Agricultural extension educators' perceptions regarding the teaching and learning processes as related to sustainable agriculture: implications for agricultural extension education

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Agricultural extension educators’ perceptions regarding the teaching and learning processes
as related to sustainable agriculture: Implications for agricultural extension education

By

Koralalage Sunil Upali Jayaratne

A dissertation submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Major: Agricultural Education (Agricultural Extension Education)

Major Professor: Robert A. Martin

Iowa State University
Ames, Iowa
2001
This is to certify that the Doctoral dissertation of

Koralalage Sunil Upali Jayaratne

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For the Major Program

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For the Graduate College
DEDICATION

This dissertation work is dedicated to my parents for their love, affection and support. You were my first teachers in my life-long learning process. Your teaching inspired me to reach this high educational goal. I am grateful for everything you did for me.
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ABSTRACT

Development of sustainability in conventional agricultural systems is a challenge that agricultural scientists and educators have to face. Review of related studies indicated that extension educators were skeptical of the application of sustainable agricultural practices. However, none of these past studies focused on extension educators' perceptions regarding the teaching learning process related to sustainable agriculture.

The purpose of this study was to determine extension educators' perceptions regarding the teaching-learning process pertaining to sustainable agricultural practices, and identify the relationship between extension educators' perceptions and their motivation for learning about sustainable agriculture.

This was a survey research study conducted with a stratified random sample of 415 individuals selected from the agricultural extension educators in the North Central region of the United States. Findings were based on 323 completed questionnaires. Non-response error was controlled enabling findings to be generalized over the population.

Findings indicated that agricultural extension educators in the North Central region of the United States were mainly middle-aged and predominantly male.

Agricultural extension educators had favorable perceptions toward sustainable agriculture. Their perceptions of sustainable agriculture did not vary with their demographic characteristics. However, sustainable agriculture was a confusing term for many agricultural extension educators.

Experiential learning, problem solving and a systems approach were effective delivery mechanisms in teaching concepts related to sustainable agriculture. One-on-one instruction, demonstrations and group discussions were considered the most effective
teaching methods and field trips study tours and workshops were considered most effective teaching tools in educating farmers about sustainable agriculture.

Availability of time was the most limiting factor for agricultural extension educators to learn about sustainable agriculture. Lack of farmers' demand, negative attitudes toward sustainable agriculture and confusion about the definition of sustainable agriculture were considered significant constraints to learning about sustainable agriculture. Agricultural extension educators perceived that they were highly motivated for extension work.

This study revealed a strong relationship between perceptions about sustainable agriculture and extension educators' motivation for learning more about sustainable agriculture.
CHAPTER I
INTRODUCTION

Development, diffusion and adoption of agricultural technology has contributed to the increased food and fiber production throughout the world. However, this increased food and fiber production has been achieved at the expense of many social and environmental problems. Ironically, conventional agriculture is now widely criticized for its adverse environmental and socioeconomic impacts (Bultena, 1991, p. 51). McNairn and Mitchell (1992) stated that soil erosion reduces Canadian farm income by more than 1 billion Canadian dollars per year. Handler (1970) reported that an estimated 100 million acres of US farmland have been severely degraded and abandoned. These facts indicate the gravity of the situation regarding soil erosion from farmland in the US and Canada. Pimentel (1990) reported that each year about 1 billion pounds of pesticide are applied to agriculture at a cost of more than US $ 4 billion. Most of the applied pesticide never reaches the target pests and accounts for environmental degradation (Pimentel & Levitan, 1986). Environmental problems associated with conventional agriculture emphasize the necessity for using sustainable agriculture practices. It is becoming increasingly clear that agriculture, as an industry, must move toward sustainability for long-term viability (Marshall & Herring, 1991).

As agriculture has changed, so too, has our interpretation of what sustainable agriculture is and what it can become. Therefore, it is important to define sustainable agriculture in light of today's vastly changing agricultural industry. "Sustainable agriculture is an ambiguous term for a counter systematic set of technological production practices and social forms" (Roberts & Hollander, 1997, p. 55). However a number of definitions of
sustainable agriculture are outlined in the literature. For instance, Poincelot (1986) defined sustainable agriculture as the elimination of agriculture's consumption and pollution of limited resources. A task force of the Texas Agricultural Extension Service (1989) defined sustainable agriculture as the application of research based knowledge to gain acceptable long-term economic returns while protecting and promoting the natural and social environment. Finally, Macrae et al. (1993, p.22) defined sustainable agriculture as both a philosophy and a system of farming. It is rooted in a set of values that reflect an awareness of both ecological and social realities, and a commitment to respond appropriately to that awareness. It emphasizes design and management procedures that work with natural processes to conserve all resources and minimize waste and environmental damage while maintaining or improving farm profitability.

The most common elements of these three definitions are environmental conservation and preservation that seek to produce food and fiber profitably in harmony with nature. Simply put, sustainable agriculture can be described as a philosophy and a dynamic long-term goal, which has three dimensions namely environmental sustainability, economic viability, and social acceptability.

If the food production system and our relation to the natural resources we use to raise food are not grounded on the principles of sustainability, our future is in doubt. Therefore, future agricultural practices need to minimize the current problems of soil erosion, and ground water contamination and sustain land productivity through stewardship of non-renewable natural resources (Francis, King, Nelson, & Lucas, 1998). Review of this information emphasizes the need for moving conventional agriculture systems towards a more sustainable venture.
Development of sustainability in conventional agricultural systems is a challenge that agricultural scientists and educators have to face. There are many proven sustainable agriculture practices (Keeney, 1990; Duffy, 1994). Even though there is new information about sustainable agriculture, it has not always been shared with and tested by others to the extent that it should (Hess, 1991). The adoption of sustainable agricultural technologies by a majority of farmers is not at a significant level (Duffy, 1994). Farmers will not change to adopt sustainable agriculture practices unless they have knowledge and information about how the new practices will work and the effect these practices will have on their productivity and profitability. Increasing awareness may not lead to adoption; but the farmer’s complete comprehension of sustainable agriculture is the first necessary step to adoption (Agunga, 1995). Extension education has a historic and very important responsibility in educating farmers about sustainable agriculture (Hess, 1991). Extension may not be able to carry out this responsibility unless extension educators perceive sustainable agriculture practices as being meaningful and appropriate for agriculture’s viability.

What are the extension educators’ perceptions regarding sustainable agricultural practices? There has been confusion about the meaning of sustainable agriculture among extension professionals in the North Carolina Cooperative Extension Service (Minarovic, 1995). A study done in Ohio (Agunga, 1995) revealed that Ohio extension agents’ attitudes toward sustainable agriculture was not favorable. Paulson (1995) reported that Minnesota county agricultural agents had diverse views and knowledge about sustainable agriculture. Sisk (1995) reported that agricultural extension agents in the southern region of the United States perceived themselves to be slightly or moderately competent in sustainable agriculture. Review of this information reveals that there are mixed views about the extension agents'
perceptions about sustainable agriculture. There is no research information related to extension agents' perceptions regarding the teaching learning process as it relates to sustainable agriculture.

**Statement of the Problem**

Review of past studies (Minarovic, 1995; Agunga, 1995; Paulson, 1995; Sisk, 1995) reveals that there were mixed views about the perceptions of extension agents toward sustainable agriculture. Little or no attention has been paid to the extension agents' perceptions regarding the teaching-learning process related to sustainable agriculture. Perceptions are important determinants of human behavior (Pittenger and Gooding, 1971). This statement implies how important it is to understand extension educators' perceptions regarding teaching and learning behavior in relation to sustainable agricultural practices. Lack of clarity about the extension educators' perceptions regarding teaching learning process of sustainable agriculture is the focused problem of this study.

**Purpose and Objectives of the Study**

The purpose of this study was to determine extension educators' perceptions regarding the teaching-learning process pertaining to sustainable agricultural practices, and to identify the relationship between extension educators' perceptions and their motivation for learning about sustainable agriculture. The study sought to draw implications for designing an in-service training model for extension educators focused on sustainable agriculture practices.
The specific objectives of the study were as follows

1. Determine agricultural extension agents' perceptions about sustainable agriculture.

2. Determine agricultural extension agents' perceptions regarding the principles related to the teaching-learning process focused on sustainable agricultural practices.

3. Determine effective teaching tools and methods for providing education regarding sustainable agriculture practices.

4. Determine the factors that limit extension educators learning about sustainable agriculture practices.

5. Determine the factors that influence agricultural extension agents' motivation for extension work.

6. Determine the relationship between the extension educators' perceptions about sustainable agriculture and their level of motivation for learning more about sustainable agriculture.

