between adoption and age. Malia and Korsching (1989) presented still another view that young farmers in Iowa were not readily adopting sustainable agriculture practices and this might be tied to the fact that these farmers were educated at a time when the unrestrained use of chemical inputs was considered good farm management.
Malia and Korschning (1989) also stated that young farmers were those who were generally not as well established and thus might not be able to assume the risks involved in adopting new practices. On the other hand older farmers may be better established and able to assume the risks involved. Additionally, since older farmers were practicing farmers in times when chemical inputs were not commonly used, it might be easier and more familiar for them to revert back to those management practices.

There was great variation among research of the significance placed on age and farm size as determinants of adoption of sustainable agriculture practices. Griffith (1984) suggested that any age group is capable of learning although the learning speed of older adults may be slower. Perhaps then a targeting of educational programs needs to be done by Extension and other change agents to those groups considered to be slower adopters of specific innovations (Korschning et al., 1983). This might include recruiting young, old, small or large farmers for meetings. By recruiting specific groups it might be discovered what knowledge and resources these clients were lacking. If the knowledge and resources were imparted to them their adoption of sustainable agriculture practices would be enhanced.

Attributes such as the relative advantage, compatibility, complexity, trialability, and observability all contribute to explaining the acceptance and the degree of adoption of sustainable agriculture practices (Alonge, 1990). At times the benefits of some of these will overshadow those that are lacking in obvious benefits. For instance, farmers urged to adopt sustainable agriculture practices may indicate that, yes, there is a relative advantage in adoption in that the cost of production will decrease but for some the
innovation may seem too risky or not financially profitable. Such was the case in Bultena’s (1991) study where he discovered all farmers felt production costs would go down but sustainable farmers did not perceive the risks or low profitability perceived by conventional farmers. Thus, these attributes are interrelated in that the decision to adopt cannot be based solely upon how desirable one attribute is. The attributes must be weighed together and then a decision to adopt or not to adopt can be made (Lionberger and Gwin, 1982).

Sources of Information

Availability and the use of information sources can influence an individual’s decision to adopt a practice and the extent to which an innovation is adopted. Information sources provide people with awareness knowledge, a consciousness of the existence of an innovation, and with how-to-knowledge, an understanding necessary to use or apply an innovation properly. Lionberger and Gwin (1982) investigated the premise that because adoption is a process involving several stages, awareness, interest, trial, and sustained use, farmers prefer contacting different sources for information at different stages in the adoption process.

The adoption process begins with awareness that a practice exists. This stage is fundamental in obtaining general information on a practice. At this stage the prevailing source from which possible adopters gain awareness knowledge is the mass media. Mass media includes newspapers, magazines, television, and radio (Rogers and Shoemaker, 1971; Lionberger and Gwin, 1982; Bultena and Hoiberg, 1986). By providing general information to farmers to make them aware, farmers were now able to ask for
more information because interest had been generated. Without this awareness farmers might not have experience with the innovation or practice. This lack of awareness is a barrier to adoption that may keep simple principles unknown. Adoption research conducted by Nebraska Extension supported this concept, for farmers did not realize that practices such as residue management constituted conservation tillage (Dickey et al., 1991a). Crossing the barrier from complete lack of awareness to a general understanding of a new practice is especially important in making sustainable management changes. Because sustainable management practices are perceived as preventive management practices some practices may be difficult to adopt or slow to show an economic return. It is vital to the adoption process that people are made aware that there are a wealth of practices considered to be sustainable and that some may be easier to adopt or produce economic returns in a shorter amount of time.

Increased awareness often heightens peoples' interest in a topic or practice. This increased curiosity results in people seeking out additional information. When a possible adopter is knowledgeable of a practice and its merits, consideration is then given as to how applicable the practice is for the specific farm operation. Careful evaluation of the new practice requires a credible, trusted, information source. Fellow farmers are often that credible, trusted source. Two-way communication is required so specific questions can be asked about implementing the practice under specific conditions and so a farmer can determine how similar farmers feel about the practice. Others farmers familiar with the innovation and farming under similar circumstances may be sought out based upon their reputation for making good management decisions (Lionberger and Gwin, 1982).
Nowak (1983, p. 164), analyzing obstacles to the adoption of conservation tillage practices identified networks of family, friends, and fellow farmers as "informal sources of information" that were especially valuable for enhancing the "positive evaluation of conservation tillage."

The transfer of information via fellow farmers does not necessarily have to occur by visiting the other's farm or exchanging information over the fence. Farmers may gain information by attending conferences and educational programs hosted by public agencies that use local farmers as a means of conveying information. Successful conferences include good planning and credible speakers. Achieving this combination involves incorporating the local farmers at all levels of program planning and then allowing them to transfer technology and thereby boost the credibility of the program (Riehle, 1986). Such was found to be the case in an educational program on conservation tillage held by the Extension Service in Nebraska (Dickey et al., 1991a). Committees of local farmers were formed to determine the needs and inadequacies of farmers in the area. Local farmers also cooperated by setting up demonstration plots on their farms to provide realistic information on practices for a specific area. Results of this educational program were positive, for by using credible, local farmers as an information source farmers once hesitant to try the practice became less apprehensive (Dickey et al., 1991a).

Finding a source familiar with a given farming situation is important at the evaluation stage, but the source can be someone other than a local farmer if their credibility is high. A survey in Winneshiek County of farm households expressing their satisfaction with informational sources on the effects of farming on groundwater indicated
Extension was the most reliable source. Extension had done quite a bit of work in the area, become familiar with local circumstances, and thus ranked as most reliable when evaluating the effects of farming practices on groundwater quality (Iowa State University, Cooperative Extension Service, 1987).

Once enough information has been gathered from credible sources on the merits of use in a farmer’s specific situation, how-to-information must be gathered to put the practice into use. This information persuades or dissuades the potential adopter from using the practice on a trial basis. The how-to-knowledge required to actually try an innovation may be gathered from many sources depending on the practice and the situation. The mass media is not consulted at this stage for they typically provide only general information on a topic. Farmers at this stage need specific answers (Rogers and Shoemaker, 1971). To obtain specific answers they tend to contact fellow farmers if adjustments need to be made for local conditions, dealers if it requires a purchase, professionals or university researchers if it requires technical expertise, or public agencies, like the Cooperative Extension Service, Soil Conservation Service, or Agricultural Stabilization and Conservation Service, if it requires general, but immediate information (Lionberger and Gwin, 1982; Bultena and Hoiberg, 1986).

The permanent adoption and maintenance of the practice as a part of the management system is the last stage. The most commonly used source at this stage is one’s own experience (Lionberger and Gwin, 1982). In fact, a survey of farmers practicing sustainable agriculture in Iowa revealed that sustainable farmers highly valued their own experience as a means of making management decisions (Malia and Korschng,
1989). Their preference was to experiment, innovate and create in trial runs. Less consultation with the source that distributes the strict how-to-information was required and more of an emphasis was placed upon one’s own intuition and experience from trial.

This premise of Lionberger and Gwin may not always fit with the sources used in the adoption of sustainable or preventive farm management practices. Just as a sustainable farm operation is viewed as a complex interworking of diverse farming systems, so the information and decisions made are more complex. As farm operations become decidedly more complex it may not be feasible to adhere to the guidelines or past norms for choosing from different sources of information at varying stages in the adoption process (Bultena and Hoiberg, 1986). Some sources may be used frequently not because of the stage of adoption, but because of the type of practice or farming system involved or the size of the farm. Studies investigating the sources used by those adopting or making management decisions concerning the use of preventive practices have given rankings of sources thought to be most influential overall. The general consensus is to include in the top sources newspapers, magazines, one-on-one consultations with neighbors, family, friends and other farmers, the use of public agencies, CES, SCS, and ASCS, and contacts with chemical dealers (Kelling, 1989; Bounaga, 1989; Tolchinsky, 1989; Alonge, 1990; Palmer et al., 1991). These were not tied to a specific stage, but rather viewed as being helpful at any point in the adoption process. There was also some indication that farm size might have something to do with obtaining information. Kelling (1989) concluded in his study that larger farmers were most in touch with and used available information sources to a greater extent. When the management practices and
information needs of small farmers in South Carolina were investigated it was discovered that they were not utilizing refined soybean technology (Palmer et al., 1991). Ultimately, it was determined that the farmers were not using the most beneficial sources at the right times. Small farmers listed CES as their primary source of information, but they either did not attend the Cooperative Extension Service’s educational programs or they came and did not have enough background information prior to coming to understand how to put the information to use in their situation (Palmer et al., 1991).

The sources of information individuals patronize when investigating and adopting new practices may be dependent upon the stage in the adoption process to which they have ascended, the sources available, or the type of practice under consideration. Reliable, timely information, regardless of the reason for choosing a particular information source, is essential if a progression from awareness to adoption or rejection is to take place.

Evaluating the Progression of Adoption

It is Extension’s intention by disseminating information to increase the rate of adoption and shorten the time over which adoption takes place. This requires that Extension use their best methods of program management and delivery. To be effective these programs must meet the needs of farmers. It is Extension’s ambition therefore to evaluate the effectiveness and impact of their programs so as to continue improving the rate of adoption (Brack and Moss, 1984). By studying the stages their clients pass through in adopting an innovation, Extension can determine whether or not they are being effective and also if there is a breakdown in the adoption process, when is it happening
and how they might best remedy the situation. Evaluating Extension programs involves employing models or standards against which to compare the client's progression.

One model Extension uses to evaluate a client's progress in adopting a practice is Bennett's hierarchy of evidence. This model has been commonly used by the Cooperative Extension Service since 1975 (Bennett, 1975; De los Santos and Norland, 1990) to qualify the usefulness and output of Extension's programs to legislators and policy makers. It is also used by Extension to determine what they need to do in future programs to improve their effectiveness (Bennett, 1977). The hierarchy of evidence suggested by Bennett consists of seven stages which give an indication of the extent to which farmers have been helped in adopting practices or technology. The first of these stages is "inputs". The inputs include the resources necessary to conduct an educational program. These resources consist of the personnel needed to conduct and plan the program, the time these individuals must devote to developing and conducting the program, and the money and materials necessary to carry out the program. The second stage in the hierarchy is labelled "activities". Activities are the educational events or methods that are employed in an effort to transfer technology. These educational messages are conveyed through the mass media, public meetings, literature or events (Bennett, 1975; 1977). These first two levels provide information only on the type of educational programs that occurred (Travis, 1981).

Level three examines the "people involvement" in the program. People involvement includes the characteristics of those that attended an educational program, the number of people that participated in the program, and the quality of communication
and interaction that occurred between program attendees and the change agent (Bennett, 1975; 1977). Exploration of attendees' characteristics gives an idea of the demographic characteristics of the population that is seeking a type of information and the attitude or predisposition these people have toward change. By investigating the communication and interaction between clients and change agents an estimation can be obtained as to what program participants have put into the learning situations provided in a program (Bennett, 1982).

From what participants and change agents put into the educational program certain outputs can be identified. These outputs begin to surface at level four, "reactions". Reactions refer to how appealing the activities conducted at the program were and how credible and interesting the participants found the speakers and manner of presentation (Bennett, 1975; 1977; 1982). Steps three and four are essential, for by knowing what type of people get involved in such programs and their reactions to the activities some estimation can be gathered as to a participant's probability of being impacted by extension and of ascending to a higher level of adoption (Travis, 1981).

Further evidence of the impact of the program is generated in the form of a change in "knowledge, skills, attitudes, and aspirations" or what Bennett refers to as level five. At this level participants are evaluated as to the extent to which they have added to their awareness that an innovation exists and gathered extra information on how to apply the innovation or alternate forms of it to their specific situation. Simply stated it is what people understand, think, and can do. At this level participants should be able to demonstrate that they have enough knowledge and skills in concert with a predisposition
to search for new alternatives, enact change, and solve problems in their own operation. Instilling a desire to initiate change and the ability to carry it out indicates that extension is having an impact, but this impact is even stronger when an individual actually practices the change. Level six, “practice change”, therefore is the use of the change in knowledge, skills, attitudes, and aspirations to implement change. At level seven, “end results”, the change is no longer considered on an individual basis, but rather for all program participants or the entire group involved. The cumulative effects on the changes in knowledge, skills, attitudes, and aspirations help determine the degree of sustained change by all the participants as a group (Bennett, 1975; Bennett, 1977; Bennett, 1982; De los Santos and Norland, 1990). As levels five through seven are ascended the impact extension has made becomes more intense and powerful, for the degree of change becomes greater and greater as established objectives for change are attained (Travis, 1981).

Each individual program, set of practices, or new technology requires an evaluator to determine which level of the hierarchy they wish to see attained by clients to indicate that extension’s efforts have an impact. Bennett suggested several guides to aid in determining extension’s impact using levels of evidence. One guideline he suggested was to not rely heavily on levels one through four, but rather put serious consideration into levels five and above. Levels one through four indicate only that an atmosphere to gain knowledge exists, while five through seven produce outputs which become stronger and stronger indications that change is occurring (Bennett, 1977).
Alternatively, Bennett (1977) suggested that it might be important to look at all the levels of evidence including one and two. By studying all levels a comparison can be made of the outputs generated for each input. Whether done purposely or subconsciously, objectives to be met are established at each level. An examination of how well the objectives were fulfilled at each level gives a more complete picture in terms of how well the program met the overall goals.

Ideally, when judging the effectiveness of a program it is helpful for the individual conducting the evaluation to establish standards by which to gauge the effectiveness of a program. With these standards in mind, evidence is collected and then what is actually happening is compared to what should be happening (Bennett, 1977; Boyle, 1981). The specific standards that are set may include specific knowledge a participant should have or skills they should be able to perform.

The extent to which new practices are used can provide a guideline as to how different an individual is after attending a program as opposed to the individual's status prior to the program. The "before and after study" (Bennett, 1977, p. 18), has been designed to gauge the extent to which the inputs contribute to changes made by program participants. Ideally, these studies are conducted by collecting information from program participants' on their situations and attitudes prior to conducting the program and then again after they have participated in the program. A modified version of this is also used. Participants are asked to reflect back and indicate their status prior to attending the program and then also indicate how they have changed since. Regardless of how the "before and after study" is completed caution must be exercised when interpreting the
difference between before and after. Changes that occur might be caused by more than
the single Extension program that individuals attended. Many other sources of
information and forces which encourage or discourage change may come into play and
thereby distort the actual effects of the extension program (Bennett, 1977).