7. Develop an in-service training model for extension educators focused on sustainable agriculture practices.

**Need for the Study**

It is clear that conventional agriculture has contributed to many social and environmental problems (Handler, 1970, Pimentel, 1990, McNairn & Mitchell, 1992). The need for the development, diffusion, and adoption of sustainable agricultural practices as alternatives to the conventional agriculture have been articulated in the literature (Marshall &
Herring, 1991). An impressive body of well-documented scientific evidence relating to all aspects of sustainable agriculture is already in the literature (Harsch, 1991). However, "an important issue facing sustainable agriculture is the lack of widespread adoption of proven sustainable practices" (Duffy, 1994, p.9.). Duffy (1994) further articulated that despite decades of research and demonstration efforts, the adoption of many of these practices is remarkably low. A study revealed that 40% of the farmers in Iowa were not familiar with the term sustainable agriculture (Duffy, 1999).

Who is responsible for diffusing sustainable agriculture practices? Extension is mainly responsible for educating farmers on sustainable agriculture (Hanson, Kauffman, & Schauer, 1995). The 1990 farm bill of the USA articulated the role of extension in this process and stressed the necessity for training extension agents on sustainable agricultural practices. What are the effective approaches to train extension educators to deliver new technology and sustainable agriculture practices? What are the extension educators' perceptions regarding teaching and learning about sustainable agriculture practices? This information could be useful in determining appropriate inservice activities to be used in teaching and learning about sustainable agriculture.

**Implications and Educational Significance**

This study aimed to assess extension educators' perceptions regarding sustainable agriculture and identify their perceptions regarding the teaching-learning process related to sustainable agriculture practices. This knowledge can be used to address extension educators' concerns, and issues related to teaching and learning sustainable agricultural practices.
Findings of this study could be used for the development of in-service training programs for agricultural extension educators on sustainable agriculture.

**Definitions of Terms**

To ensure that everyone concerned understands the particular way in which a term is being used in the study, operational definitions should be provided to delimit the means of a term (Ary, Jacobs & Razavieh, 1996). In this study, the following operational definitions are used for the following terms:

**Adult:** "An adult is a person who has come into that stage of life in which he has assumed responsibility for himself and usually for others, and who has concomitantly accepted a functionally productive role in his community" (Verner, 1964, p.29).

**Agricultural Extension Educator:** The county level extension educator who is responsible for agricultural and natural resource extension education programs in the Cooperative Extension Service of the U.S.A.

**Agricultural Practice:** The way of carrying out any discrete farming task (National Research Council, 1989).

**Attitudes:** "State of mind, behavior, or conduct regarding some matter, as indicating opinion or purpose" (Webster’s Dictionary, 1996 p.94)

**Conservation:** Management of the natural resource system for biophysical continuity

**Conventional Agriculture System:** Type of farming system that depends heavily on capital intensive external inputs such as energy, agro-chemicals and credit.

**Cooperative Extension Service:** The extended public education and information service operated by the land grant universities.
**In-service Training:** Training provided for someone during employment.

**Learning:** Learning is a change in an individual, due to the interaction of that individual, and his/her environment, which fills a need and makes him/her more capable of dealing adequately with his/her environment (Burton, 1963).

**Motivation:** Motivation is the internal force which gives direction and intensity to behavior of an individual.

**North Central Region of the USA:** The region comprised of 12 states, namely, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.

**Perception:** A personal view or judgment about a phenomenon, issue, activity, method, or practice.

**Sustainable Agriculture:** Application of sustainable agricultural technologies or practices in farming.

**Sustainable Agricultural Practices:** Farming practices that are environmentally sound, socially desirable, and economically viable.

**Teaching:** Teaching is the process by which a person facilitates learning by others.

**Teaching Method:** An approach used in facilitating the learning process.

**Training Program:** A series of learning experiences designed to achieve, in a specified period of time, certain specific learning objectives for an individual or a group of learners (Verner, 1964).

**Teaching Tool:** A device used for facilitation of the learning process.
CHAPTER H

REVIEW OF LITERATURE

This chapter presents a review of the literature on sustainable agriculture related to extension education. This literature review emphasizes the: (1) need for sustainable agriculture; (2) meaning of sustainable agriculture; (3) history of extension work on sustainable agriculture; (4) constraints to learning about sustainable agriculture; (5) conceptual frame for the teaching and learning process as it relates to agricultural education; (6) adult motivation for learning; (7) perception and human behavior and (8) information from past studies related to sustainable agriculture and extension.

Need for Sustainable Agriculture

High cost, extensive, external input-based conventional agriculture has contributed to increased food and fiber production throughout the world. However, some writers contested that this increased agricultural production has been achieved at the expense of society and environment. Conventional agriculture is now widely criticized for its adverse environmental and socio-economic impact (Bultina, 1991). Many researchers have reported the presence of harmful pesticides and fertilizers in waterways and aquifers (Hallberg, 1986, Nielsen & Lee, 1987). Pimentel (1990) reported that each year about one billion pounds of pesticides are applied to farmlands at a cost of more than US $4 billion. Most of the applied pesticides never reach the target pests and accounts for environmental pollution (Pimentel & Lavin, 1986). Kelley et al. (1986) reported that 25 percent of Iowa's population is exposed to detectable levels of agro-chemicals such as nitrate and pesticide residuals through consumption of drinking water. The excessive use of agro-chemicals have accounted for
some of the serious health problems such as leukemia, multiple myeloma, and nonhodgkin’s lymphoma (Hallberg, 1985). Increased soil erosion has accounted for diminishing farm productivity. McNarin and Mitchell (1992) reported that soil erosion has reduced Canadian farm income by more than one billion Canadian dollars per year. This depletion of fertile farmlands has compelled farmers to increase the use of external inputs such as fertilizer to maintain their farm productivity levels. It has been found that the ratio of all inputs to crop land used for crops in the U.S. rose 61 percent while the ratio of fertilizer input alone to crop land rose by 266 percent between 1951 and 1972 (U.S.D.A., 1982). The World Commission on Environment and Development (1987) reported that the incremental grain to fertilizer response ratio dropped from 14.8 in 1934-38 to 11.5 in 1948-52 and 5.8 in 1979-81. This information shows the trend of diminishing agricultural productivity per unit of external input. This increasing dependency on nonrenewable, external resources for farm productivity has become a serious sustainability issue for conventional agriculture. Diminishing agricultural productivity per unit of external input can reduce farm profitability leading small farmers to close down their business. The National Research Council (1989) has reported that more people are now reluctant to accept the negative externalities of industrialized agriculture such as smaller number of people in the farming business, lower rural bio-diversity, ground water contamination, and eroded top soils, because these factors detract from the sustainability of the agro-ecosystem and serve only to shift costs among different sectors of society. Therefore, conventional agriculture is now widely criticized for its adverse environmental, social, and economic impacts (Bultena, 1991). It is becoming increasingly clear that agriculture, as an industry, must move toward sustainability for long-term viability (Marshall
& Herring, 1991). Now there is a growing concern about the environment among the agriculturists as a result of the realization that intensive, high chemical and energy input agriculture is neither always full of promise nor of profit (National Research Council, 1989).

**Meaning of Sustainable Agriculture**

According to the Webster's Comprehensive Dictionary of the English Language (1996), "sustain" means "to keep from failing; to uphold; withstand; to keep up or maintain." If the term "sustainable agriculture" is used with the above meaning, it implies that a sustainable agriculture possesses the quality of keeping or maintaining the present situation. This direct meaning of the term "sustainable agriculture" is very complicated in the agriculture literature. The term sustainable agriculture gives different meanings to different people (Hess, 1991). Various groups have defined the term with various meanings making it difficult to provide a singular definition for sustainable agriculture. "Sustainable agriculture is an ambiguous term for a counter systematic set of technological production practices and social forms" (Roberts & Hollander, 1997:55). There is no single definition for sustainable agriculture (Dunlap, Beus, Howell, & Wand, 1992). Francis (1990) stated that sustainable agriculture encompasses everything from organic farming to maximum economic yields. Sometimes the term sustainable agriculture is used synonymously with such terms as "organic farming," "alternative farming," "ecological farming," and "regenerative farming" (Lockeretz, 1988).

Sustainable agriculture, has spawned numerous problematic definitions, perhaps because there appears to be no consensus on what constitutes unsustainable agriculture, practices which are regarded pro and con to destroy the resource base of the land, consume beyond replacement, and may have impacts which defy recovery. (Thomas & Kevan, 1993, p. 2)
A review of these different perceptions regarding the meaning of sustainable agriculture indicates that different people attach different meanings to sustainable agriculture. Due to this ambiguity, it is not easy to define what practices are sustainable.

Fisher gave one of the earliest interpretations for sustainable agriculture in 1978 (as cited in Gips, 1988). He pointed out that there were nine basic components for sustainability: systemic dynamism, harmony with nature, diversity, renewable resources, people involvement, nutrition, community, aesthetics and economics. Dauglass (1986) mentioned ecology, community and economics as the three main components of sustainable agriculture. Most of the time, the meaning of the term “sustainable agriculture” has been focused only on maintaining productive capacity of the agro-ecology system (Gips, 1988). Those who follow this meaning might accept organic farming as sustainable agriculture.

Wittwer (1978) (as cited in Gips, 1988) stated, economically viable, socially acceptable and ecologically sound as three main elements essential in developing new technologies. Taking all the diverse elements into account Gips (1988) outlined a comprehensive definition for sustainable agriculture. According to his definition, sustainable agriculture is ecologically sound, economically viable, socially just and humane. This definition establishes four basic factors by which various agricultural practices and agricultural systems can be assessed for sustainability (Gips, 1988). According to Gips’ definition of sustainable agriculture, overall sustainability would be determined by the degree to which it could satisfy each of the four factors. Gips, (1988, p.64) further articulated that “sustainable agriculture represents a never-ending, ultimate goal, an ongoing process whose measured achievement of sustainability at any particular point is only the groundwork for its
future.” Parr (1991) also described sustainability as a long-term goal that seeks to overcome the problems and constraints that afflict agriculture worldwide.

A task force of the Texas Agricultural Extension Service (1989) defined sustainable agriculture as “the application of scientific knowledge to produce acceptable long-term economic returns, protect the environment and promote social values including human health and safety.” Crosson (1992) described sustainable agriculture as a farming system that can indefinitely meet demands for food and fiber at socially acceptable economic and environmental costs. According to Poincelot (1986) sustainable agriculture means the elimination of agriculture’s consumption and pollution of limited resources. Benbrook (1991) indicated that physical, biological, and socioeconomic components are the main elements of a comprehensive definition of sustainable agriculture. According to his definition (1991, p.4)

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

By giving this definition, Benbrook (1991) identified sustainability as a goal to strive toward. Macrae et al. (1993, p. 22) defined sustainable agriculture as

....both a philosophy and a system of farming. It is rooted in a set of values that reflect an awareness of both ecological and social realities, and a commitment to respond appropriately to that awareness. It emphasizes design and management procedures that work with natural processes to conserve all resources and minimize waste and environmental damage while maintaining or improving farm profitability.

Many similar definitions could be cited, but there is a general consensus regarding the essential elements of sustainable agriculture (Benbrook,1991). All of these definitions of
sustainable agriculture have three common elements such as environmental preservation, social desirability and economic profitability. Therefore any agricultural practice or technology which has these three basic qualities can be considered to be a sustainable agricultural practice or technology. However, there are different views about the relative importance of these three factors in a sustainable agricultural context. For instance, some ecologists advocated the need for more emphasis on environmental preservation than social and economic aspects of sustainable agriculture (Thomas & Kevan, 1993). Anderson (1995) mentioned the need for further research on the social component of sustainable agriculture. Ruttan (1998, p.128) indicated that a "meaningful definition of sustainable agriculture must include the enhancement of agricultural productivity." When all of these views are taken into account it seems that sustainable agriculture has only a relative meaning in terms of utilizing non-renewable farm inputs such as land and energy. However many writers agreed that the sustainable agriculture concept has social desirability, economic profitability and environmental preservation elements.

**History of Sustainable Agriculture in the USA**

Sustainable agriculture as a concept started as low input sustainable agriculture (LISA). Schaller (1991) described the farm crisis as a turning point of U.S. agriculture toward LISA. Farmers who survived that economic crisis realized the necessity of farming in ways that would lower production costs and debt. Farmers’ extreme dependence on external inputs such as chemical fertilizer and pesticides had been seen as weakening agriculture’s economic sustainability. However, the U.S. Congress failed to pass legislation supporting sustainable agriculture research and education in the early 1980s. This may be due to the fact
that initial attempts at establishing sustainable agriculture were identified with only organic farming and it was not widely supported because organic farming was seen as a way of catering to niche markets (Schaller, 1991). The U.S. Congress passed the Food Security Act (P.L. 99-198) in 1985. That act established agricultural research and education programs focused on increasing agricultural productivity while reducing soil erosion, conserving energy, and protecting the environment (U.S. Government Printing Office, 1985). Following the Food Security Act in 1985, USDA formed a task force on alternative farming systems and started to compile existing sustainable agriculture related research information (Schaller, 1991). The agriculture appropriation bill for 1988 allocated funds for LISA research and extension work. According to Schaller (1991), it was the first time that the U.S. Congress approved funds for low input agriculture research and extension to find alternative farming systems to reduce the cost of production. With additional funds received from the Senate committee, a program known as appropriate technology transfer for rural areas was started in 1988. This program was focused on farmers who were interested in learning how alternative farming methods could be used to reduce production costs and reduce soil erosion and ground water pollution caused in part by heavy use of chemical fertilizer, pesticides and monocultural cropping patterns. This program was administrated through the USDA’s Cooperative State Research Service (Schaller, 1991). The first policy statement defining and establishing support for research and education on alternative farming systems was issued by the Secretary of Agriculture in January, 1988 (U.S. Department of Agriculture, 1988). Following this policy initiative, four regional centers were started in each of the four U.S. regions to invite, review and approve LISA projects. The four regional centers were located at the University of Vermont, Burlington (North East), the University of Georgia, Athens
(South), the University of Nebraska, Lincoln (North Central), and the University of California, Oakland (West). Coordinators were named for each of these centers and technical committees were established to work on LISA programs in the region.

**Constraints to Learning about Sustainable Agriculture**

Harsch (1991) mentioned that there is an impressive scientific knowledge base related to all aspects of sustainable agriculture. Despite the availability of scientific knowledge and some extension efforts, the adoption of sustainable agriculture practices by farmers is at a very low level (Duffy, 1999). Review of this literature implies that there are constraints to learning about and adoption of sustainable agriculture practices.

What are the factors limiting learning and adoption of sustainable agriculture practices? Pelsue (1991) indicated that delivery of sustainable agriculture research information to farmers and other users was not in an easily comprehensible form. This may be an important constraint to learning about sustainable agriculture practices. To find solutions for problems related to social, economic and environmental sustainability of alternative farming systems, it is necessary to follow multidisciplinary whole-farm systems approaches (Dobbs, Smolik & Mends, 1991; Madden & Dobbs, 1990). However, this multidisciplinary whole-farm systems approach is lacking in the research and extension programming process. For instance, Smith-Sebasto (1998) reported that environmental education has not achieved the level of acceptance that might be expected from such an established nonformal education sector as the University of Illinois Cooperative Extension Service. Further, Smith-Sebasto (1998) revealed that only about 53-69% of the extension educators in the University of Illinois Cooperative Extension Service were delivering or
developing extension programs about the environment or environmental issues. Eighty percent of the educators, who were doing environmental education programs, reported doing so in less than 25% of their programming efforts. This study indicated that due attention on environmental education was lacking in extension programs. The same study reported that better access to resources and more inservice training were factors that would determine the extent to which extension educators include environmental education concepts into their extension programs. Lack of extension educator's knowledge was the primary reason for not infusing environmental education concepts into their extension programs (Smith-Sebasto, 1998).

Agunga (1995) reported that extension agents in Ohio were skeptical of sustainable agricultural concepts and were less interested in promoting sustainable agriculture. Agunga (1995) further reported that extension agents had negative attitudes toward sustainable agriculture practices. Conner and Kolodinsky (1997) reported that extension agents in New England also had a skeptical attitude toward sustainable agriculture. Paulson (1995) reported that Minnesota Extension agents remained skeptical about whether sustainable agricultural practices were feasible and needed. Extension educators' skepticism, negative attitude and low interest can be considered as constraints to learn more about sustainable agriculture practices. Conner and Kolodinsky (1997) described that when extension educators have a skeptical view toward sustainable agriculture, they may not gain demonstrable learning outcomes from training programs on sustainable agriculture. This can be a serious constraint to learn about sustainable agriculture. Many researchers (Agunga, 1995; Conner & Kolodinsky, 1997) attributed extension educators' skepticism toward sustainable agriculture to the ambiguity and lack of clarity in the definition of sustainable agriculture. Extension
educators’ confusion about the definition of sustainable agriculture was one of the main barriers that prevented their active involvement in learning about sustainable agriculture (Minarovic, 1995). This can be considered as a serious constraint to learning about sustainable agriculture.