The innovation-diffusion process is another model that can be used to assess the
extent of adoption of technology and practices. This method first proposed in 1955 by the
North Central Rural Sociology Subcommittee for the Study of Diffusion of Farm Practices
(Rogers and Shoemaker, 1971) is composed of five stages which recognize that
individuals become aware of an innovation’s existence and with that knowledge move on
to make a decision to adopt the innovation (Rogers and Shoemaker, 1971; Rogers, 1983;
Lambe, 1984). This decision to adopt is not however immediate upon gaining
awareness, but rather it requires an organized series of stages an individual passes
through over time. Extension is most concerned with the length of time required to reach
a decision, for the determining factor as to how successful Extension’s programs are is
determined by the extent to which the time between becoming aware and making a
decision can be reduced so as to increase the rate of adoption (Lambe, 1984).

The first stage in the innovation-diffusion process is awareness. At this stage
individuals are just becoming knowledgeable of the existence of an innovation (Rogers
and Shoemaker, 1971; Lionberger and Gwin, 1982; Lambe, 1984). Awareness helps
individuals realize that there are other options available, that they have needs that are not
being met, or that an individual has certain interests or problems that deserve further
investigation. For instance, an individual may not realize what the economic losses due
to erosion amount to each year (Nowak, 1983). Or as with a survey conducted on a population of small farmers in South Carolina it was found that the participants did not perceive insect damage to have a major effect on their crop yields. In actuality nematodes were very prevalent in the area and caused major crop yield losses. But, because the farmers were unaware that nematodes existed and the damage they could do, the farmers could do nothing to change or improve their situation (Palmer et al., 1991).

The development of awareness may arouse an individual's curiosity, thereby causing them to research the innovation more completely. Seeking additional information is the second stage in the adoption process, known as interest. A general development of interest causes an individual to study the advantages and disadvantages of the innovation and in so doing pass on to the third stage, evaluation. Evaluation entails giving mental consideration to the appropriateness of the innovation for the current farming system or what it is hoped the farming system will become. The evaluation also includes making a decision to use it on a trial basis. To be able to try an innovation requires that an individual gather information on how to implement the practice, what quantity to use, when to use it, and how to apply it properly. Extension, as well as other change agents, needs to recognize when an individual reaches this stage and then supply them with the necessary information in an usable form. Without this information obstacles occur in the process either slowing it down or causing dissonance which brings it to a halt (Rogers and Shoemaker, 1971; Nowak, 1983; Lamble, 1984).
Once mental ideas are formulated as to how the innovation can be used in the current farming situation an actual trial is made. Trial, the fourth stage, is the small scale use of an innovation to determine its usefulness in a situation. Innovations which are not divisible for trial must be tried in their entirety (Rogers and Shoemaker, 1971; Lamble, 1984). Obstacles can also occur at this stage. Using the innovation requires that the individual attain the competency necessary to implement the practice properly. If this competency is lacking, then the implementation system may fail. It fails because the individual does not have enough knowledge to implement it properly and not because of the assumed worthlessness of the practice. This is often the case with conservation or preventive innovations. Because these can involve many aspects of the farming operation several management decisions come into play, so people need to be aware of what other management decisions hinge on the use of this new practice (Nowak, 1983).

The fifth stage in the innovation-diffusion process is the adoption of the innovation. This indicates that trial was successful and there is sustained use of the innovation on a full scale. Sustained use of the innovation may be inhibited by general shifts in environmental conditions from year to year, by varying what crops are grown, or by changing the chemicals used. To prevent inhibition of the adoption process requires individuals have the know-how to make adjustments in the practice as needed. This may require the individual have a knowledge of the principles forming a basis for the technology from which the innovation was derived (Rogers and Shoemaker, 1971; Nowak, 1983; Lamble, 1984).
A common criticism of this process is that it is incorrect to assume the process always ends in adoption or that it ends because adoption has occurred. Opponents argue that individuals do not have to complete all five stages to adopt a practice, that they may pass through the stages out of order, that evaluation does not just occur at one stage but at all stages in the process, that the process does not always end in adoption, it could end in rejection, and finally, adoption or rejection may be only temporary. An individual might still actively seek information to confirm their decision to use the practice, alter it as need be, or discontinue its use (Rogers and Shoemaker, 1971; Lamble, 1984). For instance the process might begin before the individual is completely aware of the practice, for some individuals are predisposed to adoption based on their environment or contacts with others. Individuals might skip a stage such as trial entirely since some innovations are not easily divisible, or a breakdown in the process may occur for the same reason because the risk is too great without having the experience of using it on a trial basis first (Lionberger and Gwin, 1982).

This opposition has lead to the development of an alternate model for the adoption process. It consists of first acquiring knowledge, an understanding that the innovation exists and some in depth information on it. From the knowledge gained an individual proceeds on to a persuasion stage. This stage involves a more affective than cognitive manner of seeking information. Individuals develop attitudes about a specific innovation based on the current farming situation and how the technology was interpreted by them. Based on the technical understanding and feelings the individual has of the innovation, an evaluation is made as to the trialability of the innovation. At this stage adoption or
rejection may occur. Regardless of the decision to adopt or reject, the individual progresses into a period during which confirmation of one’s decision to adopt or reject is conducted. Adoption or rejection is not finite, for the period of confirmation allows for individuals to continue researching the practice in question, to make improvements as warranted, and if necessary to discontinue using the practice (Rogers and Shoemaker, 1971; Lamble, 1984).

Still there are others who contend the model is not applicable at all to the adoption of preventive or environmental practices. Its usefulness is only in the predicting the adoption of commercial innovations. A commercial orientation indicates that the farmer is concerned about increasing the efficiency of the farm operation by adopting those management practices which are high in short-term economic returns and are less demanding in terms of skills and technology required. An environmental orientation indicates that adoption of the innovation is intended to prevent the unfortunate loss or destruction of natural resources and the practices are for the most part unprofitable. The farmer is strongly oriented toward farming as a way of life rather than as a business venture. These orientations it is believed are the underlying causes for the desire to adopt innovations. Because the factors contributing to the adoption of profitable innovations are different from those contributing to the adoption of unprofitable innovations and because the original use for the model was for more economic practices (Rogers and Shoemaker, 1971), the use of the innovation-diffusion model is not a reliable tool in predicting the adoption of environmental or preventive innovations (Pampel and van Es, 1977).
In response to this contention that the innovation-diffusion process model is unreliable, several studies have been conducted to attest to its reliability in predicting the adoption of environmental innovations. Taylor and Miller (1978) in their survey which questioned participants' attitudes and adoption of pollution control innovation in northern Indiana tested the model as to its applicability in predicting adoption. They found the model to be reliable, for a farmer's knowledge of pollution control innovations was positively related to the development of feelings toward the use of the innovation. These feelings were positively related to decisions that were made as to whether or not to try and subsequently adopt or reject the innovation. From this information they concluded that the model does work in predicting the adoption of environmental innovations.

Similarly, Nowak (1987) investigated the model's applicability in predicting the adoption of profitable and unprofitable conservation technologies. Specifically, the ecological and economic factors which affect adoption were investigated. It was determined that with such innovations they were often site specific so the technology needed to be appropriate for the situation in which they were used. Therefore, the dissemination of information on practices appropriate for the setting was found to be important and this being accomplished the adoption process continued to work nicely. Korschning et al. (1983) also lent support to the reliability of the innovation-diffusion model in their analysis of the adoption patterns for minimum tillage. They argued with Pampel and van Es (1977) that it was unfair to label all environmental practices as being unprofitable, for reducing tillage could lead to energy and time savings in the short-term. They therefore suggested the
innovation-diffusion model was a valuable tool for improving and instilling more successful conservation tillage practices among farmers.

Models such as Bennett’s hierarchy and the innovation-diffusion process may be helpful to change agents like extension in determining the innovativeness of farmers and the techniques that may be helpful in encouraging adoption and increasing the rate at which it progresses. Part of extension’s responsibility is to remove the obstacles that interfere with adoption. Availability of models that help measure the progression of the adoption process are very valuable to extension for they can use these models as standards to determine where the process was inhibited and how it might be fixed.

Summary

Agriculture is a rapidly changing industry. Recent emphasis on encouraging the sustainability of the land and its resources requires agriculturalists examine the management strategies they now employ and revise them so as to gravitate toward a more sustainable form of agriculture. In order to make a change in management practices farmers need to realize what their sustainable goals are, such as reducing inputs or complementing the environment, and what processes are required to achieve these goals. The attributes of the practices, such as their relative advantage, compatibility, complexity, observability, and trialability, and the attributes of the farmer, such as the farmer’s age or size of farm operation, will determine what specific practices are adopted to obtain these goals. Obtaining a general knowledge of sustainable management practices and their attributes is generally accomplished by farmers passively or actively seeking out various sources of information. The source which is sought may
be dependent upon the type of information needed or the stage in the adoption process that has been reached. Thus, a source may be called upon to aid in problem-solving or obtain new ideas. For many since the early 1900s a popular source has been the Cooperative Extension Service. In fact, Extension’s main objective has been to diffuse useful and timely agricultural information. In order to continue to fulfill this objective Extension must constantly evaluate their efforts; models which monitor the stages individuals pass through when adopting a practice may be helpful.
CHAPTER III. MATERIALS AND PROCEDURES

Introduction

This study sought to determine if attending one or both of the Extension conferences on sustainable agriculture affected adoption and level of information of these practices. This study was also designed to assess what effect the sources of information used, the attributes of the practice, and demographic characteristics of the farm or farmer had on the level of adoption and information. This chapter describes the research design and methods used in population selection, instrument development, data collection, and data analysis.

Research Design

This study was designed to note the differences between two groups of central Iowa farmers which were seemingly equivalent in all pertinent characteristics except one, attendance at sustainable agriculture conferences held by Extension. This was done in order to measure the effects attendance at Extension conferences on sustainable agriculture had on the adoption of sustainable practices. Ary et al. (1990) described the design of research studies such as this one as ex post facto. Ex post facto (Latin for "after the fact") research is conducted to "test hypotheses concerning the relationships between an independent variable, X, and a dependent variable, Y" (Ary et al., 1990, p. 355). Unlike in an experimental research design, the independent variable cannot be controlled by the researcher. This principle held true in this study, for there was no way to control the individuals who would or would not attend the Extension conferences. This study, as the name ex post facto implies, therefore was conducted after variations in attendance had already been determined through the normal progression of events.
Thus, rather than exposing groups that were completely alike to varying treatments, variation in this study was achieved by selecting central Iowa farmers who varied in attendance at Extension conferences. From this, this study tried to ascertain what factors contributed to any differences that might be apparent in their adoption of sustainable agriculture practices. When conducting ex post facto studies it is important to remember that there might be other variables present other than the one selected that contribute to the relationship between the independent and dependent variable. For this reason the researchers should be cautious when comparing groups and assigning causes because this form of research might not produce evidence that is as persuasive as experimental research (Ary et al., 1990).

Population Selection

On December 13, 1989 and December 12, 1990, Iowa Central Area Extension, including the counties of Greene, Boone, Story, Marshall, Guthrie, Dallas, Polk, Jasper, and Warren, held day long conferences on sustainable agriculture. The names and addresses of those farmers attending one or both of the conferences were recorded. A tally was kept of the number of farmers attending from each county. Half of the population of the study was composed of these attendees. The total number of attendees was 143.

The other half of the population consisted of 143 farmers from the nine central Iowa counties who did not attend either conference on sustainable agriculture held by Extension. The non-attendee portion was randomly drawn from mailing lists used by county agriculturalists in each county. From each county list a number of non-attendees
equal to the number of attendees from each county were randomly selected. Random selection was achieved by numbering the entries on each mailing list consecutively and then using a table of random numbers to generate numbers to use to select individuals from the mailing lists.

Instrument Development

Several steps were employed to develop the instrument used. Steps were: conducting a preliminary study, devising questions to include, and conducting tests and reviews of the instrument. A preliminary study of the adoption of sustainable agriculture practices used by farmers in central Iowa was conducted to unveil ideas, methods, and suggestions to employ in creating the instrument format and questions. To obtain this information a population other than the selected 286 attendees and non-attendees was consulted. A mailing list of Practical Farmers of Iowa (PFI) for the central Iowa area was obtained from their newsletter editor. From this list five farmers were selected. These five farmers were each sent a letter (Appendix) explaining that they would be called, why and when they would be called, and the importance of their cooperation. Four of the five PFI members contacted agreed to discuss their farm operation, management practices used, sources of information consulted, and changes in management decisions they had made in the recent past.

From information obtained in the preliminary study, a review of similar studies (Alonge, 1990; Tolchinsky, 1989; Bounaga, 1989), the literature on sustainable farming systems (National Research Council, 1989; Poincelot, 1990), and information presented at the two Extension sustainable agriculture conferences, the format and questions for the instrument were developed.
The final step in creating the instrument was to have it reviewed. A review was necessary to ensure all the necessary questions had been asked, to eliminate any irrelevant questions, to check the format and readability of the questionnaire, and to ensure all instructions were understandable and easy to follow. The review was conducted by farmers from Iowa who spoke at the two sustainable agriculture conferences held by Extension, faculty and personnel at Iowa State University, and members of the Extension committee that organized and conducted the two conferences.

The research instrument consisted of three sections, each with its own five point scale. Each section had specific instructions to assist participants in understanding the scales and procedures used. A five point scale was used for each section with a not applicable choice (NA) when appropriate. The five point scale was identified with one always being the lowest choice while five was always the highest choice (Appendix).

The first of the three sections asked participants to rank their level of adoption and level to which they were informed of the benefits and usage of twenty selected management practices. Respondents ranked their adoption and level of information prior to the 1990 cropping season and for the 1990 cropping season to the present. Because participants were asked to report the state of their management practices before Extension conferences were held and after they were held this section of the survey serves as a “before-after study” (Bennett, 1977).

The second section of the survey was divided into two sub-sections dealing with sources of information. The first sub-section questioned participants on the sources of information they used to determine the degree to which the selected sources of information determined their management practices. Additionally, if participants attended
one or both of the sustainable agriculture conferences held by Extension, they were asked
to indicate their attendance by checking the conference attended. Attendee participants
were also asked to indicate to what extent the information presented at the sustainable
agriculture conferences helped them begin to use new practices or helped them refine
their present practices (Appendix). The second sub-section required participants to
indicate the extent to which the attributes of an innovation influenced their adoption of
sustainable agriculture practices. In order to pass this judgment, participants were
provided with examples of the attributes of innovations, relative advantage, compatibility,
complexity, observability, and trialability (Appendix).