**Conceptual Frame of the Teaching and Learning Process**

Blum (1996) emphasized the need for effective teaching in agriculture in order to comprehend its interdisciplinary nature. To make teaching effective it is necessary to apply appropriate teaching learning concepts in agricultural education. What teaching-learning concepts are appropriate in educating people about sustainable agriculture?

**Experiential Learning Model**

“Education is a development within, by, and for experience” (Dewey, 1938, p17).

“Learning is the human act of making meaning from experience” (Wlodkowski, 1999, p.10.).

These two statements clearly describe the significance of experience in the teaching-learning process.

Human beings are curious and make meaning from experience (McCombs and Whisler, 1997). The experiential learning approach is based on the learner’s “impulse”, interest and the current problems of a changing society (Hall-Quest, 1938). Experiential learning is a process and it involves education, work and personal development. Experiential learning as a concept is “a holistic integrative perspective on learning that combines experience, perception, cognition and behavior” (Kolb, 1984, p.21). In this process “the learner is directly in touch with the realities being studied. It involves direct encounter with
the phenomenon being studied rather than merely thinking about the encounter or only considering the possibility of doing something with it” (Keeton & Tate, 1978, p.2). Every experience is not educational. The educational value of any experience depends on the quality of the experience. Dewey (1938) described that a quality learning experience motivates learners into further engagement with new experiences. Good educational experience leads to future experiences. “Hence the central problem of an education based upon experience is to select the kind of present experiences that live fruitfully and creatively in subsequent experiences” (Dewey, 1938, p.16-17). This experiential continuum means that “every experience both takes up something from those which have gone before and modifies in some way the quality of those that come after” (Dewey, 1938, p 27). Dewey described “longitudinal” and “lateral” aspects of experience respectively refer to the “continuity” and “interaction” of experience. According to Dewey (1938), these two are not separate from each other. They intercept and unite. This principle of “interaction” relates to the adaptation of educational materials to the learner’s needs and capacities. The better the adaptation the higher the interaction and learning achievement. The principle of “continuity” in its educational application means that the future has to be taken into account at every stage of the educational process. This principle of “continuity” leads to inspire the learner for future experiences. “Continuity” and “interaction” in their active union with each other determine the educative significance and value of an experience. Dewey (1938) described that experiential education leads to prepare a person for later experiences of a deeper and more expansive quality. He referred to it as the very meaning of growth, continuity, reconstruction of experience. An experience is because of an interaction taking place between an individual and what, at the time, constitutes his/her learning environment (Dewey, 1938). This
interaction leads to a cyclic process of experiential learning. Kolb (1984, p.40) conceptualized the structural process of experiential learning into “four-stage cycle involving four adaptive learning modes - concrete experience, reflective observation, abstract conceptualization and active experimentation. Kolb’s experiential model explained that when a person is exposed to a learning experience – affective mode, he/she develops reflective observations on that experience – perceptual mode. This reflective observations leads learner to develop abstract meaning of the experience – symbolic mode. Then, these meaningful concepts to the learner move him/her to apply them in real life – behavioral mode, leading to a new higher level experience. The four learning modes taking place in the four phases of experiential learning process are termed as affective, perceptual, symbolic and behavioral (Kolb & Fry, 1975). The degree of each learning mode varies with the experiencing event or educational activity. Any learning experience can have some or all of these learning modes. According to this structural explanation, knowledge is developed through the transformation of experience and learning is defined as the process by which knowledge is developed through the transformation of experience (Kolb, 1984).

Dewey (1938) explained that every experience is a moving force and its educational value can be judged only on the grounds of what it moves toward and into. It is educationally valuable if that experience contributes to the personal, intellectual and professional growth of a person. Experience does not take place in a vacuum. There are sources outside an individual which give significance to experience. It is the educators’ responsibility to make experience worthwhile or significant toward learners’ expected growth. Educators should know how to utilize the physical and social surroundings that exist so as to extract from them all that they have to contribute to building up experiences that are worthwhile. “The principle
that development of experience comes about through interaction means that education is essentially a social process” (Dewey, 138, p65). In this social process, the educator has to function as a facilitator of the learning group activities. Dewey (1938) emphasized the necessity of a learner’s participation in the formation of the purposes, which direct his/her learning activities in the teaching learning process. In order to build the teaching learning process on the learner’s purposes, the educator should consider planning as a joint activity of the educator and the learning group. It is essential that the new learning activities should be related intellectually to those of the learner’s earlier experiences to ensure experiential learning continuity. An intelligent learning activity is distinguished from aimless activities by the fact that it involves selection of means from the variety of available conditions and their arrangement to reach the intended educational outcome (Dewey, 1938). Review of Dewey’s experiential learning concept reveals that it is based on pragmatism and lifelong learning.

This differentiates experiential learning theory from rationalist and other cognitive theories of learning that tend to give primary emphasis to acquisition, manipulation, and recall of abstract symbols, and from behavioral learning theories that deny any role for consciousness and subjective experience in learning process (Kolb, 1984, p. 20).

Historically, agricultural knowledge was generated and transmitted across generations by using learning by doing which is the conceptual foundation for the experiential learning model (Blum, 1996). Review of the literature shows that this experiential learning model is very appropriate for learning about agriculture.

**Problem Solving Approach**

“Problem solving is learning” (Hill, 1979, p.15). The problem solving approach to teaching and learning is based on the theories of John Dewey. Blum (1996) described that
experiential learning is geared towards problem solving. This statement indicates that there is a close relationship between the experiential learning approach and problem solving approach. The problem solving approach has been used especially in agricultural education as a way to relate classroom learning to real-life situations or problems (Brown, 1998). Research confirms that the problem solving approach is more effective than a subject matter approach as a way of improving student achievement in agricultural education (Burton, 1979). The problem solving approach is not only used in teaching agriculture but also widely used in teaching mathematics, engineering, psychology, business management and science. The problem solving approach stimulates critical and creative thinking skills, and encourages the learner to develop a vision for the future (Torrance, 2000). Schmuck, Chesler, and Lippitt (1966) described five-steps in adopting a problem solving teaching approach. The first step is identification of the problem and it is crucial for achieving learning objectives. The selected problem should be of interest not only to the teacher, but also to the learner (Hill, 1979). To identify related educational problems the educator must have a clear notion of his/her teaching goals and be sensitive to the learning process of the educational setting. Clear goals guide the teaching learning process. The second step is diagnosing the problem. In this stage, the educator needs to re-examine the problem in order to look for specific information and choose diagnostic tools and techniques that will give him/her knowledge of specifics. The third stage is developing a plan to present the problem and get the learners involved. Adoption is the fourth phase. In this stage, the educator uses the selected problem and interacts with the learners. The final stage is evaluation. In this stage, the educator gets feedback from the learners and redesigns the next learning cycle (Schmuck, Chesler, & Lippitt, 1966).
The problem solving teaching-learning approach is based on an identified problem where the teacher maintains a continuous dialogue with the students during the teaching-learning process. The teacher's role in this approach is more as a facilitator than a leader (Brown, 1998). This statement indicates the appropriateness of the problem solving approach in adult education programs. Identification of the problem is a key to the success of this approach. Therefore, it is important to "use problems that have real meaning to students, thus motivating them to reach a solution" (Brown, 1998, p.1). Stepien and Gallagher (1993) described four functions involved in the problem solving approach namely, engagement, inquiry, solution building and reflection. Engagement means "the problem raises concepts and principles relevant to the content area and addresses real issues to the larger social context of the students' personal world" (Brown, 1998, p.4). Inquiry means exploration of the problem to define its nature. Solution building involves generating solutions and formulating conclusions that are consistent with the nature of the problem. Students are expected to take an active role in finding solutions. In reflection, students focus on the complexity of the problem and the reasoning process "as benchmarks for thinking" (Brown, 1998, p.5).

Brown (1998) stated that one of the main obstacles to adoption of the problem solving approach into teaching learning is peoples' reluctance to deviate from traditional teaching methods. Students' learning style is another factor, which can influence the effectiveness of the problem solving approach. For successful implementation of the problem solving approach, teachers need to improve their skills in group dynamics and communication. According to Brown (1998), for effective use of the problem solving approach in education, teachers will have to change three things: balance of power in the classroom, focus of
attention and teaching skills. Successful application of the problem solving approach in agricultural education is helpful for the learner to apply subject matter knowledge in real life situations (Brown, 1998).

**Systems Approach to Education**

"The systems view is a way of looking at ourselves, at the environment we live in, and at the entities that surround us or that we are part of" (Banathy, 1973, p. 1). Systems that can be precisely determined are called deterministic systems while systems that change with time are called probabilistic systems. Deterministic systems are closed while probabilistic systems are open. When a system is open it changes over time (Silvern, 1968). Systems concerned in education are never totally closed (Katz & Kahn, 1966). Banathy (1973) described that a system is made out of components and components are connected by patterned relationships. This pattern is the structure of the system. The relationships between components can be static or dynamic. Static relationships do not change with time and this is characteristic of closed systems. Dynamic relationships are continuously changing and this is characteristic of open systems. Due to the interactions between the subsystems or components a system is more than the sum of its components.

Baron (1973) described that the systems approach is a general term for the application of scientific thinking to large-scale problems in order to realize the holistic view. When the systems approach is used it is necessary to analyze the system in order to understand the components and their relationships. When this concept is applied in education it is necessary to begin with a description of the total educational program and its related groups and institutions and determining the role or each involved in the program. During the design
process of the systems approach, it is necessary to consider the relationships between the subsystems or components. It is important to identify possible problems during the design process and plan accordingly for successful implementation of the systems approach. The systems approach is useful to comprehend a broad view of problems within a productive framework for understanding the process and functions inherent within the system.

Application of a systems concept in education is an interdisciplinary approach to realize the holistic view of a complex problem (Romiszowski, 1970). Silvern (1968) described analysis, synthesis, modeling and simulation as four sequential stages involved in application of the systems approach in education. Analysis is the identification of parts or subsystems and their interrelationships. Synthesis means combining various elements together with new elements previously unrelated. Modeling is the construction of alternatives to predict the effectiveness of the system. Simulation is the testing of models before application in real life.

What is the significance of a systems approach in agricultural education? Blum, (1996, p.4) described, that “agriculture is a complex subject which cuts across many scientific, social and practical disciplines. One of the more difficult tasks of the effective agricultural teacher is to integrate these different aspects in order to give students a holistic view.” The systems approach is helpful to comprehend the broad view of complex problems and interdisciplinary areas (Baron, 1973; Romiszowski, 1970). This review of literature shows the significance of the systems approach in agricultural education for helping learners to comprehend the holistic view of farming systems.
Teaching Adults

Teaching adults is not easy (Draves, 1984). It is not easy to teach adults because there are individual differences in motivations, goals, experience, social, educational and employment background (Haverkamp, 1983). Therefore, it is necessary to plan adult educational programs based on the teaching-learning principles related to adults. Gregor (as cited in Knapper & Cropley, 1985) stated that adults do learn differently and should be approached differently. Knowles (1980) emphasized adult education as a process of facilitating self-directed learning and a redefinition of the role of the teacher as a facilitator of self-directed learning and a resource to self-directed learners. Knowles (1980) described adult education as very different from child education or pedagogy – the art and science of teaching children. Knowles (1980) termed adult education as andragogy – the art and science of helping adults learn. Compared to children, adults are more application-oriented self-directed learners and rich in experience (Knowles, 1980). Self-direction is considered as a basic part of helping adults to enhance and expand their learning skills (Cheren, 1983). Andragogy is based upon the use of adult learning orientation and the wealth of experience in helping adults learn. Adults are more performance-centered than subject-centered in their nature of orientation toward education (Knowles, 1980).

In an andragogical perspective, adult self-directed learning is placed at a significant importance in planning, delivering and evaluating stages of the educational programs (Knowles, 1980). Therefore, when needs assessment is done, a great emphasis should be placed on the involvement of adult learners in the process of self-diagnosis of learning objectives. By doing so the adult educator will be able to share the ownership of the program with the learner and get his/her active cooperation in the program (Knowles, 1980). Due to
the nature of the adult’s self-directivity, andragogical practice treats the learning-teaching transaction as the mutual responsibility of learners and teacher. In fact the teacher’s role is redefined as that of a resource person, and co-inquirer; more a catalyst than an instructor (Knowles, 1980). Evaluation of adult learning should not be done by the teacher. Because “nothing makes an adult feel more childlike than being judged by another adult; it is the ultimate sign of disrespect and dependency” (Knowles, 1980, p.49). Due to this reason, Knowles (1980) suggested a process of self-evaluation, in which the teacher helps the adults get evidence for themselves about the progress they are making toward their mutually set learning goals. “The most important social characteristic of the adult learner is an abundance and variety of experiences. This aspect alone makes teaching adults different from teaching children or youth” (Draves, 1984, p.11). According to Knowles (1980, p.50) this difference in adults has three implications for learning:

1) adults have more to contribute to the learning of others; for most kind of learning they are themselves a rich resource for learning; 2) adults have a richer foundation of experience to which to relate new experiences (and new learnings tend to take on meaning as we are able to relate them to our past experience); 3) adults have acquired a larger number of fixed habits and patterns of thought, and therefore tend to be less open-minded.

Due to the reason that adults are rich and diverse in experience, adult learners themselves make a great resource for learning (Draves, 1984). Therefore, it is important to use teaching techniques that tap the experience of adult learners for the benefit of each other. Teaching techniques such as group discussions, case studies, and demonstrations are good for facilitating adult learners to share their experience. When sharing experience among the adult learners, the educator him/herself has to play a reciprocal learner role (Knowles, 1980). Adults’ orientation to learning is based on seeking solutions for their problems. Knox (1974)
found that adults are seldom interested in learning answers to problems or issues of which they are not aware. Adult learning is more problem-centered, and adults are more satisfied with their learning if it applies to their everyday experiences, is practical, or is current (Draves, 1984).

Every adult comes to learn with some perception about the subject to be discussed. Some will have positive views while others may have neutral or negative views about the subject to be discussed (Draves, 1984). However, it is obvious that adults usually come to learn with clearly developed personal goals and objectives (Knapper & Cropley, 1985). Therefore, it is very appropriate to design a learning-teaching process based on the problems and concerns that the adult learners have on their minds as they enter into the program (Knowles, 1980). The best way to meet adults’ learning goals is to sit down with them before the class and invite them to plan the program with the educator (Draves, 1984).

Draves (1984) said that time is the most limiting factor for adults to participate in educational programs. Therefore, it is very important to focus adult education programs on the needs and objectives as identified by the adult learners. Thereby, adult educational programs can be made meaningful to learners and ensure their active participation.

Adults’ Motivation for Learning

Motivation to learn can be defined as a person’s tendency to find learning activities meaningful and to benefit from them (Brophy, 1988). The combined effect of one’s mental, emotional, physical and social status determines a person’s motivation to learn (Draves, 1984). There are no significant research studies that clearly establish the relationship between adult motivation and learning. However, research evidence from youth education confirms
that motivation is consistently positively related to student educational achievement (Wlodkowski, 1999). For instance, Uguroglu and Walberg, (1979) studied the relationship between motivation and student achievement among the students from grade 7 to 12 and found that 98 percent of the correlations between motivation and academic achievement was positive. Nevertheless, they found that the relationship between motivation and learning achievement increased along with the age of the students, with the highest correlation being with twelfth grade students. By reviewing research information related to young students, Wlodkowski (1999) mentioned that it is reasonable to assume that there is a positive relationship between motivation and learning achievement even among the adult learners.

One of the indicators used to measure motivation is persistence (Schunk, 1991). Motivated learners care more and concentrate better while they work toward their learning goal, and they are more cooperative in the learning process (Wlodkowski, 1999).