Demographic questions constituted the third section of the survey. Participants
were asked to indicate their age, acreage farmed, percent of farm operation devoted to
crop production and livestock production, and the annual net income of the farm
operation.

Collection of Data

Data collection for this study was accomplished by a mailed questionnaire. On
February 20, 1991, a questionnaire on sustainable agriculture with a cover letter
explaining the purpose and importance of completing the survey was mailed to the
population of attendees and non-attendees (Appendix). Each instrument was prepared
with instructions for its return. Additionally, each instrument was addressed and stamped
for the return mailing.

The instruments were each coded with a number to maintain anonymity upon
return and to serve as a reference to determine which ones were not returned. The
instruments were numbered 1-286; 1-143 identified attendees and 144-286 identified non-
attendees. The two groups were identified to determine percent return from both groups. Participants were informed in the cover letter that all code numbers would be removed upon return of the questionnaire. Participants were also advised that if they preferred not to complete the questionnaire, then return of the blank form would be appreciated.

Questionnaires were allowed to be returned over the next month and on March 20, 1991, a follow-up mailing of a coded instrument accompanied by a cover letter was sent to those members of the population who had not yet returned their first copy. Once again instructions were included for completing and returning the questionnaire and postage was paid for its return. The cover letter (Appendix) served to remind participants of the purpose and importance of completing and returning the questionnaire. Again, it was stressed that all information would be held confidential. From this follow-up mailing complete and incomplete questionnaires were received for the next six weeks.

As questionnaires were received from both mailings they were sorted as to attendees, complete and incomplete, non-attendees, complete and incomplete, and first or second mailing response. Each questionnaire was inspected to determine if data were missing from specific items within a section of the questionnaire or from entire sections. All data were entered into three Lotus files. Each file represented a section of the questionnaire. From these three files a SAS data set was created. All missing data were accounted for by entering a period in place of a numerical value. The entering of this data into Lotus 1-2-3 was determined to be accurate by different means for each section of the questionnaire. The first section, level of adoption and level of information, was entered by using only five columns, farmer, question number, response to adoption prior to the 1990 cropping season, response to adoption 1990 cropping season to the present,
response to level of information prior to the 1990 cropping season, and response to level of information 1990 cropping season to the present. Thus, lines were numbered one through twenty for each question for each farmer and only four columns of responses had to be entered rather than having one farmer with 80 columns for responses to the twenty questions. Every line of data was scrutinized for values less than zero or greater than five.

Data for the second section of the questionnaire, sources of information, were entered by farmer identification number with twenty-six columns for responses to the questions for this section. All responses were checked for values less than zero and greater than five. Additionally, each farmer’s response as to attendance at conferences was compared to their response to information presented at the conferences. This was done to ensure a missing value symbol, a period, was entered for all non-attendees’ responses to information presented at the conferences. All entered data were rechecked to ensure accuracy.

Data for the third section, demographics, were also entered by farmer identification number. Because some of the four questions in this section required more than one response it was necessary to use six columns for the response to each of the four questions. Each question for each farmer was rechecked for accuracy of data entry and for responses outside the range of possible numerical choices.

Data Analysis

Analysis of data collected for this study was conducted using SAS for the mainframe. The following procedures were used:

1. PROC SORT was used to sort participants as to those attending or not
attending the sustainable agriculture conferences held by Extension and as

to those responding to the first mailing on February 20, 1991 or to the

2. PROC FREQ was used to determine the percentage of participants that fell
into the different ranges of age and annual net farm income, the
percentage of attendees that felt the conferences helped them begin to use
new practices or refine their present ones, and the percentage that
recognized different degrees of effect due to a sustainable practice’s
attributes on its adoption.

3. The NPAR1WAY procedure was used to conduct the Kruskal-Wallis test.
Because this study dealt with non-parametric data normality of the
population could not be assumed. Therefore, it was necessary to use the
Kruskal-Wallis test which is the non-parametric counterpart to a “t” test
(Montgomery, 1984). A significance level of .05 was established by the
researcher prior to conducting the research. Analysis was done to
determine if age of the farmer, size of the farm operation, the source of
information used, and attendance at sustainable agriculture conferences
held by Extension significantly affected the adoption and level of
information of sustainable agriculture practices. The Kruskal-Wallis test
was also used to determine if there were differences in attendees’ adoption
and level of information depending on if they attended one or both of the
conferences. Finally, the Kruskal-Wallis test was used to determine if those
responding to the first mailing of the survey responded differently than those responding to the follow-up mailing.

4. The PROC CORR procedure was used for reliability testing of the survey.

Summary

An ex post facto research design was used to measure the effects attendance at Extension conferences on sustainable agriculture had on the adoption of sustainable agriculture practices. The population for the study consisted of central Iowa farmers who did and did not attend the conferences. Farmers were mailed a questionnaire to determine their level of adoption and level of information of selected practices. Descriptive statistics such as frequencies, means, and standard deviations were used to describe adoption and level of information on sustainable practices and sources of information and other factors that influence adoption. Using the Kruskal-Wallis test means of attendees and non-attendees were compared to determine if adoption, level of information, and sources of information used by attendees to determine practices were significantly different from the adoption, level of information, and sources used by non-attendees.
CHAPTER IV. RESULTS AND DISCUSSION

Introduction

This study was designed to describe the factors that influence the adoption and level of information of sustainable agriculture practices. By collecting data from central Iowa farmers analysis could be done to determine if factors such as attendance at Extension conferences on sustainable agriculture, sources of information farmers consult, and the attributes of the practices contribute to the degree of adoption or level of information. This chapter investigates the results of this analysis and provides a discussion concerning the importance and relevance of these results.

Return Rate

The research instrument was mailed to a population of 286 central Iowa farmers. Half of this population, 143, were attendees of the two conferences held by Extension on sustainable agriculture in 1989 and 1990. The other half were randomly selected central Iowa farmers chosen from nine individual county Extension mailing lists. Each of the participants was mailed a questionnaire and a cover letter that instructed them to return the questionnaire whether or not they chose to complete it. A total of 109 or seventy-six percent of attendees returned the questionnaire. Sixty-four percent, or 93, of the 109 were returned complete and eleven percent, or 16, were returned incomplete. A total of eighty-two, or fifty-seven percent, of non-attendees returned the questionnaire. Thirty-nine percent, or 56, of the 82 were returned complete while eighteen percent, or 26, were returned incomplete. This response was considered adequate for achieving the degree of accuracy desired in the measurements to be made.
Reliability of the Instrument

Cronbach’s alpha correlation procedure was used to determine the internal consistency of the instrument. Alpha coefficients were generated for each of the first two sections of the instrument. The first section consisted of questions on adoption and level of information of sustainable agriculture practices. An alpha coefficient value of 0.88 was calculated for questions dealing with the degree of adoption of sustainable agriculture practices. For questions dealing with the level of information for these practices the alpha coefficient was 0.93. Alpha coefficients were also generated for questions concerning sources of information farmers used in making management decisions and for questions concerning the degree to which attributes of a practice influenced its adoption. An alpha coefficient of 0.77 was generated for sources of information used and an alpha coefficient of 0.62 was generated for attributes influencing adoption. Alpha coefficients for each section were considered to be acceptable in terms of the instrument accurately obtaining the desired information and therefore achieving the objectives for which it was designed. Nunnally (1982) stated that an alpha coefficient of 0.65 or greater is the minimum suggested for research purposes, but Ary (1990) stated that a lower reliability of .3 to .5 was acceptable if the measurement is to be used for decision making about a group or for research purposes. Reliability expressed by the calculated coefficient is related to the length of the test. Therefore, it was not surprising that the alpha coefficients for sources of information used and attributes influencing adoption were lower, for the tests for these parts of the questionnaire were conducted on a smaller number of questions than for adoption and level of information of sustainable agriculture practices.
Comparison of First and Follow up Mailing Response

Seven questions from the research instrument were chosen at random. A mean response for each question was generated for participants that responded to the first mailing of the research instrument and for those that responded to the follow up mailing. These means were compared by use of the Kruskal-Wallis test which generated a probability of a greater Chi square statistic. The researcher determined that differences would be judged significant at the .05 level. In general, there were no perceived differences between first and follow up mailing respondents. The means and probabilities generated for first and follow up mailing respondents for level of information questions are found in Table A1 (Appendix). No significant differences were detected between the respondents of the two mailings in their level of information. Similarly, no significant differences were detected between first and follow up mailing respondents for their level of adoption (Table A2, Appendix). First and follow up mailing respondents were judged to be significantly different in their reported use of farm machinery dealers as an information source used in making management decisions (Table A3, Appendix). However, they were not significantly different in their use of neighbors, family and friends as an information source. Finally, no significant differences were detected between the mailing respondents for the influence they reported improvement of the environment had on their adoption of sustainable agriculture practices (Table A4, Appendix) or in the age range breakdown of the groups.
Attributes of the Adopter Contributing to Innovativeness

Demographic information was collected from the entire population to determine how similar the groups of attendees and non-attendees were and for use in determining what effect demographic factors had on the adoption and level of information of sustainable agriculture practices. One demographic factor that was considered was age. Distributions of age for attendees and non-attendees are found in Figure 1.

Similarities in the attendee and non-attendee portions of the population in their distribution of age were as follows: Neither group consisted of anyone below the age of twenty, the lowest percentage of attendees and non-attendees, six percent for both, were in the age bracket of 20-29 years. For attendees the second smallest age

![Pie charts showing distribution of age for attendees and non-attendees.](image)

Figure 1. Distribution of age for the population
group, or 18% of the population, was 60 years of age and older. The percentage of participants 60 and older in the non-attendee group was slightly higher, 22%. This was equal to the percentages of the non-attendee group that fell into the 30-39 age bracket and into the 50-59 age bracket. The largest segment was the 40-49 year old for both attendees (29%) and non-attendees (28%).

Several studies in searching for factors that contributed to the adoption of practices investigated what effects age might have. Some studies, such as those done by Korsching et al. (1983) that investigated the characteristics of adopters of minimum tillage practices and the work of Tolchinsky (1989) that investigated adopter characteristics influencing adoption of integrated pest management practices, indicated that adoption of innovative farm practices was related to the age of the farmer. Specifically, younger farmers were more receptive to new innovations. However, data gathered for this study did not agree with these studies. As Alonge (1990) found in looking at factors influencing adoption of low-input sustainable agriculture practices, this study concurred that age was not significantly related to adoption. This held true for the adoption of all the farming system categories with the exception of tillage and pest management practices in 1990 cropping season to the present. Similar results were generated when looking at age in relation to level of information for the system categories. No significant relationships were detected between age and level of information for the five farming system categories.

Farm size was also studied as an indicator of how similar were attendees and non-attendees. Farm size was based upon annual net farm income. As with age,
similarities were found between attendees and non-attendees in the breakdown of farm sizes. Distributions of farm size for attendees and non-attendees are found in Figure 2.

Over half of the population for each group, seventy-seven percent of non-attendees and sixty-four percent of attendees, had annual net farm incomes of less than $50,000. The smallest income range for attendees and non-attendees was in the $50,000 to 69,999 range.

Realizing a wide range of annual net farm incomes was reported within the population, analysis was conducted to investigate whether or not farm size was a determining factor in the adoption and level of information of sustainable agriculture practices. Palmer et al. (1991) and Lyson et al. (1983) both recognized in their

Figure 2. Distribution of annual net farm income for the population
respective studies a trend toward a slower or reduced rate of adoption among smaller farmers. However, research for this study did not recognize the same trend. In fact, this research did not identify a significant relationship between farm size and adoption of practices. These findings were in agreement with those of Malia and Korsching (1989) and Alonge (1990) whose studies investigated the use of sustainable agriculture farming practices in Iowa. Both agreed that farm size was not a reliable predictor of the adoption of sustainable farming practices. They also agreed that farm size was not a good predictor of how well informed participants were of the farming system categories. This was true except for information on cropping systems prior to the 1990 cropping season which did show a significant relationship to farm size.

Evaluating the Progression of Adoption

Extension employs the use of models to evaluate its efforts. These models monitor the stages individuals pass through when adopting a practice or set of practices. In order to describe what effect Extension conferences might have had on the adoption of sustainable agriculture practices by central Iowa farmers, this research asked respondents to indicate at what stage in the adoption process they were for each of twenty selected practices prior to and after the presentation of Extension conferences on sustainable agriculture. Stages were determined by respondents ranking on a one to five scale their adoption of practices. Respondents also ranked on a one to five scale how well informed they were of each practice. The mean adoption and level of information of the selected sustainable agriculture practices by attendees is found in Table 1. In general, attendees ranked their
Table 1. Attendees’ adoption and level of information of sustainable agriculture practices before and after Extension conferences

<table>
<thead>
<tr>
<th>Practice</th>
<th>Adoption of practices&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Level of information&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Prior to 1990</td>
<td>1990 to Present</td>
</tr>
<tr>
<td>Diversify cropping system</td>
<td>M&lt;sup&gt;d&lt;/sup&gt;</td>
<td>2.08</td>
</tr>
<tr>
<td></td>
<td>SD&lt;sup&gt;e&lt;/sup&gt;</td>
<td>1.24</td>
</tr>
<tr>
<td>Soil &amp; leaf testing for nitrogen needs</td>
<td></td>
<td>2.20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.38</td>
</tr>
<tr>
<td>Reduce rate of nitrogen application</td>
<td></td>
<td>2.84</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.34</td>
</tr>
<tr>
<td>Supplement commercial fertilizer with animal or green manure</td>
<td></td>
<td>3.18</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.76</td>
</tr>
<tr>
<td>Scout field to determine if weed control is needed</td>
<td></td>
<td>3.37</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.53</td>
</tr>
<tr>
<td>Scout field to determine if insect control is needed</td>
<td></td>
<td>3.02</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.65</td>
</tr>
<tr>
<td>Control weeds through increased cultivation</td>
<td></td>
<td>3.28</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.57</td>
</tr>
<tr>
<td>Control insects through crop rotation</td>
<td></td>
<td>3.86</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.41</td>
</tr>
<tr>
<td>Reduce herbicide application</td>
<td></td>
<td>2.99</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.52</td>
</tr>
</tbody>
</table>

<sup>a</sup>Attendees: N=95.