What is the significance of adult motivation in the teaching learning context? Wlodkowski (1999, p.2.) suggested that “seeing human motivation as purposeful allows us to create a knowledge base about effective ways to help adults begin learning, make choices and give direction to their learning, sustain learning and complete learning.” The literature cites intrinsic and extrinsic motivation as two forms of human motivation. For instance, McKeachie (1999, p. 303) “differentiated between extrinsic motivation - motivation for grades, money, or other rewards that are a consequence of learning – and intrinsic motivation – enjoying an activity regardless of the consequences.” McKeachie (1999) further described that curiosity, interest and achievable challenge are closely associated with intrinsic motivation. Motivation is extrinsic when the only reason for doing a thing is to get something outside the activity itself. According to Stipek (1988) extrinsic motivation described the
behavior determined by psychical drives and by stimulus-response learning. This is based on reinforcement theory and it assumes that the frequency of behavior increases if a person is positively reinforced (rewarded) for the behavior. The frequency of a behavior is decreased if the person is negatively reinforced (punished) for his/her behavior. Reinforcement theory is considered mechanistic because it doesn’t explain the relationship between motivation and person’s emotions, beliefs and values (Stipek, 1988). Reinforcement theory assumes that a person’s motivation at any given time is completely determined by his/her reinforcement history and the contingencies in the present environment (Skinner, 1971). In contrast to this situation, theories of intrinsic motivation assume emotions are critical to learning (Wlodkowski, 1999). Extrinsic motivation is the old notion of student motivation associated with rewards and punishment (Csikszentmihalyi & Nakamura, 1989). Research and theory support the notion that excessive use of rewards has negative effects on the natural regulatory processes of human beings (Ryan & Deci, 2000).

Intrinsic motivation means “the primary propensity of human beings to engage in activities that interest them and, in so doing, to learn, develop, and expand their capacities” (Ryan & Deci, 2000, p. 16). The most central issue of educational psychology is ascertaining how to combine intrinsic motivation in the teaching learning process. Wlodkowski (1999, p. 12) suggested that “for adult learners to experience intrinsic motivation, they need to connect who they are with what they learn.” It has been found that irrespective of cultural differences, people intrinsically are motivated to do activities that are enjoyable to them. Wlodkowski (1999) explained that external rewards were not necessary to keep them doing an enjoyable activity. In this situation, the activity itself is rewarding and the human organism is functioning at its fullest capacity. When a person is totally engaged in an enjoyable activity
due to intrinsic motivation there is an unusual match between the person and the environment. It is a challenge for educators to design the teaching-learning process to be enjoyable and intrinsically motivational to students at their fullest capacity to engage in learning activities (Csikszentmihalyi & Nakamura, 1989).

Research and theory support the notion that human beings are naturally curious and intrinsically motivated to seek out and master challenges (McKeachie, 1999; Raffini, 1996). Intrinsically motivated learning is enhanced by

students’ psychoacademic needs to control their own decisions (autonomy); to do things that help them feel successful (competence); to feel part of something larger than themselves (belonging and relatedness); to feel good about who they are (self-esteem); and to find pleasure in what they do (involvement and stimulation). (Raffini, 1996, p. 3)

The desire to seek and conquer challenges is at the core of intrinsic motivation in the teaching-learning process (Raffini, 1996). Adults’ intrinsic motivation for learning is characterized by their interest, involvement, and a search for understanding (Wlodkowski, 1999). Malcolm Knowles’s andragogy concept provides two assumptions important to understanding adult motivation. First “adults have a self-concept of being responsible for their own lives... they develop a deep psychological need to be seen and treated by others as being capable of self-direction,” and second, “adults become ready to learn those things they need to know or... to cope effectively with their real-life situations” (Knowles, 1989, pp. 83-84). Even though self-directed learning is considered as central to adult education, the practice of it is not always supported by adult learners due to their cultural differences (Hiemstra & Brockett, 1994). Therefore, it is advisable to use self-directed learning as an optional instructional approach rather than a mandated approach in adult education. To retain the adult’s motivation in the teaching-learning process, it is essential to ensure that the adult
learner has his/her choice and success in the learning activity (Wlodkowski, 1999). This implies the significance of building adult educational programs based on the interests of the learners and letting them set learning goals. Wlodkowski (1999) described four conditions influential for motivating adults in the learning process. The first condition is inclusion of the learner into the learning process by respecting and connecting to one another in the group. This will create a comfortable learning environment in which the learner feels safe, capable and accepted and tends to share views freely. The second condition is attitude. Learner attitudes constantly influence behavior and learning. Therefore, it is necessary to develop a favorable disposition toward the learning experience through personal relevance and choice. The third motivational condition is enhancing meaning. The meaning of the learning experience related to the learner’s values does influence behavior. Creating a challenging learning experience within the learner’s values and perspectives is important to enhance learning motivation. Wlodkowski’s fourth motivational condition is competence. Competence provides emotional support for an adult to learn new skills and knowledge. Therefore, it is necessary to create a situation in which learners feel that they are competent and the learning experience is further sharpening their competence. Review of this information indicates the significance of intrinsic motivation in inspiring adults for a lifelong learning process.

**Perception and Human Behavior**

Human behavior in relation to perception provides the theoretical foundation for this study. Perception is a complex psychological process (Ben-Zeev, 1993). It is a highly individualized phenomenon (Hentschel, Smith, & Draguns, 1986). Allport (1955) described
perception as the way things look to us, or the way they sound, feel, taste, or smell. But perception also involves, to some degree, an understanding awareness, a meaning or recognition of these objectives. Allport (1955) explained the following facts about perception. 1) Perceptions are always specific and definite, even when they are associated with generalized meanings. 2) Perceptions are specifically related to their stimulus objectives. 3) Long-standing personal experience determines the characteristic content of perception. Hentschel et al. (1986) viewed perception as an event over time rather than as an instantaneous reaction to outside stimulation. They also considered perception an event the roots of which are to be found beyond the restricted confines of awareness, often closely intertwined with the observer's private world of memories, and emotional experiences. Our everyday perceptions are shaped by experience and motivational objectives (Hentschel et al., 1986). This concept implies that perceptual differences between two people can be somewhat attributed to their differences in experience and motivational objectives. Lacing, Phillipson, and Lee (1966) observed that people develop perceptions on the basis of their subjective experience with a stimulus, and not to the objective-physical stimulus pattern. They conceptualized perception as a psychological process which has different cognitive stages. Hentschel, Smith and Draguns (1986) also conceptualized perception as a psychological process which has different cognitive stages.

The final product of conscious perceptual apprehension of an external object is in many cases but an intermediate step in a more extended sequence of information processing. It may also be a point of departure, an instrument, or a trigger for further cognitive process. In the case of concept formation, problem solving, thinking, and attitude development, these progressions may take place exclusively within the individual. (Hentschel et al., 1986, p. 6)
Review of this information shows the complexity and the nature of human perception and its association with other traits such as experience, and motivational objectives. Therefore it is reasonable to assume that perceptions reflect someone’s world-view, experience and motivation. Based on this assumption, it is possible to study extension educators’ world-view, experience and motivation about sustainable agriculture by studying their perceptions.

Perception and Social Context

Hentschel et al. (1986) indicated that the social context of perception does not necessarily constitute the cornerstone of a conceptualization of perceptual activity. However, studies have shown that social context is important for interpreting individual differences in object perception (Hentschel & Smith, 1980; Smith & Westerlundh, 1980). This notion can be used to infer that extension agents’ perceptions toward sustainable agriculture may differ in different social contexts.

Perception and Knowledge Acquisition

Holzkamp’s work (as cited in Hentschel, Smith & Draguns, 1986) indicated that perception has less of a central role to play in those conceptualizations that emphasize the action aspects of scientific knowledge. According to Royce (1974), there are three fundamental pathways to knowledge, namely: logical-illogical thinking pathway, universal- idiosyncratic symbolizing pathway, and perception-misperception sensing pathway. Royce (1974) regarded perception as the least significant pathway to knowledge. However, he cautioned against viewing these three pathways as independent. Based on this view it can be
expected that someone's perception toward sustainable agriculture may be different from that of his/her knowledge. That means, a knowledgeable extension agent may have a negative perception toward sustainable agriculture.

According to Prinz (1993), perceptions always involve recognition of information. During this recognition of information, the respondent compares the information provided by the external stimulus against information stored in his/her memory. It is obvious with this view that the process of perception does not only depend on external stimulus factors, but also on the factors related to the perceiver's learning history. This implies that levels of education may never affect on perception. Parallel to this concept, it can be inferred that there might be a relationship between extension agents' perceptions and their demographic characteristics such as education, experience, and amount of training on sustainable agriculture.

**Review of Related Studies**

Extension agents could play a key role in helping farmers in their decision making process regarding the application of sustainable agricultural practices (Agungu, 1995). But the issue is whether extension agents have been adequately oriented for this responsibility. A study done with extension agents in Ohio revealed that extension agents did not have a firm understanding of sustainable agriculture. They were skeptical of the sustainable agricultural concepts and were not interested in promoting sustainable agriculture. A vast majority of them had perceived sustainable agriculture primarily in terms of environmental protection and concern for the family farm. The common image conceived by extension agents was that sustainable agriculture is less productive, less profitable, and therefore, an obsolete
technology. Because of that, extension agents were concerned that if sustainable agricultural practices do not lead to increased farm yields, they will be rejected. There was a communication gap between the members of the sustainable agriculture movement and extension agents in Ohio. The Ohio study revealed that extension agents' attitude toward sustainable agriculture was not positive and they were therefore, unwilling to base their extension programs on it (Agunga, 1995). In the same way, a study done with farmers who applied sustainable agricultural practices revealed that a major hindrance to adoption of sustainable agriculture was the perception that it causes lower yields (Hanson, Kauffman, & Schauer, 1995).

Like in Ohio, Conner and Kolodinsky (1997) reported that extension agents in New England also have a skeptical attitude toward sustainable agriculture. Researchers (Agunga, 1995; Conner & Kolodinsky, 1997) attributed this skepticism to the lack of a clear definition about sustainable agriculture. Even though, extension agents in Ohio and New England were skeptical about sustainable agriculture, they expressed the need for training in sustainable agriculture (Agunga, 1995; Conner & Kolodinsky, 1997). This implies that in some cases, extension agents' skepticism toward sustainable agriculture may be due to their inadequate knowledge about sustainable agriculture.

Conner and Kolodinsky (1997) suggested that when extension agents have a skeptical view toward sustainable agriculture, they may not gain demonstrable learning experience from a training program on sustainable agriculture. In contrast, those who had favorable attitudes about sustainable agriculture were able to derive noticeable learning benefits from the training program on sustainable agriculture. Based on these findings, Conner and Kolodinsky (1997) concluded that extension agents with different attitudes about sustainable
agriculture have different training needs. Therefore, it is important to understand extension agents' perceptions and identify the factors that influence their perceptions toward sustainable agriculture. Without this information it is difficult to make suggestions regarding sustainable agricultural extension education.

Paulson (1995) reported that Minnesota agricultural extension agents were diverse in their views and knowledge of sustainable agriculture. Most of the extension agents who participated in the study in Minnesota were broadly aware of sustainable agricultural practices, but remained skeptical about whether these practices were feasible and needed.

Some researchers have pointed out that the Cooperative Extension Service has not adequately addressed the informational needs of sustainable farmers (Hanson, Kauffman, & Schauer, 1995). In contrast to this situation, a study conducted in the southern region of the United States indicated that the Cooperative Extension Service provided the major leadership in areas of sustainable agricultural technology (Sisk, 1995). According to this study, county agricultural extension agents perceived themselves to be slightly or moderately competent in sustainable agriculture. The extension agents with farm backgrounds perceived themselves to be more competent in sustainable agriculture than agents with no farm background. Extension agents working in the plant sciences perceived themselves to be more competent in sustainable agriculture than extension agents working in animal science or urban plant science (Sisk, 1995).

North Carolina Extension Service professionals had a shared vision toward sustainable agriculture. They showed strong support for the environmental aspects of sustainable agriculture. This study revealed that extension professionals were confused about the definition of sustainable agriculture and it was one of the main barriers that prevented
their active involvement in sustainable agriculture. Even though professionals in the North Carolina Extension Service seemed to have had supportive attitudes toward sustainable agriculture, their actions did not directly support sustainable agriculture (Minarovic, 1995).

As review of related studies (Agunga, 1995; Conner & Kolodinsky, 1997; Paulson, 1995) revealed that extension educators' perceptions toward sustainable agriculture were not very clear and they were skeptical of the application of sustainable agricultural practices. This indicates the necessity of effective inservice training programs especially designed for learning about sustainable agriculture. The understanding of the teaching learning process as it relates to sustainable agriculture is key to designing effective inservice training programs.

Summary

The review of literature (Hallberg, 1986; Mitchell, 1992; Nielsen & Lee, 1987; Pimental, 1990) reveals that there are environmental, social and economic problems associated with conventional agricultural practices. The National Research Council (1989) has reported that more people are now reluctant to accept the negative externalities of industrialized agriculture such as the small number of people in the farming business, lower rural bio-diversity, ground water contamination and eroded top soils. As an alternative to these adverse effects there is a growing concern about long-term sustainability and sustainable agriculture (Marshall & Herring, 1991).

Historically, sustainable agriculture as a concept started as low input sustainable agriculture in the USA. However, sustainable agriculture was an ambiguous term for many people due to its various interpretations by various groups. There was no single definition for sustainable agriculture (Dunlap, Beus, Howell & Wand, 1992). However, by reviewing many
definitions of sustainable agriculture it was determined that environmental, social and economic appropriateness are three essential qualities of sustainable agriculture practices.

Review of past studies (Agunga, 1995) indicated that extension educators are also confused about the meaning of sustainable agriculture. Additionally, past studies (Agunga, 1995; Conner & Kolodinsky, 1997) indicate that this confusion about the definition contributed to extension educators' skeptical attitude toward sustainable agriculture. Ambiguity about the definition was cited (Conner & Kolodinsky, 1997) as an important barrier to learning about sustainable agriculture. This situation indicates the significance of determining extension educators' perceptions regarding sustainable agricultural practices and their clarity about the meaning of sustainable agriculture.

This perception study is based on Dewey's experiential learning concept which articulates that "education is a development within, by, and for experience" (1938, p.17). Kolb further developed Dewey's learning model and described the experiential learning concept as "a holistic integrative perspective on learning that combines experience, perception, cognition and behavior" (1984, p.21). According to Keeton and Tate, (1978, p.2) during this experiential learning process, "the learner is directly in touch with the realities being studied. It involves direct encounter with the phenomenon being studied rather than merely thinking about the encounter or only considering the possibility of doing something with it". Experiential learning theory articulates that continuity of experience leads to inspire the learner for future experiences leading to change attitudes, knowledge and skills. Kolb (1984, p.40) conceptualized this structural process of experiential learning into a "four-stage cycle involving four adaptive learning modes – concrete experience, reflective observation, abstract conceptualization and active experimentation."
Adult learning concepts indicate that adults are self-directed learners and motivated to find solutions for their problems. Motivation to learn means someone's tendency to find learning activities meaningful and to benefit from them (Brophy, 1988). It has been documented that there is a positive correlation between adult learners' motivation for learning and learning achievement (Wlodkowski, 1999).

However, there was no study focused on adults' perceptions about sustainable agriculture and their motivation for learning more about it. Perception is an important determinant of human behavior (Pittenger & Gooding, 1971). Long-standing personal experience determines the characteristic content of human perception (Allport, 1955).

By investigating extension educators' perceptions regarding sustainable agriculture this study will retest experiential learning theory and establish the relationship between adult learners' perceptions regarding a new concept such as sustainable agriculture and their motivation for learning about that new concept.

**Research Questions**

The following research questions framed and guided the study for conclusions:

1. What are the perceptions of agricultural extension educators about sustainable agriculture?
2. What are the perceptions of agricultural extension educators regarding the principles related to the teaching-learning process focused on sustainable agricultural practices?
3. What are the teaching tools and methods for providing education regarding sustainable agriculture practices?
4. What are the limiting factors for extension educators learning about sustainable agriculture practices?

5. What are the factors that motivate extension educators in extension work?

6. Is there any relationship between extension educators' perceptions about sustainable agriculture and their level of motivation for learning more about sustainable agriculture?
CHAPTER III

METHODS AND PROCEDURES

The purpose of this study was to determine extension educators' perceptions regarding the teaching-learning process pertaining to the use of sustainable agricultural practices, and identify the relationship between extension educators' perceptions and their motivation for learning about sustainable agriculture. The study sought to draw implications for designing an in-service training model for extension educators focused on sustainable agriculture practices.

The specific objectives of the study were as follows:

1. Determine agricultural extension agents' perceptions about sustainable agriculture.

2. Determine agricultural extension agents' perceptions regarding the principles related to the teaching-learning process focused on sustainable agricultural practices.

3. Determine effective teaching tools and methods for providing education regarding sustainable agriculture practices.

4. Determine the factors that limit extension educators learning about sustainable agriculture practices.

5. Determine the factors that influence agricultural extension agents' motivation for extension work.

6. Determine the relationship between the extension educators' perceptions about sustainable agriculture and their level of motivation for learning more about sustainable agriculture.
7. Develop an in-service training model for extension educators focused on sustainable agriculture practices.

Research Design

Sample survey research design was adopted for this study. This was the appropriate design for the study since the objectives of this study were exploratory, descriptive and correlational. The required data were obtained by using a self-administered structured mailed questionnaire, because this method was time and cost effective (Tuckman, 1978).