<sup>b</sup>Adoption of practices: 1=aware; 2=gathering more information; 3=trial use; 4=fine tuning; 5=permanent use.

<sup>c</sup>Level of information: 1=not informed; 2=slightly; 3=moderately; 4=well; 5=highly.

<sup>d</sup>M = mean.

<sup>e</sup>SD = standard deviation.
Table 1. Continued

<table>
<thead>
<tr>
<th>Practice</th>
<th>Adoption of practices&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Level of information&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Prior to 1990</td>
<td>1990 to Present</td>
</tr>
<tr>
<td>Discourage livestock dunging in hutches</td>
<td>2.08</td>
<td>2.43</td>
</tr>
<tr>
<td></td>
<td>1.35</td>
<td>1.50</td>
</tr>
<tr>
<td>Use of pasture farrowing</td>
<td>2.11</td>
<td>2.06</td>
</tr>
<tr>
<td></td>
<td>1.51</td>
<td>1.41</td>
</tr>
<tr>
<td>Use of intensive pasture grazing rotation</td>
<td>2.08</td>
<td>2.51</td>
</tr>
<tr>
<td></td>
<td>1.23</td>
<td>1.33</td>
</tr>
<tr>
<td>All-in, all-out, &amp; vacant, buying &amp; selling livestock to reduce disease</td>
<td>2.83</td>
<td>3.02</td>
</tr>
<tr>
<td></td>
<td>1.65</td>
<td>1.63</td>
</tr>
<tr>
<td>Reduce use of fall plowing</td>
<td>3.87</td>
<td>4.15</td>
</tr>
<tr>
<td></td>
<td>1.57</td>
<td>1.37</td>
</tr>
<tr>
<td>Use of post emergence herbicides</td>
<td>3.90</td>
<td>4.20</td>
</tr>
<tr>
<td></td>
<td>1.28</td>
<td>1.05</td>
</tr>
<tr>
<td>Reduce erosion by conversion of row crop acreage to cover crop</td>
<td>2.39</td>
<td>2.71</td>
</tr>
<tr>
<td></td>
<td>1.44</td>
<td>1.45</td>
</tr>
<tr>
<td>Soil test for phosphorus &amp; potassium needs</td>
<td>4.39</td>
<td>4.49</td>
</tr>
<tr>
<td></td>
<td>1.14</td>
<td>1.07</td>
</tr>
<tr>
<td>Take nitrogen credits for past season's legume crop</td>
<td>4.10</td>
<td>4.23</td>
</tr>
<tr>
<td></td>
<td>1.40</td>
<td>1.29</td>
</tr>
<tr>
<td>Use of ridge tillage for row crops</td>
<td>1.97</td>
<td>2.22</td>
</tr>
<tr>
<td></td>
<td>1.45</td>
<td>1.56</td>
</tr>
<tr>
<td>Strip cropping to reduce erosion</td>
<td>2.19</td>
<td>2.45</td>
</tr>
<tr>
<td></td>
<td>1.36</td>
<td>1.45</td>
</tr>
</tbody>
</table>
adoption of sustainable agriculture practices in the second through fourth stages: stage two, gathering more information and thinking about the practice before making decision, stage three, using the practice on a trial basis, or stage four, fine tuning the practice to meet their specific needs on a permanent basis. The only practice for which attendees reported a value of less than two was for use of ridge tillage prior to the 1990 cropping season. They reported a high level of awareness of the practice, corresponding to a rank value of 1.97. This value is very close to the stage of gathering more information and thinking about the practice and accordingly they indicated being moderately informed of the practice. This demonstrated that being informed does not necessarily indicate adoption has taken place. In general, attendees were moderately (three) to well (four) informed of these twenty practices. The only exception to this was that of the practice of discouragement of livestock dunging in hutches. This practice was ranked at 2.46 for prior to 1990 and 2.61 for 1990 to the present which relates to being only slightly to moderately informed. Little change was detected over time for this practice in means and standard deviations.

The means and standard deviations of adoption and level of information of the selected sustainable agriculture practices by non-attendees are found in Table 2. Just as attendees had ranked their adoption of sustainable agriculture practices from gathering more information and thinking about the practices before making a decision (stage 2) to fine tuning the practice to meet their needs on a permanent basis (stage 4), non-attendees in general also ranked themselves as being at the same stages. Similarly, the only practice that non-attendees reported a rank less than two was for
Table 2. Non-attendees\textsuperscript{a} adoption and level of information of sustainable agriculture practices before and after Extension conferences

<table>
<thead>
<tr>
<th>Practice</th>
<th>Adoption of practices\textsuperscript{b}</th>
<th>Level of information\textsuperscript{c}</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Prior to 1990</td>
<td>1990 to Present</td>
</tr>
<tr>
<td>Diversify cropping system</td>
<td>M\textsuperscript{d} = 2.80</td>
<td>2.95</td>
</tr>
<tr>
<td></td>
<td>SD\textsuperscript{e} = 1.84</td>
<td>1.78</td>
</tr>
<tr>
<td>Soil &amp; leaf testing for nitrogen needs</td>
<td>2.06</td>
<td>2.35</td>
</tr>
<tr>
<td></td>
<td>1.46</td>
<td>1.43</td>
</tr>
<tr>
<td>Reduce rate of nitrogen application</td>
<td>2.88</td>
<td>3.24</td>
</tr>
<tr>
<td></td>
<td>1.41</td>
<td>1.29</td>
</tr>
<tr>
<td>Supplement commercial fertilizer with animal or green manure</td>
<td>3.82</td>
<td>3.98</td>
</tr>
<tr>
<td></td>
<td>1.55</td>
<td>1.40</td>
</tr>
<tr>
<td>Scout field to determine if weed control is needed</td>
<td>3.54</td>
<td>3.78</td>
</tr>
<tr>
<td></td>
<td>1.48</td>
<td>1.37</td>
</tr>
<tr>
<td>Scout field to determine if insect control is needed</td>
<td>3.40</td>
<td>3.60</td>
</tr>
<tr>
<td></td>
<td>1.57</td>
<td>1.43</td>
</tr>
<tr>
<td>Control weeds through increased cultivation</td>
<td>3.57</td>
<td>3.67</td>
</tr>
<tr>
<td></td>
<td>1.62</td>
<td>1.52</td>
</tr>
<tr>
<td>Control insects through crop rotation</td>
<td>3.78</td>
<td>3.88</td>
</tr>
<tr>
<td></td>
<td>1.46</td>
<td>1.37</td>
</tr>
<tr>
<td>Reduce herbicide application</td>
<td>3.20</td>
<td>3.23</td>
</tr>
<tr>
<td></td>
<td>1.60</td>
<td>1.63</td>
</tr>
</tbody>
</table>

\textsuperscript{a}Non-Attendees: N=56.
\textsuperscript{b}Adoption of practices: 1=aware; 2=gathering more information; 3=trial use; 4=fine tuning; 5=permanent use.
\textsuperscript{c}Level of information: 1=not informed; 2=slightly; 3=moderately; 4=well; 5=highly.
\textsuperscript{d}M = mean.
\textsuperscript{e}SD = standard deviation.
Table 2. Continued

<table>
<thead>
<tr>
<th>Practice</th>
<th>Adoption of practices$^b$</th>
<th>Level of information$^c$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Prior to 1990</td>
<td>1990 to Present</td>
</tr>
<tr>
<td>Discourage livestock dunging in hutches</td>
<td>M$^a$</td>
<td>SD$^a$</td>
</tr>
<tr>
<td></td>
<td>2.46</td>
<td>2.71</td>
</tr>
<tr>
<td></td>
<td>1.33</td>
<td>1.44</td>
</tr>
<tr>
<td>Use of pasture farrowing</td>
<td>2.31</td>
<td>2.31</td>
</tr>
<tr>
<td></td>
<td>1.75</td>
<td>1.75</td>
</tr>
<tr>
<td>Use of intensive pasture grazing rotation</td>
<td>3.05</td>
<td>3.00</td>
</tr>
<tr>
<td></td>
<td>1.43</td>
<td>1.52</td>
</tr>
<tr>
<td>All-in, all-out, &amp; vacant, buying &amp; selling livestock to reduce disease</td>
<td>2.68</td>
<td>3.00</td>
</tr>
<tr>
<td></td>
<td>1.53</td>
<td>1.69</td>
</tr>
<tr>
<td>Reduce use of fall plowing</td>
<td>4.48</td>
<td>4.56</td>
</tr>
<tr>
<td></td>
<td>1.20</td>
<td>1.03</td>
</tr>
<tr>
<td>Use post emergence herbicides</td>
<td>3.98</td>
<td>4.10</td>
</tr>
<tr>
<td></td>
<td>1.39</td>
<td>1.33</td>
</tr>
<tr>
<td>Reduce erosion by conversion of row crop acreage to cover crop</td>
<td>3.15</td>
<td>3.29</td>
</tr>
<tr>
<td></td>
<td>1.51</td>
<td>1.52</td>
</tr>
<tr>
<td>Soil test for phosphorus &amp; potassium needs</td>
<td>4.13</td>
<td>4.23</td>
</tr>
<tr>
<td></td>
<td>1.35</td>
<td>1.22</td>
</tr>
<tr>
<td>Take nitrogen credits for past season's legume crop</td>
<td>4.15</td>
<td>4.22</td>
</tr>
<tr>
<td></td>
<td>1.37</td>
<td>1.32</td>
</tr>
<tr>
<td>Use of ridge tillage for row crops</td>
<td>1.31</td>
<td>1.47</td>
</tr>
<tr>
<td></td>
<td>0.87</td>
<td>0.97</td>
</tr>
<tr>
<td>Strip cropping to reduce erosion</td>
<td>2.56</td>
<td>2.54</td>
</tr>
<tr>
<td></td>
<td>1.75</td>
<td>1.72</td>
</tr>
</tbody>
</table>
use of ridge tillage for row crops. Non-attendees, like the attendees, were also moderately to well informed of the twenty practices with the exception of the practice of discouraging dunging in hutches. Additionally, non-attendees reported being slightly less than moderately informed, 2.81, of soil and leaf testing for nitrogen needs prior to the 1990 cropping season.

In order to determine what effects attendance at Extension conferences on sustainable agriculture had on the adoption and level of information of these practices, the mean change in adoption and level of information prior to the 1990 cropping season to the 1990 cropping season to the present was calculated for attendees and non-attendees. Determination of any significant differences between the adoption change for attendees and the adoption change for non-attendees and the level of information change for both groups was accomplished by using the Kruskal-Wallis test from which was generated a probability of a greater Chi square. This statistic revealed whether or not the change in adoption and level of information over time for attendees was different from that of non-attendees. The results of analysis to detect a change in adoption are found in Table 3. A mean change is listed for each of the twenty practices except of the practice of use of pasture farrowing. This practice was not included because the Kruskal-Wallis test will not calculate a probability of a greater Chi square when one of the means is zero. Therefore, no comparison of the mean change for attendees to mean change for non-attendees could be made. The mean change was calculated by subtracting the adoption of the practice before the Extension conferences from the
Table 3. Probability of attendance at Extension conferences affecting mean change in stages of adoption of sustainable agriculture practices

<table>
<thead>
<tr>
<th>Practice</th>
<th>Mean change in stage of adoption</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Attendees b</td>
<td>Non-Attendees c</td>
<td>P&gt;CHISQ d</td>
</tr>
<tr>
<td>Diversify cropping system</td>
<td>0.204</td>
<td>0.127</td>
<td>0.559</td>
</tr>
<tr>
<td>Soil &amp; leaf test for nitrogen needs</td>
<td>0.333</td>
<td>0.273</td>
<td>0.405</td>
</tr>
<tr>
<td>Reduce rate of nitrogen application</td>
<td>0.258</td>
<td>0.327</td>
<td>0.218</td>
</tr>
<tr>
<td>Supplement commercial fertilizer with animal or green manure</td>
<td>0.129</td>
<td>0.182</td>
<td>0.157</td>
</tr>
<tr>
<td>Scout field to determine if weed control is needed</td>
<td>0.194</td>
<td>0.236</td>
<td>0.891</td>
</tr>
<tr>
<td>Scout field to determine if insect control is needed</td>
<td>0.204</td>
<td>0.200</td>
<td>0.528</td>
</tr>
<tr>
<td>Control weeds through increased cultivation</td>
<td>0.247</td>
<td>0.091</td>
<td>0.491</td>
</tr>
<tr>
<td>Control insects through crop rotation</td>
<td>0.097</td>
<td>0.091</td>
<td>0.762</td>
</tr>
<tr>
<td>Reduce herbicide application</td>
<td>0.194</td>
<td>-0.036</td>
<td>0.080</td>
</tr>
<tr>
<td>Discourage livestock dunging in hutches</td>
<td>0.065</td>
<td>0.109</td>
<td>0.496</td>
</tr>
<tr>
<td>Use of intensive pasture grazing rotation</td>
<td>0.172</td>
<td>-0.018</td>
<td>0.171</td>
</tr>
</tbody>
</table>

*Mean = expressed as change in Adoption of practices: 1=aware; 2=gathering more information; 3=trial use; 4=fine tuning; 5=permanent use.

bAttendees: N=95.

cNon-Attendees: N=56.

dP>CHISQ = probability of a greater Chi square.
Table 3. Continued

<table>
<thead>
<tr>
<th>Practice</th>
<th>Mean* change in stage of adoption</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Attendees^b</td>
<td>Non-Attendees^c</td>
<td>P&gt;CHISQ^d</td>
</tr>
<tr>
<td>All-in, all-out, &amp; vacant, buying &amp; selling livestock to reduce disease</td>
<td>0.043</td>
<td>0.163</td>
<td>0.363</td>
</tr>
<tr>
<td>Reduce use of fall plowing</td>
<td>0.258</td>
<td>0.073</td>
<td>0.798</td>
</tr>
<tr>
<td>Use post emergence herbicides</td>
<td>0.333</td>
<td>0.036</td>
<td>0.156</td>
</tr>
<tr>
<td>Reduce erosion by conversion of row crop acreage to cover crop</td>
<td>0.247</td>
<td>0.109</td>
<td>0.361</td>
</tr>
<tr>
<td>Soil test for phosphorus &amp; potassium needs</td>
<td>0.108</td>
<td>0.091</td>
<td>0.301</td>
</tr>
<tr>
<td>Take nitrogen credits for past season's legume crop</td>
<td>0.118</td>
<td>0.055</td>
<td>0.716</td>
</tr>
<tr>
<td>Use ridge tillage for row crops</td>
<td>0.183</td>
<td>0.127</td>
<td>0.999</td>
</tr>
<tr>
<td>Strip cropping to reduce erosion</td>
<td>0.204</td>
<td>-0.018</td>
<td>0.605</td>
</tr>
</tbody>
</table>
adoption after the conferences for each farmer and then calculating the overall mean difference. The same procedure was used to determine change in level of information. Interesting was the observance that the change in adoption seen for attendees prior to attending Extension conferences until after they had attended one or both conferences was not significantly different from the change in adoption for non-attendees over the same time period. This was true for all twenty practices including those specifically covered at the conferences held by Extension. These practices included control of weeds through increased cultivation, reduce herbicide application, e.g., banding, use of intensive pasture grazing rotation system, reduce erosion by conversion of row crop acreage to cover crops, use of ridge tillage for row crops, and strip cropping to reduce erosion. For each of these practices the attendees showed an increase in their adoption over time, but this increase was not significantly different from the change non-attendees experienced. Tolchinsky (1989) similarly compared the level of adoption of IPM practices in corn by farmer cooperators and noncooperators of an IPM Extension program. He concluded that cooperators and noncooperators were not significantly different in their level of adoption, but that both showed a positive attitude toward the adoption of IPM practices.

The comparison of results for the change in level of information by attendees and non-attendees is found in Table 5. The comparison of the change in level of information for both groups yielded results similar to those detected for the mean change in adoption. Just as there was no significant difference between the change
Table 4. Probability of attendance at Extension conferences affecting mean change in level of information of sustainable agriculture practices

<table>
<thead>
<tr>
<th>Practice</th>
<th>Mean change in level of information</th>
<th>Attendees</th>
<th>Non-Attendees</th>
<th>P&gt;CHISQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diversify cropping system</td>
<td>0.226</td>
<td>0.127</td>
<td>0.999</td>
<td></td>
</tr>
<tr>
<td>Soil &amp; leaf test for nitrogen needs</td>
<td>0.376</td>
<td>0.273</td>
<td>0.677</td>
<td></td>
</tr>
<tr>
<td>Reduce rate of nitrogen application</td>
<td>0.419</td>
<td>0.255</td>
<td>0.674</td>
<td></td>
</tr>
<tr>
<td>Supplement commercial fertilizer with animal or green manure</td>
<td>0.151</td>
<td>0.145</td>
<td>0.249</td>
<td></td>
</tr>
<tr>
<td>Scout field to determine if weed control is needed</td>
<td>0.226</td>
<td>0.164</td>
<td>0.686</td>
<td></td>
</tr>
<tr>
<td>Scout field to determine if insect control is needed</td>
<td>0.204</td>
<td>0.200</td>
<td>0.594</td>
<td></td>
</tr>
<tr>
<td>Control weeds through increased cultivation</td>
<td>0.258</td>
<td>0.109</td>
<td>0.637</td>
<td></td>
</tr>
<tr>
<td>Control insects through crop rotation</td>
<td>0.086</td>
<td>-0.018</td>
<td>0.336</td>
<td></td>
</tr>
<tr>
<td>Reduce herbicide application</td>
<td>0.161</td>
<td>0.055</td>
<td>0.864</td>
<td></td>
</tr>
<tr>
<td>Discourage livestock dunging in hutches</td>
<td>0.032</td>
<td>0.055</td>
<td>0.661</td>
<td></td>
</tr>
<tr>
<td>Use of intensive pasture grazing rotation</td>
<td>0.151</td>
<td>0.127</td>
<td>0.294</td>
<td></td>
</tr>
</tbody>
</table>

*aMean = expressed as change in Level of information: 1=not informed; 2=slightly; 3=moderately; 4=well; 5=highly.
*bAttendees: N=95.
*cNon-Attendees: N=56.
*dP>CHISQ = probability of a greater Chi square.
Table 4. Continued

<table>
<thead>
<tr>
<th>Practice</th>
<th>Mean change in level of information</th>
<th>Attenees&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Non-Attendees&lt;sup&gt;c&lt;/sup&gt;</th>
<th>P&gt;CHISQ&lt;sup&gt;d&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>All-in, all-out, &amp; vacant, buying &amp; selling livestock to reduce disease</td>
<td>-0.022</td>
<td>0.145</td>
<td>0.327</td>
<td></td>
</tr>
<tr>
<td>Reduce use of fall plowing</td>
<td>0.043</td>
<td>0.109</td>
<td>0.487</td>
<td></td>
</tr>
<tr>
<td>Use post emergence herbicides</td>
<td>0.086</td>
<td>0.036</td>
<td>0.330</td>
<td></td>
</tr>
<tr>
<td>Reduce erosion by conversion of row crop acreage to cover crop</td>
<td>0.129</td>
<td>0.127</td>
<td>0.893</td>
<td></td>
</tr>
<tr>
<td>Soil test for phosphorus &amp; potassium needs</td>
<td>0.054</td>
<td>0.018</td>
<td>0.197</td>
<td></td>
</tr>
<tr>
<td>Take nitrogen credits for past season's legume crop</td>
<td>0.097</td>
<td>0.145</td>
<td>0.820</td>
<td></td>
</tr>
<tr>
<td>Use ridge tillage for row crops</td>
<td>0.161</td>
<td>0.109</td>
<td>0.495</td>
<td></td>
</tr>
<tr>
<td>Strip cropping to reduce erosion</td>
<td>0.247</td>
<td>0.145</td>
<td>0.133</td>
<td></td>
</tr>
</tbody>
</table>
in stage of adoption for attendees versus non-attendees, the level of information change for attendees prior to attending Extension conferences until after they had attended one or both conferences was not significantly different from the level of information change experienced by non-attendees over the same period of time.

This investigation of adoption and level of information prior to and after Extension conferences were held closely resembles a "before and after study" as described by Bennett (1977, p. 18). This study was designed to gauge the extent to which the Extension conferences, the inputs according to Bennett, contributed to changes made by program participants. A modified version of Bennett's model was used in this study because the researcher was not able to collect information from study participants prior to December 13, 1989 to determine what their attitudes and situations were before the Extension conferences took place. The participants were required to reflect back on their status prior to the 1990 cropping season and also give an account from then to the present. Extension has found this to be an effective means of obtaining valid information to document behavior. Rockwell (1989, p. 19) referred to this method as the "post-then-pre evaluation". She explained that by asking study participants after a program was given to describe their behavior as a result of the program (postest) and then also their behavior before the program (pretest) the participant was better equipped to give an accurate account of their behavior before the program. The information obtained in a pretest given during the posttest is more accurate than that obtained from pretests prior to programs "because participants may have limited knowledge at the beginning of the program that
prevents them from accurately assessing baseline behaviors" (Rockwell, 1989, p. 19). Bennett, however, emphasized that care must be taken when interpreting the differences between before and after, for changes might have occurred due to forces other than the one in question, in this case the Extension conferences’ effect on adoption of sustainable agriculture. The trend for attendees, although not significant, was an increase in adoption and level of information over time. This increase, however, cannot be attributed entirely to attendance at Extension conferences, for the trend for non-attendees was also a general increase; therefore, there might be factors other than Extension conferences contributing to the adoption of sustainable agriculture practices.

Each of the twenty practices were also grouped as to farming system categories established by the researcher. Practices were grouped as to categories for purposes of reducing possible statistical error that would be introduced if each of the twenty practices were compared individually. These categories included cropping, tillage, fertility, pest management, and livestock systems. A mean level of adoption and level of information was calculated for each of these systems prior to the 1990 cropping season and for the 1990 cropping season to the present. A comparison was made between attendees and non-attendees as to their adoption and level of information for each of these systems. In order to make these comparisons, a probability of a greater Chi square was generated using the Kruskal-Wallis test. The results of the comparison for system adoption by attendees and non-attendees prior to the 1990 cropping season and the 1990 cropping season to the present are found.
in Table 5. There were no significant differences in adoption of these farming systems detected between attendees and non-attendees either prior to 1990 or from 1990 to the present. Similarly, no significant differences were detected for the level of information of these systems between attendees and non-attendees either prior to 1990 or from 1990 to the present (Table 6).

The rankings respondents assigned to their progression in adoption and level of information of the selected sustainable agriculture practices were comparable to those established stages of adoption in the innovation-diffusion process (Rogers and Shoemaker, 1971; Rogers, 1983; Lamble, 1984). When comparing the mean rankings assigned by attendees and non-attendees whether on the individual practices (Table 1 and Table 2) or for the farming system categories (Table 5 and Table 6), both groups had attained at least the second and third stages in the innovation-diffusion process in their adoption of sustainable agriculture practices. Research suggests (Rogers and Shoemaker, 1971; Rogers, 1983; Lamble, 1984), that the respondents in this study were past being aware that the practice, problem, or opportunity existed, that is, they were beyond stage one of the innovation-diffusion process. Respondents, as a ranking of two suggested, were seeking information and evaluating what they knew in terms of what they could use. Some respondents had reached what is known as the fourth stage in the innovation-diffusion process, trial. At this stage, as a respondent ranking of 3 suggested, the respondents, having formulated mental ideas of the practice, made a decision to use it on a trial basis. Some respondents ranked themselves as a four or better, indicating that trial was
Table 5. Mean adoption of farming systems prior to the 1990 cropping season and for the 1990 cropping season to the present as affected by attendance at Extension conferences on sustainable agriculture.

<table>
<thead>
<tr>
<th>Systems</th>
<th>Prior to 1990 Cropping Season</th>
<th>1990 Cropping Season to Present</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Attendees&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Non-Attendees&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Cropping</td>
<td>M&lt;sup&gt;e&lt;/sup&gt;</td>
<td>2.29</td>
</tr>
<tr>
<td></td>
<td>SD&lt;sup&gt;f&lt;/sup&gt;</td>
<td>0.91</td>
</tr>
<tr>
<td>Tillage</td>
<td>2.77</td>
<td>2.84</td>
</tr>
<tr>
<td></td>
<td>1.19</td>
<td>0.91</td>
</tr>
<tr>
<td>Fertility</td>
<td>2.91</td>
<td>2.86</td>
</tr>
<tr>
<td></td>
<td>0.98</td>
<td>0.92</td>
</tr>
<tr>
<td>Pest management</td>
<td>3.24</td>
<td>3.36</td>
</tr>
<tr>
<td></td>
<td>1.04</td>
<td>1.16</td>
</tr>
<tr>
<td>Livestock</td>
<td>1.33</td>
<td>1.58</td>
</tr>
<tr>
<td></td>
<td>0.81</td>
<td>1.01</td>
</tr>
</tbody>
</table>

<sup>a</sup>Adoption: 1=aware; 2=gathering more information; 3=trial use; 4=fine tuning; 5=permanent use.

<sup>b</sup>Attendees: N=95.

<sup>c</sup>Non-Attendees: N=56.

<sup>d</sup>P>CHISQ = probability of a greater Chi square.

<sup>e</sup>M = mean.

<sup>f</sup>SD = standard deviation.
Table 6. Mean level of information* of farming systems prior to the 1990 cropping season and for the 1990 cropping season to the present as affected by attendance at Extension conferences on sustainable agriculture

<table>
<thead>
<tr>
<th>Systems</th>
<th>Prior to 1990 Cropping Season</th>
<th>1990 Cropping Season to Present</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Attendees b</td>
<td>Non-Attendees c</td>
</tr>
<tr>
<td>Cropping</td>
<td>3.08</td>
<td>2.88</td>
</tr>
<tr>
<td></td>
<td>1.00</td>
<td>1.07</td>
</tr>
<tr>
<td>Tillage</td>
<td>3.42</td>
<td>3.38</td>
</tr>
<tr>
<td></td>
<td>1.01</td>
<td>1.01</td>
</tr>
<tr>
<td>Fertility</td>
<td>3.28</td>
<td>3.23</td>
</tr>
<tr>
<td></td>
<td>0.89</td>
<td>0.82</td>
</tr>
<tr>
<td>Pest management</td>
<td>3.50</td>
<td>3.40</td>
</tr>
<tr>
<td></td>
<td>0.89</td>
<td>0.98</td>
</tr>
<tr>
<td>Livestock</td>
<td>2.03</td>
<td>2.15</td>
</tr>
<tr>
<td></td>
<td>1.17</td>
<td>1.08</td>
</tr>
</tbody>
</table>

*Level of information: 1 = not informed; 2 = slightly; 3 = moderately; 4 = well; 5 = highly.

bAttendees: N=95.

cNon-Attendees: N=56.

dP>CHISQ = probability of a greater Chi square.

M = mean.

SD = standard deviation.
successful and they were moving toward sustained, permanent use of the practice by improving it to fit their specific needs. Thus, the farmer might still be actively seeking information to confirm the decision to use the practice, alter it, or discontinue its use (Rogers and Shoemaker, 1971; Lamble, 1984).

Analysis was also completed to determine if attending one or both of the Extension conferences on sustainable agriculture made a difference in the mean adoption or level of information of the five farming system categories. In general, the results produced in this comparison yielded no significant differences. Those attending one or both of the Extension conferences differed only in their adoption of tillage practices prior to the 1990 cropping season and in their level of information of tillage systems from the 1990 cropping season to the present. Conclusions as to why those attending one or both of the conferences would be significantly different for their adoption of tillage systems prior to 1990 cannot be derived from the results of this research. Attending one or both though could have made a difference in their level of information on tillage systems, for two of the three tillage practices in the tillage system category were discussed at the Extension conferences.

Attributes Influencing the Adoption of Innovations

The process of making farm management decisions on what practices to employ typically involves taking into consideration the attributes of the practices. These attributes include the relative advantage, compatibility, complexity, trialability, and observability. Investigation of the effects these attributes had on the adoption of sustainable agriculture practices was accomplished by asking participants to indicate
the extent to which examples of these attributes influenced their adoption.

The effects of the relative advantage were determined by questioning participants on the influence of a practice improving the environment, the short and long-term profitability of a practice, and the possibility that a practice might contribute to reduced yields. Participants ranked these attributes on a five point scale, one indicating a low influence and five indicating a high influence. The majority of participants, whether they were attendees or non-attendees, ranked these attributes symbolizing the relative advantage at a three or better. Improvement of the environment showed the strongest response with approximately ninety-eight percent of non-attendees and ninety-two percent of attendees ranking this attribute as a three or better (Figure 3). The influence reduction of yields (Figure 4) might have, however, did not show quite as strong of a response. Sixty-six percent of non-attendees and seventy-seven percent of attendees ranked reduction of yields as having a medium, three, to high influence with the majority of these concentrated around three to four. The influence of short and long-term profitability was also ranked as medium to highly influential. However, the distributions of participants' feelings were not identical for the short and long-term. The influence of short-term profitability (Figure 5) had a more normal distribution with approximately forty-five percent of non-attendees and thirty-nine percent of attendees ranking it as having a medium influence. The influence of long-term profitability (Figure 6) was skewed more toward the upper end of the scale with approximately ninety-two percent of non-attendees and
Figure 3. Degree to which improvement of the environment influenced adoption of sustainable agriculture practices by percentage of those responding.
Figure 4. Degree to which reduction of yields influenced adoption of sustainable agriculture practices by percentage of those responding.
Figure 5. Degree to which short term profitability influenced adoption of sustainable agriculture practices by percentage of those responding.
Figure 6. Degree to which long term profitability influenced adoption of sustainable agriculture practices by percentage of those responding.
approximately ninety-seven percent of attendees ranking it as medium to highly influential.

The population as a whole perceived these four attributes which reflect the relative advantage of a practice as being positively related to the adoption of a practice. These results concurred with other studies such as Dickey et al. (1991 a) who pointed out that farmers were very interested in adopting conservation tillage practices from which they could see an immediate savings in fuel and labor costs, and Poincelot (1990), who pointed out that farmers would be interested in the possible savings on commercial fertilizer costs by using legume crops for fertilizer credit. These attributes are realized in the short-term, but in general sustainable agriculture practices are preventive innovations, oriented to long-term productivity goals. For these the rewards may not be immediate. Malia and Korsching (1989) pointed out that this might lead to decreased motivation to adopt such practices. Results of this study did not indicate that the relative advantage was reduced when rewards were not immediate. The strong influence that improving the environment, which does not occur immediately, and the long-term profitability had on adoption indicated to the researcher that farmers were not solely interested in the short-term, but also the long-term.

The effects of the compatibility were determined by questioning participants on the influence of the availability of equipment and financing necessary to adopt or use a practice. The majority of participants, whether attendees or non-attendees, ranked these compatibility attributes as being medium to highly influential. The distribution of
rankings for influence of equipment availability (Figure 7) was fairly normal for both groups with the exception of a large response, forty-eight percent, of attendees to the rank of four. However, eighty-five percent of non-attendees and eighty-one percent of attendees perceived equipment availability as being medium to highly influential. The influence of necessary financing (Figure 8) was also fairly normally distributed. As with equipment availability, the majority of respondents, sixty-five percent of non-attendees and eighty-one percent of attendees, perceived necessary financing as medium to highly influential.

The overall trend for these attributes, which reflected the compatibility of an innovation, was a positive relationship to the adoption of a management practice. This research concurred with Rogers' (1983) contention that the two were positively related. Similar research on the adoption of low-input sustainable agriculture practices in Iowa (Alonge, 1990) also agreed that as the compatibility of a practice to the existing situation increased so did the adoption of the practice. An example of compatibility affecting adoption that was closely tied to the compatibility attributes this research investigated was provided in a study done by Dickey et al. (1991b). Dickey et al. indicated that educating Nebraska farmers about inexpensive modifications that could be made to their equipment increased their interest in adoption of minimum tillage practices.

The effects of the trialability on the adoption of a practice were determined by questioning participants on the influence of the opinions of other farmers. It had been suggested that trialability, the ability to test an innovation on a limited scale, had a
Figure 7. Degree to which availability of equipment influenced adoption of sustainable agriculture practices by percentage of those responding.
Figure 8. Degree to which availability of necessary financing influenced adoption of sustainable agriculture practices by percentage of those responding.
positive relationship to adoption of practices (Rogers and Shoemaker, 1971; Lionberger and Gwin, 1982; Lamble, 1984). Testing an innovation on a limited scale may either be accomplished by personal experience with the practice on a small, experimental basis or by observance of trial on someone's farm that is similar. Dickey et al. (1991b) reported that it was evident that farmers from neighborhoods in which the rate of trial was high for conservation tillage were in a superior situation in reference to complying with their conservation plans. Viewing the use of these practices by other farmers was positively related to their own adoption. Similarly, this study investigated the influence of opinions of other farmers, such as those on a practice they might have tried, on the adoption of sustainable agriculture practices (Figure 9). As Tolchinsky (1989) and Fliegel and Kivlin (1962) found, the research for this study revealed that trialability was not as strongly related to adoption as was relative advantage and compatibility. The majority of participants responded in the two to four range. Forty-seven percent of attendees gave a rating of three with eighty-eight percent falling in the two to four range. Eighty-two percent of non-attendees ranked opinions of other farmers as a two to four.

The effects of complexity and observability were determined by questioning participants on the influence of the opportunity to watch or ask others how to do it. The influence of an opportunity to watch or ask how to do it was positively related to the adoption of sustainable agriculture practices (Figure 10). Eighty-four percent of non-attendees and ninety percent of attendees ranked the opportunity as a three or better. Having the opportunity to watch or ask how to use a practice indicates that
Figure 9. Degree to which the opinions of other farmers influenced adoption of sustainable agriculture practices by percentage of those responding.
Figure 10. Degree to which the opportunity to watch or ask how to do it influenced adoption of sustainable agriculture practices by percentage of those responding.
the practice is observable or results may be visualized. The results of this research were in agreement with the contention of other researchers (Rogers and Shoemaker, 1971; Rogers, 1983; Tolchinsky, 1989), who expressed that as the observability of a practice increased so did its rate of adoption.

Having the opportunity to watch or ask how to use a practice also indicated that a possibility for removing some of the complexity involved in adopting the practice could be removed. An opportunity to watch or ask how may be obtained through educational programs such as those conducted by the Cooperative Extension Service. The Extension Service in Nebraska delivered educational programs to clarify the basic knowledge and skills required to adopt conservation practices. Providing clients with an opportunity to interact on the topic reduced the complexity and increased the adoption of conservation tillage practices (Dickey et al. 1991a). This example concurred with the opinions expressed by participants in this study (Figure 10).

Sources of Information

The decision to adopt a farm management practice requires gathering and processing information from trusted sources and then applying it to one's own circumstances. The sources of information sought might depend upon the stage in the adoption process a farmer has attained, the personal preference or affiliations of the farmer, or the practice in question. Bounaga (1989), in his investigation of preferred sources of information related to adoption of soil conservation practices, asked respondents to rate the importance of nine sources of information played in
helping them make soil conservation management decisions. The top five in rank order were (1) neighbors, friends, family, and other farmers, (2) the Soil Conservation Service, (3) the Agricultural Stabilization and Conservation Service, (4) the Cooperative Extension Service, and (5) agribusiness. Similarly, Tolchinsky (1989), in his investigation of farmers' attitudes toward sources of information used when deciding to apply a pesticide, asked respondents to rank seven information sources as to their importance. Tolchinsky found that regardless of the farmer's usage of IPM methodology and cooperation in IPM Extension programs there was no difference in how important they judged these sources to be in making a decision whether or not to apply a pesticide. Finally, Alonge (1990) identified the sources of information respondents used to gather information on low-input sustainable agriculture practices. Alonge reported that most of the respondents were obtaining their information from the mass media and farm chemical dealers and that they had only minimal contact with the CES, the Iowa State University Experiment Station, and the SCS. In fact, respondents felt that government agencies were unable to provide them with adequate information on low-input sustainable agriculture practices.

Research for this study asked respondents to rank sources of information as to their degree of use in determining management practices. Mean use of each source was determined for attendees and non-attendees of Extension conferences on sustainable agriculture. From the mean usages by attendees and non-attendees, the researcher assigned a rank order to the sources according to the degree of use by each group (Table 1). The source with the highest rating of use was ranked number
Table 7. Probability of differences between attendees and non-attendees in degree of use of information sources

<table>
<thead>
<tr>
<th>Source</th>
<th>Attendees&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Non-Attendees&lt;sup&gt;b&lt;/sup&gt;</th>
<th>P&lt;sup&gt;d&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Rank</td>
<td>Mean</td>
</tr>
<tr>
<td>Fertilizer and herbicide dealers</td>
<td>3.46</td>
<td>1</td>
<td>3.61</td>
</tr>
<tr>
<td>County Extension Service</td>
<td>3.43</td>
<td>2</td>
<td>3.00</td>
</tr>
<tr>
<td>Farm magazines and publications</td>
<td>3.42</td>
<td>3</td>
<td>3.41</td>
</tr>
<tr>
<td>Soil Conservation Service</td>
<td>3.30</td>
<td>4</td>
<td>3.00</td>
</tr>
<tr>
<td>Neighbors, family, friends</td>
<td>3.22</td>
<td>5</td>
<td>3.33</td>
</tr>
<tr>
<td>Iowa State University Experiment Station</td>
<td>3.14</td>
<td>6</td>
<td>2.74</td>
</tr>
<tr>
<td>Personal consultation with Area Extension Crop Production Specialist</td>
<td>2.77</td>
<td>7</td>
<td>2.08</td>
</tr>
<tr>
<td>Seed dealers</td>
<td>2.76</td>
<td>8</td>
<td>2.80</td>
</tr>
<tr>
<td>Farm organizations</td>
<td>2.59</td>
<td>9</td>
<td>2.22</td>
</tr>
<tr>
<td>Livestock feed dealers</td>
<td>2.48</td>
<td>10</td>
<td>2.61</td>
</tr>
<tr>
<td>Farm machinery dealers</td>
<td>2.46</td>
<td>11</td>
<td>2.35</td>
</tr>
<tr>
<td>Practical Farmers of Iowa</td>
<td>2.15</td>
<td>12</td>
<td>1.72</td>
</tr>
<tr>
<td>High school agriculture teachers</td>
<td>1.53</td>
<td>13</td>
<td>1.47</td>
</tr>
</tbody>
</table>

<sup>a</sup>Attendee: N=95.
<sup>b</sup>Non-Attendee: N=56.
<sup>c</sup>Mean: 1 = Never; 2 = Seldom; 3 = Sometimes; 4 = Frequently; 5 = Always.
<sup>d</sup>P<sup>CHISQ</sup> = probability of a greater Chi square.
<sup>*</sup>Significant at .05 level.
<sup>**</sup>Significant at .01 level.
Attendees and non-attendees listed among their top five the same sources. These top five included some of the same top five indicated in Bounaga's (1989) study. Attendees and non-attendees did not have the same rank order for these top five sources nor were they of the same rank order as Bounaga's. The top five sources for attendees, in rank order, were fertilizer and herbicide dealers, CES, farm magazines and publications, SCS, and neighbors, family, and friends. The top five sources for non-attendees, in rank order, were fertilizer and herbicide dealers, farm magazines and publications, neighbors, family, and friends, and the CES and SCS tied for fourth. A probability of a greater Chi square was generated to determine if the degree of use of these sources by attendees was significantly different from the degree of use by non-attendees. Attendees and non-attendees were significantly different at the .01 level in the degree to which they used the Cooperative Extension Service, with attendees having the higher usage. However, this difference did not seem to have any adverse effects on how well informed non-attendees were or to what stage in the adoption process they were, for non-attendees showed a level of adoption and information on sustainable agriculture practices similar to that of attendees. These results suggested that sources other than the CES were influential in increasing the level of information and adoption of sustainable agriculture in central Iowa. Often times Extension has served as a source of information for other institutions or the media. It is therefore possible that although non-attendees reported a significantly lesser direct use of the CES, they could have been indirectly receiving Extension's information through other sources such as chemical dealers, farm
magazines, or neighbors. Significant differences were also detected between attendees and non-attendees for their use of the Iowa State University Experiment Station, personal consultation with Area Extension Crop Production Specialist, farm organizations, and Practical Farmers of Iowa. Respondents in this study, regardless of their attendance at the Extension conferences, indicated a somewhat higher degree of use of the CES than did respondents to Alonge’s (1990) study. Respondents were also asked to indicate if there were sources of information beyond the selected thirteen that they used to determine management practices. Personal experience, television and newspapers, professional consulting services, contacts with professors at Iowa State University, and reference to conservation publications were indicated as other sources used to determine management practices.

Because attendees of the sustainable agriculture conferences held by Extension were obviously using the Extension Service as an information source, respondents in the attendee group were asked to indicate the extent to which the information presented at the conferences helped them begin to use new practices and refine their present practices. The majority, seventy-nine percent, indicated that the conferences were not that helpful in initiating the use of new practices by ranking this factor at a three or lower (Figure 11). This was indicated by a ranking of three, medium, to one, low. However, when asked about how helpful the conferences were in refining present practices, the majority, seventy-seven percent, ranked them as a three, medium, to five, highly helpful (Figure 12).
Figure 11. Extent to which the information presented at the sustainable agriculture conferences helped participants begin to use new practices by percentage of those responding.
Figure 12. Extent to which the information presented at the sustainable agriculture conferences helped participants refine their present practices by percentage of those responding
Summary

By examining attributes of the adopter and of practices the researcher was able to obtain a better idea of the factors influencing the adoption of sustainable agriculture practice by central Iowa farmers. In general, age and farm size did not significantly affect the adoption of sustainable agriculture practices. The attributes of a practice such as its relative advantage, compatibility, and observability were positively related to its adoption. Trialability was also positively related to adoption although the relationship was not as strong as for relative advantage and compatibility. The complexity of a practice had a negative relationship to adoption.

Attendees and non-attendees listed the same top five sources of information they consulted in making management decisions. These top five choices were not in the same rank order for both groups. In fact, attendee and non-attendee usage of the CES was significantly different. Attendees found the conferences on sustainable agriculture presented by Extension to be more helpful in assisting them to refine present practices than begin use of new practices.

An evaluation of the progression of adoption of sustainable agriculture practices was made of attendees and non-attendees of Extension conferences on sustainable agriculture prior to the 1990 cropping season and the 1990 cropping season to the present. The results of this evaluation suggest that farmers in central Iowa were not significantly different in their adoption of sustainable agriculture practices regardless of their attendance at the conferences held by Extension. The
evaluation also indicated an increase, although insignificant, in the adoption of sustainable agriculture practices by farmers in central Iowa over time.
CHAPTER V. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Based on the results of this study the following conclusions were made:

1. The responding attendees and non-attendees were similar in age and annual net farm income.

2. Age and annual net farm income did not significantly affect the adoption or level of information of sustainable agriculture practices.

3. Relative advantage, compatibility, and observability were considered the most important attributes influencing the adoption of sustainable agriculture practices.

4. It was apparent respondents were interested in the long term effects of a practice in addition to short term.

5. Attendees and non-attendees agreed that fertilizer and herbicide dealers were the source of information they used the most in determining management practices.

6. Both attendees and non-attendees ranked the Cooperative Extension Service as an important source used to determine management practices, but attendees found the CES to be significantly more useful.

7. According to the reported levels of adoption and information by attendees the conferences were more helpful to attendees in terms of refining practices, rather than in beginning to use new practices.
8. The responding attendees and non-attendees were not significantly different in their progress in adopting sustainable agriculture practices from before the Extension conferences to after them and up to the present, therefore sources other than the CES played an important role in determining management practices.

9. In general, farmers in the nine central Iowa counties included in this study had a positive inclination to adopt sustainable agriculture practices and increase their level of information about them.

10. Respondents in this study were at least at stage two in the innovation-diffusion process (seeking more information) and many had reached stages three and four (evaluation and trial).

Recommendations

Based on the results of this study and the conclusions that were drawn from them, the following recommendations are suggested:

1. This study contains a list of sustainable agriculture practices with means that indicate the extent to which farmers in central Iowa are informed. This list should be used by the Cooperative Extension Service as a guide for topics future programs.

2. Farmers in central Iowa were highly informed on topics and these have been covered sufficiently: reduction in use of fall plowing, use of post emergence herbicides, soil testing for phosphorus and potassium needs, taking nitrogen credits for past season's legume crop.
3. Farmers in central Iowa were not well informed on the topics of diversification of cropping systems, soil and leaf testing for nitrogen needs, discouragement of livestock dunging in hutches, pasture farrowing, and strip cropping to reduce erosion. These should be included in future programs.

4. Field days or local field presentations in each of the nine counties should be used during the growing season to make the ideas covered in the winter conferences more observable and triable.

5. Because herbicide and fertilizer dealers in central Iowa were rated the highest as sources of information used in decision making, Extension should target them as a group to work with on improving the sustainability of agriculture in central Iowa.

6. If the nine individual counties intend to continue Extension education on sustainable agriculture, then they should assess the present needs of farmers in each county to determine what type of program or education is still needed on the topic before conducting more programs.

7. If a practice has some undesirable attributes that deter its adoption, but yet its overall worth is quite high as far as contributing to sustainability, the Cooperative Extension Service and other change agents should emphasize the positive attributes of the practice and provide ideas for working around the undesirable attributes.

8. The Soil Conservation Service and the Cooperative Extension Service throughout Iowa should be made aware of the results of this study.
REFERENCES


De los Santos, Saturnino and Emmalou Van Tilburg Norland. 1990. Use of Bennett’s hierarchical model in the evaluation of the extension education program for cacao farmers in the Northeast Region of the Dominican Republic. Summary of Research, Department of Agricultural Education, Ohio State University, Columbus, Ohio.


ACKNOWLEDGEMENTS

I would like to express thanks to my parents for their guidance and encouragement during my academic pursuits. Special thanks to the following: Anita McVey for all the guidance she gave me on my statistical analysis, Central Iowa Area Extension for funding my research, and Dr. Julia Gamon and my committee, Dr. Wade Miller and Dr. John Pesek, for all the advice and direction they have given me. My greatest thanks goes to my husband, Steve. It was through his loving support that I was able to complete my graduate work.
APPENDIX
Table A1. Probability of a significant difference between respondents of the first mailing and the follow up mailing in their level of information*

<table>
<thead>
<tr>
<th>Practice</th>
<th>Prior to 1990</th>
<th>1990 to the Present</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First Mailing</td>
<td>Follow up</td>
</tr>
<tr>
<td>Supplement commercial fertilizer input with animal and green manure</td>
<td>M = 3.58</td>
<td>3.94</td>
</tr>
<tr>
<td></td>
<td>SD = 0.99</td>
<td>0.93</td>
</tr>
<tr>
<td>Control weeds through increased cultivation</td>
<td>3.78</td>
<td>3.79</td>
</tr>
<tr>
<td></td>
<td>1.10</td>
<td>0.80</td>
</tr>
<tr>
<td>Take nitrogen credits for past season's legume crop</td>
<td>3.98</td>
<td>4.03</td>
</tr>
<tr>
<td></td>
<td>1.09</td>
<td>1.01</td>
</tr>
</tbody>
</table>

*Level of information: 1=not informed; 2=slightly; 3=moderately; 4=well; 5=highly.

*P>CHISQ = probability of a greater Chi square.

*M = mean.

SD = standard deviation.
Table A2. Probability of a significant difference between respondents of the first mailing and the follow up mailing in their level of adoption

<table>
<thead>
<tr>
<th>Practice</th>
<th>Prior to 1990</th>
<th>1990 to the Present</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First Mailing</td>
<td>Follow up</td>
</tr>
<tr>
<td>Supplement commercial fertilizer input with animal and green manure</td>
<td>3.41</td>
<td>3.39</td>
</tr>
<tr>
<td></td>
<td>1.73</td>
<td>1.71</td>
</tr>
<tr>
<td>Control weeds through increased cultivation</td>
<td>3.35</td>
<td>3.49</td>
</tr>
<tr>
<td></td>
<td>1.62</td>
<td>1.52</td>
</tr>
<tr>
<td>Take nitrogen credits for past season's legume crop</td>
<td>4.10</td>
<td>4.19</td>
</tr>
<tr>
<td></td>
<td>1.39</td>
<td>1.38</td>
</tr>
</tbody>
</table>

\textsuperscript{a}Adoption of practices: 1=aware; 2=gathering more information; 3=trial basis; 4=fine tuning; 5=use on a permanent basis.

\textsuperscript{b}P>CHISQ = probability of a greater Chi square.

\textsuperscript{c}M = mean.

\textsuperscript{d}SD = standard deviation.
Table A3. Probability of a significant difference between respondents of the first mailing and the follow up mailing in their mean use of information sources

<table>
<thead>
<tr>
<th>Source</th>
<th>First Mailing</th>
<th>Follow up</th>
<th>P&gt;CHISQ&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm machinery dealers</td>
<td>M&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.40</td>
<td>0.96</td>
</tr>
<tr>
<td></td>
<td>SD&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.96</td>
<td>0.87</td>
</tr>
<tr>
<td>Neighbors, family, &amp; friends</td>
<td>2.72</td>
<td>2.95</td>
<td>0.95</td>
</tr>
</tbody>
</table>

<sup>a</sup>P>CHISQ = probability of a greater Chi square.
<sup>b</sup>M = mean.
<sup>c</sup>SD = standard deviation.
<sup>*</sup>Significant at .05 level.

Table A4. Probability of a significant difference between respondents of the first mailing and the follow up mailing in their reported mean influence attributes of a practice have on its adoption

<table>
<thead>
<tr>
<th>Attribute</th>
<th>First Mailing</th>
<th>Follow up</th>
<th>P&gt;CHISQ&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improvement of the environment</td>
<td>M&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.91</td>
<td>0.73</td>
</tr>
<tr>
<td></td>
<td>SD&lt;sup&gt;c&lt;/sup&gt;</td>
<td>3.76</td>
<td>0.85</td>
</tr>
</tbody>
</table>

<sup>a</sup>P>CHISQ = probability of a greater Chi square.
<sup>b</sup>M = mean.
<sup>c</sup>SD = standard deviation.
Dear Participant:

Because of your interest in PFI and alternative agriculture, you have been selected as 1 of 6 people to be questioned in a pilot study on the adoption of alternative farm management practices. I would be grateful if you would take just a few minutes (15 or less) to answer a few questions about your management practices when I phone you. Your response is very important.

The ISU Cooperative Extension Service presented an Extension program last winter on sustainable agriculture to increase the awareness of farmers and agriculturalists on this subject. As a follow up to the awareness program they will present a combination awareness and how-to program December 13 at the Starlite Village in Ames. In order to evaluate farmer perceptions and adoption of alternative/sustainable agriculture practices, I will be surveying those attending these programs. The information provided by the surveys will help Extension better meet the needs of farmers on this topic. All information will be confidential.

It is our wish to develop a survey which will accurately assess perceptions and adoption. For this reason, it would be very helpful to do a pilot study to determine, in general, where farmers are in their use of alternative management practices. You were recommended by Rick Exner for this pilot study. In order to conduct a pilot study, I will telephone you sometime between November 12-20 to determine what changes, if any, you are making to ensure the nation's food and fiber supply for the future. The information gathered from you will be held confidential. It will be used only as a basis for developing a valid survey.

Your response is very important to this study. If however you do not wish to answer the questions, you may decline to answer. Again, I would appreciate your input and I look forward to talking with you.

Sincerely,

Signature redacted for privacy

Julia Gamon
Associate Professor
Agricultural Education and Studies

Wyomi Cooper
1126L Agronomy Hall
Iowa State University
Ames, Iowa 50011

Signature redacted for privacy
1. Do you own or rent a cash grain farming operation only?
2. Do you own or rent a livestock farming operation only?
3. Do you own or rent a cash grain and livestock farming operation?
4. Has your cropping system management changed since December 13, 1989? If so, then how (added diversity, alternative crops?)
5. Have you changed your tillage practices since December 13, 1989? If so, then what were they prior to December 13, 1989?
6. Have you changed your fertilizer application practices since December 13, 1989? If so, then what changes have been made (rate, placement)?
7. Have you changed your herbicide application practices since December 13, 1989? If so, then what changes have been made (placement, rate, type)?
8. Have your farrowing practices changed since December 13, 1989? If so, then how (field farrowing)?
9. Have your livestock disease management practices changed since December 13, 1989?
10. What sources of information do you regularly rely on to determine management practices (list some to rank)?
11. If you have made changes in you management practices, then are these changes on a trial basis (1 year or 2) or a more permanent basis?
January 2, 1990

Dear

I am doing a study which is a follow-up to the December 1989 and 1990 Central Iowa Area Extension Sustainable Agriculture meetings. I need a mailing list from you of names and addresses of farmers in your county. I will use this list to randomly select names in order to evaluate the program and their effect on the adoption of alternative agriculture practices.

This mailing list is essential to the study, for I wish to compare adoption of alternative agriculture practices by attendees of the Sustainable Agriculture meetings with adoption by non-attending farmers/producers who reside in one of the nine central Iowa counties: Greene, Boone, Story, Marshall, Guthrie, Dallas, Polk, Jasper, and Warren. From the mailing list you provide, I will select every tenth name (excluding those who did attend the Sustainable Agriculture meetings). I am interested only in group data. All information from the questionnaires will be held confidential. I will return the list to you and it will not be used for any other purpose.

Your cooperation is very important to this study. I would appreciate a copy of the mailing list as soon as possible.

Thank you for your cooperation.

Signature redacted for privacy

Naomi Cooper  
1126L Agronomy  
Iowa State University

John Creswell  
Extension Crop Production Specialist, Central Iowa Area

Julia Gamon  
Associate Professor  
Iowa State University
January 10, 1991

Dear Participant:

As a producer and speaker at the December 13, 1991, Central Iowa Area Extension Sustainable Agriculture meeting you have been selected to be part of a pilot study on the adoption of sustainable agriculture practices. You may remember that I informed the audience at the meeting that I would be mailing a questionnaire to meeting attendees and non-attendees from the Central Iowa Area to assess their level of adoption of sustainable agriculture practices. Attached is this questionnaire. I would like you, as a producer, to complete the questionnaire and contribute any suggestions you have for it.

It is my wish to develop a survey which will accurately assess perceptions and adoption of sustainable agriculture practices. For this reason, it would be helpful if you would complete the questionnaire and offer any comments you may have on such areas as question clarity, question relevancy, and overall questionnaire content. All answers and comments you provide will be held confidential.

Your response is very important to this study. Please complete and return the questionnaire and any comments you may have by January 18, 1991. Postage is paid for the return mailing.

Thank you for your cooperation.

Thank you,

Signature redacted for privacy

Naomi K. Cooper
Dear Participant:

As a resident of one of nine central Iowa counties, you have been selected to be part of a study on the adoption of sustainable farm management practices. We are interested in knowing to what extent you are informed of these practices and use them. By providing this information on the following questionnaire you will help the extension service better meet your needs and the needs of other farmers on this topic. We would be grateful if you would take a few minutes to complete the attached questionnaire. Your response is very important.

In December 1989 and 1990 the ISU Cooperative Extension Service presented programs for nine central Iowa counties at the Ames Starlite Village. The purpose of these programs was to increase the awareness and how-to-knowledge of sustainable farm management practices. Whether or not you attended we need your input. As a follow-up to these programs, we wish to survey farmer/producers and program attendants from these counties in order to assess their level of awareness and adoption of alternative agriculture practices. We are also interested as to whether you were informed of these practices prior to the 1990 cropping season or if you have become aware of them and just began using them during the 1990 cropping season to the present. All information from the questionnaires will be held confidential. We are only interested in group data. Each questionnaire has been coded so that we can contact those who might not return the questionnaire on time. All code numbers will be removed upon the return of the questionnaire.

Your response is very important to this study. Please complete and return the questionnaire within two weeks of receipt. Postage is paid for the return mailing. The questionnaire should take 20 minutes or less to complete. If you do not wish to complete the questionnaire, please return the blank form.

Thank you for participating in this study.

Naomi Cooper
1126L Agronomy
Iowa State University

John Creswell
Extension Crop Production Specialist, Central Iowa Area

Julia Gamon
Associate Professor
Iowa State University
SUSTAINABLE AGRICULTURE

Below is a list of statements which may be considered sustainable agriculture practices. Using the respective scales, rank these practices as to your Adoption and Level of Information of them Prior to the 1990 Cropping Season and the 1990 Cropping Season to the Present. Please circle your answer. Please respond to both scales for each question.

**ADOPTION OF PRACTICES**
Using the following scale rank your adoption of the practices listed below.

- 1 = I am aware of the practice.
- 2 = I am gathering more information and thinking about the practices before making a decision.
- 3 = I am using the practice on a trial basis.
- 4 = I am fine tuning the practice to meet my needs on a permanent basis.
- 5 = I am currently using this as a permanent management practice.
- NA = Not applicable for use in my situation

**LEVEL OF INFORMATION**
Using the following scale indicate to what extent you are informed of the benefits and usage of each practice.

- 1 = Not Informed
- 2 = Slightly Informed
- 3 = Moderately Informed
- 4 = Well Informed
- 5 = Highly Informed
- NA = Not applicable for use in my situation

<table>
<thead>
<tr>
<th>ADOPTION OF PRACTICES</th>
<th>LEVEL OF INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prior to 1990</strong></td>
<td><strong>1990</strong></td>
</tr>
<tr>
<td><strong>Cropping Season</strong></td>
<td><strong>Cropping Season-Present</strong></td>
</tr>
<tr>
<td><strong>Prior to 1990</strong></td>
<td><strong>1990</strong></td>
</tr>
<tr>
<td><strong>Cropping Season</strong></td>
<td><strong>Cropping Season-Present</strong></td>
</tr>
<tr>
<td><strong>1. Diversify cropping system beyond corn and soybean rotation</strong></td>
<td>1 2 3 4 5 NA</td>
</tr>
<tr>
<td><strong>2. Soil or leaf testing for Nitrogen needs</strong></td>
<td>1 2 3 4 5 NA</td>
</tr>
<tr>
<td><strong>3. Reduce rate of Nitrogen fertilizer application</strong></td>
<td>1 2 3 4 5 NA</td>
</tr>
<tr>
<td><strong>4. Supplement commercial fertilizer input with animal or green manure</strong></td>
<td>1 2 3 4 5 NA</td>
</tr>
<tr>
<td><strong>5. Scout field to determine if weed control is needed</strong></td>
<td>1 2 3 4 5 NA</td>
</tr>
<tr>
<td><strong>6. Scout field to determine if insect control is needed, e.g., corn rootworm</strong></td>
<td>1 2 3 4 5 NA</td>
</tr>
<tr>
<td><strong>7. Control weeds through increased cultivation, e.g., rotary hoe</strong></td>
<td>1 2 3 4 5 NA</td>
</tr>
</tbody>
</table>
### ADOPTION OF PRACTICES

<table>
<thead>
<tr>
<th>Practice</th>
<th>Prior to 1990</th>
<th>1990</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control insects through crop rotation</td>
<td>1 2 3 4 5 NA</td>
<td>1 2 3 4 5 NA</td>
</tr>
<tr>
<td>Reduce herbicide application, e.g., banding</td>
<td>1 2 3 4 5 NA</td>
<td>1 2 3 4 5 NA</td>
</tr>
<tr>
<td>Discouragement of livestock dunging in hutches</td>
<td>1 2 3 4 5 NA</td>
<td>1 2 3 4 5 NA</td>
</tr>
<tr>
<td>Use of pasture farrowing</td>
<td>1 2 3 4 5 NA</td>
<td>1 2 3 4 5 NA</td>
</tr>
<tr>
<td>Use of intensive pasture grazing rotation system</td>
<td>1 2 3 4 5 NA</td>
<td>1 2 3 4 5 NA</td>
</tr>
<tr>
<td>All-in, all-out, &amp; vacant, buying &amp; selling livestock to reduce exposure to disease</td>
<td>1 2 3 4 5 NA</td>
<td>1 2 3 4 5 NA</td>
</tr>
<tr>
<td>Reduction in use of fall plowing</td>
<td>1 2 3 4 5 NA</td>
<td>1 2 3 4 5 NA</td>
</tr>
<tr>
<td>Use of post emergence herbicides where needed</td>
<td>1 2 3 4 5 NA</td>
<td>1 2 3 4 5 NA</td>
</tr>
<tr>
<td>Reduce erosion by conversion of row crop acreage to cover crops</td>
<td>1 2 3 4 5 NA</td>
<td>1 2 3 4 5 NA</td>
</tr>
<tr>
<td>Soil test for phosphorus and potassium needs</td>
<td>1 2 3 4 5 NA</td>
<td>1 2 3 4 5 NA</td>
</tr>
<tr>
<td>Take nitrogen credits for past season's legume crop</td>
<td>1 2 3 4 5 NA</td>
<td>1 2 3 4 5 NA</td>
</tr>
<tr>
<td>Use of ridge tillage for row crops</td>
<td>1 2 3 4 5 NA</td>
<td>1 2 3 4 5 NA</td>
</tr>
<tr>
<td>Strip cropping of a row crop, drilled row crop or small grain, and a hay crop to reduce erosion</td>
<td>1 2 3 4 5 NA</td>
<td>1 2 3 4 5 NA</td>
</tr>
</tbody>
</table>

### LEVEL OF INFORMATION

<table>
<thead>
<tr>
<th>Level</th>
<th>Prior to 1990</th>
<th>1990</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### SOURCES OF INFORMATION

A. Which of the following meetings on Sustainable Agriculture did you attend?

- December 1989, Extension meeting on Sustainable Agriculture
- December 1990, Extension meeting on Sustainable Agriculture
- Did not attend either.
B. If you did attend either Sustainable Agriculture meeting, to what extent did the information presented at the meetings help you with the following?

<table>
<thead>
<tr>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>Begin to use new practices</td>
</tr>
<tr>
<td>2</td>
<td>Refine present practices</td>
</tr>
</tbody>
</table>

C. Using the scale below, indicate the degree to which you use the following sources of information to determine your management practices. Please circle your answer.

1 = Never
2 = Seldom
3 = Sometimes
4 = Frequently
5 = Always

1. Farm magazines and publications
2. Soil Conservation Service
3. County Extension Service
4. Farm Organizations
5. Fertilizer and Herbicide Dealers
6. Livestock Feed Dealers
7. Farm Machinery Dealers
8. Seed Dealers
9. Iowa State University Experiment Stations
10. Neighbors, family, and friends
11. Personal consultation with area extension crop production specialist
12. Practical Farmers of Iowa
13. High School Agriculture Teachers
14. Other ____________________________

D. Using the above scale in section C, indicate the extent to which each item influences your adoption of sustainable agriculture practices.

<table>
<thead>
<tr>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>Availability of equipment</td>
</tr>
<tr>
<td>2</td>
<td>Opinions of other farmers</td>
</tr>
<tr>
<td>3</td>
<td>Improvement of the environment</td>
</tr>
</tbody>
</table>
4. Short term profitability of the practice 1 2 3 4 5
5. Long term profitability of the practice 1 2 3 4 5
6. Reduction of yields 1 2 3 4 5
7. Necessary financing to adopt new practices 1 2 3 4 5
8. Opportunity to watch or ask how to do it 1 2 3 4 5

DEMOGRAPHIC INFORMATION
1. Check the range that includes your age.
   ___ A. 19-20 ___ D. 40-49
   ___ B. 20-29 ___ E. 50-59
   ___ C. 30-39 ___ F. 60 or older

2. A. How many acres do you currently farm? ______
   B. How many of these acres are rented? ______

3. What percentage of your profits is due to cash grain or livestock production?
   ___% Cash grain
   ___% Livestock

4. Check the range that most closely resembles the annual net income of your farm operation.
   ___ A. $0.0-19,999   ___ F. $60,000-69,999
   ___ B. $20,000-29,999 ___ G. $70,000-79,999
   ___ C. $30,000-39,999 ___ H. $80,000-89,999
   ___ D. $40,000-49,000 ___ I. $90,000-99,999
   ___ E. $50,000-59,000 ___ J. $100,000 or more

Please complete and return within two weeks of receipt.
Naomi Cooper, 1126L Agronomy Hall, Iowa State University, Ames, Iowa 50011
Dear Participant:

You may remember that 3 weeks ago you were selected to be part of a study on the adoption of sustainable farm management practices. Because we have not received a response from you, we are mailing you a second copy of the questionnaire in the hope that you will provide us with information as to what extent you are informed of these practices and use them. By taking a few minutes to complete the following questionnaire you will help the extension service better meet your needs and the needs of other farmers on this topic. Your response is very important.

To refresh your memory, in December 1989 and 1990 the ISU Cooperative Extension Service presented programs for nine central Iowa counties at the Ames Starlite Village. The purpose of these programs was to increase the awareness and how-to-knowledge of sustainable farm management practices. Whether or not you attended we need your input. As a follow-up to these programs, we wish to survey farmer/producers and program attendants from these counties in order to assess their level of awareness and adoption of alternative agriculture practices. We are also interested as to whether or not you were informed of these practices prior to the 1990 cropping season or if you have become aware of them and just began using them during the 1990 cropping season to the present. All information from the questionnaires will be held confidential. We are only interested in group data. Each questionnaire has been coded so that we can contact those who might not return the questionnaire on time. All code numbers will be removed upon the return of the questionnaire.

Your response is very important to this study. Please complete and return the questionnaire immediately. Postage is paid for the return mailing. The questionnaire should take 20 minutes or less to complete. If you do not wish to complete the questionnaire, please return the blank form.

Thank you for participating in this study.

Signature redacted for privacy

Naomi Cooper
1126L Agronomy
Iowa State University

Jonh Creswell
Extension Crop Production Specialist, Central Iowa Area

Julia Gamon
Associate Professor
Iowa State University
1. Title of Project: Impact of Extension programming on the level of adoption of alternative agriculture practices in Central Iowa

2. I agree to provide the proper surveillance of this project to insure that the rights and welfare of the human subjects are protected. I will report any adverse reactions to the committee. Additions to or changes in research procedures after the project has been approved will be submitted to the committee for review. I agree to request renewal of approval for any project continuing more than one year.

Naomi K. Cooper 1/4/91
Typed Name of Principal Investigator Date

3. Signatures of other investigators
Signature redacted for privacy Date Relationship to Principal Investigator

1/4/91 Major Professor

4. Principal Investigator(s) (check all that apply)
☐ Faculty ☐ Staff ☒ Graduate Student ☐ Undergraduate Student

5. Project (check all that apply)
☐ Research ☒ Thesis or dissertation ☐ Class project ☐ Independent Study (490, 590, Honors project)

6. Number of subjects (complete all that apply)
200 Adult, non-students 1 # ISU student 1 # minors under 14 1 # minors 14 - 17 other (explain)

7. Brief description of proposed research involving human subjects: (See instructions, Item 7. Use an additional page if needed.)

The purpose of this study is to assess the level of adoption of alternative agriculture practices among Central Iowa residents. The research objectives are:
1) to compare farmer management practices before and after an Extension program,
2) to compare program attendees' vs. non-attendees' adoption of alternative agriculture practices,
3) to identify sources of information which influence adoption of alternative agriculture practices, and
4) to determine what effect the compatibility, complexity, and relative advantage of alternative agriculture practices has on the adoption of these practices. The attached survey will be used to gather data. It will be sent to attendees of the December 13, 1990, Central Iowa Area Extension Sustainable Agriculture meeting and randomly selected residents of the following Central Iowa counties: Greene, Boone, Story, Marshall, Guthrie, Dallas, Polk, Jasper, Warren.

(Please do not send research, thesis, or dissertation proposals.)

8. Informed Consent:
☐ Signed informed consent will be obtained. (Attach a copy of your form.)
☒ Modified informed consent will be obtained. (See instructions, item 8.)
☐ Not applicable to this project.
9. Confidentiality of Data: Describe below the methods to be used to ensure the confidentiality of data obtained. (See instructions, item 9.)

   For the purpose of this study the researcher is only interested in group data. All information will be held confidential. Each questionnaire will be coded so that those who might not return the questionnaire on time can be contacted with a follow-up letter. All code numbers will be removed upon return of the questionnaire.

10. What risks or discomfort will be part of the study? Will subjects in the research be placed at risk or incur discomfort? Describe any risks to the subjects and precautions that will be taken to minimize them. (The concept of risk goes beyond physical risk and includes risks to subjects' dignity and self-respect as well as psychological or emotional risk. See instructions, item 10.)

   No risks are perceived in this study.

11. CHECK ALL of the following that apply to your research:

   A. Medical clearance necessary before subjects can participate  
   B. Samples (Blood, tissue, etc.) from subjects  
   C. Administration of substances (foods, drugs, etc.) to subjects  
   D. Physical exercise or conditioning for subjects  
   E. Deception of subjects  
   F. Subjects under 14 years of age and/or  
   G. Subjects in institutions (nursing homes, prisons, etc.)  
   H. Research must be approved by another institution or agency (Attach letters of approval)

   If you checked any of the items in 11, please complete the following in the space below (include any attachments):

   Items A - D Describe the procedures and note the safety precautions being taken.

   Item E Describe how subjects will be deceived; justify the deception; indicate the debriefing procedure, including the timing and information to be presented to subjects.

   Item F For subjects under the age of 14, indicate how informed consent from parents or legally authorized representatives as well as from subjects will be obtained.

   Items G & H Specify the agency or institution that must approve the project. If subjects in any outside agency or institution are involved, approval must be obtained prior to beginning the research, and the letter of approval should be filed.
Checklist for Attachments and Time Schedule

The following are attached (please check):

12. ☐ Letter or written statement to subjects indicating clearly:
   a) purpose of the research
   b) the use of any identifier codes (names, #s), how they will be used, and when they will be removed (see Item 17)
   c) an estimate of time needed for participation in the research and the place
   d) if applicable, location of the research activity
   e) how you will ensure confidentiality
   f) in a longitudinal study, note when and how you will contact subjects later
   g) participation is voluntary; nonparticipation will not affect evaluations of the subject

13. ☐ Consent form (if applicable)

14. ☐ Letter of approval for research from cooperating organizations or institutions (if applicable)

15. ☐ Data-gathering instruments

16. Anticipated dates for contact with subjects:
   First Contact
   ____________________________
   Last Contact
   ____________________________
   Month / Day / Year
   Month / Day / Year

17. If applicable: anticipated date that identifiers will be removed from completed survey instruments and/or audio or visual tapes will be erased:
   ____________________________
   Month / Day / Year

18. Signature of Departmental Executive Officer
   Date
   ____________________________
   Department or Administrative Unit
   ____________________________
   Signature redacted for privacy

19. Decision of the University Human Subjects Review Committee:
   __ Project Approved  __ Project Not Approved  __ No Action Required
   ____________________________
   ____________________________
   Name of Committee Chairperson
   Signature redacted for privacy
   ____________________________
   Signature of Committee Chairperson