Population and Sampling Procedure

The target population of this study was comprised of agricultural extension educators in the 12 states of the North Central Region of the United States. The proportional stratified random sampling technique was used to draw the study sample. Stratified random sampling may give a more representative sample in terms of agricultural extension agents serving in different states than simple random sampling in this instance (Ary, Jacobs, & Razavieh, 1996). There were 897 agricultural extension educators in the target population. According to Krejcie & Morgan, (1970) the appropriate sample size for this population was 270 extension educators. However, in pilot-testing the instrument with a randomly selected sample of 50 extension educators, only 65% of the extension educators responded to the questionnaire. Assuming this return rate the required mailing sample size was calculated as 415 extension educators. This sample was randomly drawn proportionate to the total number of agricultural extension agents in each of the twelve states. The sampling frame was prepared by using
information received from the extension sustainable agriculture state coordinators, web sites and the 2000-2001 County Agents Directory.

Instrumentation

A survey questionnaire was designed to collect data for this study. This questionnaire was developed based on the literature review, the researcher's personal experience and input from the researcher's dissertation committee. This survey questionnaire contained the following sections.

1. Extension educators' perceptions regarding sustainable agriculture
2. Educators' perceptions regarding the teaching-learning process
3. Factors affecting extension educators' motivation to conduct extension programs
4. Demographic information

For sections 1, 2 and 3, a five-point Likert-type scale was used. This scale ranged from 1- strongly disagree to 5-strongly agree. The perception-measuring instrument consisted of 10 statements.

Validity and Reliability

Validity is defined as the appropriateness, meaningfulness, and usefulness of the inferences made from the scores of the instruments (Ary et al., 1996). There are three types of validity to be established in a research study: face validity, content validity, and external validity. Face validity refers to the appropriateness of the instrument for the intended purpose. Face validity of the survey instrument was established by incorporating the feedback received from the extension educators during pilot-testing.
Content validity refers to the meaningfulness of the instrument in measuring the intended human behavior. Convergent validity and discriminant validity can be considered as two sub-categories of content validity. Convergent validity may be defined as the confirmation of the existence of a trait or behavior by independent measurement and discriminant validity may be defined as the extent to which a given trait is differentiated from other traits (Thomson, 1970). Convergent validity and discriminant validity can be achieved by using a multiplicity of traits or factors rather than using a few factors in rating scales (Lawler III, 1967). Therefore, in this study, extension agent perception was measured by using different traits of perception about sustainable agriculture. The most obvious type of scientific validity evidence is content-related, which may be gathered by having critical views from some competent colleagues who are familiar with the purpose of the survey (Ary et al., 1996). The agricultural education faculty and the extension sustainable agriculture state coordinator of the Iowa State University Cooperative Extension Service critically reviewed the instrument for content validity.

External validity refers to the generalizability of the findings to the target population. By drawing a random sample, external validity was established for the study.

The survey instrument was pilot-tested with randomly selected 50 county agricultural extension educators in the Iowa Cooperative Extension Service. Factor analysis was conducted and construct-related evidence was obtained to further verify content validity of the survey instrument.

Reliability refers to the ability of the survey instrument to obtain consistent data from respondents. Reliability of the survey instrument was verified by establishing the Cronbach's reliability coefficient from the pilot-test data. Cronbach's reliability coefficient for the
instrument ranged from .81 to .90 for the respective sections of the instrument indicating that
the instrument was adequately reliable for the study.

**Methods of Data Collection**

The Human Subjects Committee of the Iowa State University approved the survey
questionnaire and it was mailed to the subjects with a cover letter cosigned by the researcher,
the major professor, and the state extension sustainable agriculture coordinator. Respondents
were asked to return the completed questionnaire within ten days. Each of the state extension
sustainable agriculture coordinators was informed of the study by being sent a letter and a
copy of the survey questionnaire. Ten days after the first mailing, a reminder letter was sent
to nonrespondents requesting their response. Since the response rate was not adequate, a
second mailing was conducted.

Non-response error was addressed by conducting a telephone interview with a
randomly selected sample of nonrespondents and comparing these data with the data received
from the mailed questionnaires. This is an appropriate procedure to address the non-response
error (Miller & Smith, 1983).

**Analysis of Data**

Questionnaire items were coded and entered into the Statistical Package for Social
Science (SPSS-windows) computer program for data analyses.

There were two analytical expectations of this study: (1) to summarize the data; and
(2) to analyze the relationship between the extension agents' perceptions and other variables.
For these analytical expectations, the following statistical analysis was conducted.
1. Descriptive statistics such as means, standard deviations, and percentages of the variables of interest.

2. Correlation coefficients between the perceptions and the other variables.

Assumptions of the Study

The following assumptions were made regarding the study:

1. The respondents provided accurate information.

2. The respondents did not interact with each other in responding to the questionnaire.

Limitations of the Study

The findings of this study may have been limited by the following factors:

1. The sampling frame was made by using three sources, the agricultural extension educators' list provided by the state extension sustainable agriculture coordinators, Web sites, and the 2000/2001 County Extension Agents' Directory. The agricultural extension agents who may not have been listed in any of these sources were not in the sample. This situation represents a violation of the random selection principles and can be a limiting factor for the external validity of the study.

2. This is a perception study. Human perception changes with time. Therefore, the findings of this study will reflect only the situation at the time of data collection.
3. This study population was limited to the agricultural extension educators in the North-Central region of the USA. Therefore, the findings of the study are limited to this study population.
CHAPTER IV
FINDINGS

The purpose of this study was to determine extension educators' perceptions regarding the teaching-learning process focused on sustainable agricultural practices, and the relationship between the extension educators' perceptions and their motivation for learning more about sustainable agriculture. The study sought to draw implications for designing an in-service training model for extension educators focused on sustainable agriculture practices.

This chapter presents the data and findings of this study. Out of the 415 randomly selected agricultural extension educators in the study, 336 completed and returned questionnaires for a response rate of 81%. There were 323 usable questionnaires. Non-response error was controlled by conducting a telephone interview with a randomly selected sample of 20 nonrespondents and comparing these data with the data received from mailed questionnaires. This is an appropriate procedure to address the non-response error (Miller & Smith, 1983). An independent t-test was used to determine if respondents and nonrespondents of the agricultural extension educators differed significantly in their perceptions regarding sustainable agriculture practices. No significant difference ($p<.05$) was found between the respondents and nonrespondents in their perceptions regarding sustainable agriculture practices. Therefore, it is reasonable to generalize the findings of this research over the study population.

Findings of this study will be presented on the basis of the objectives of the study. First, demographic data related to the study sample will be presented in order to describe the characteristics of the respondents. Then the findings will be presented and described in the
following order of the objectives. 1) agricultural extension agents' perceptions about sustainable agriculture practices; 2) agricultural extension agents' perceptions regarding the principles related to the teaching-learning process focused on sustainable agricultural practices; 3) effective teaching tools and methods for providing education regarding sustainable agriculture practices; 4) factors that limit extension educators learning about sustainable agriculture practices; 5) factors that influence agricultural extension agents' motivation for extension work; 6) the relationship between the extension educators' perceptions about sustainable agriculture and their level of motivation for learning about sustainable agriculture.

**Demographic Characteristics**

A majority of the respondents (89.5%) were males as shown in the Figure 1. Under the demographic characteristics, distribution of respondents' ages, years of experience in the extension service, levels of education, current extension responsibility and the number of sustainable agriculture related inservice training programs attended during the last five years will be summarized.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>10.5%</td>
</tr>
<tr>
<td>Male</td>
<td>89.5%</td>
</tr>
</tbody>
</table>

Figure 1. Distribution of agricultural extension educators' gender
Distribution of Respondents' Age

Respondents' mean age was 45 years. Table 1 shows these data. The majority (36.1%) of the respondents were 41 to 50 years old. Only 8.4% of the respondents were less than 30 years old. About 31.5% of the respondents were older than 50 years. These findings are summarized in the Table 2.

Distribution of Respondents' Years of Experience in the Extension Service

The mean of respondents' experience in the extension service was 15 years as shown in the Table 1. Nearly 60% of the respondents had more than 11 years of experience in the

Table 1. Means and standard deviations of selected demographic characteristics of agricultural extension educators (n=323)

<table>
<thead>
<tr>
<th>Demographic item</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>45.0</td>
<td>9.49</td>
</tr>
<tr>
<td>Years of experience in extension service</td>
<td>15.0</td>
<td>9.79</td>
</tr>
<tr>
<td>Number of sustainable agriculture related inservice training programs attended during the last five years</td>
<td>3.2</td>
<td>3.31</td>
</tr>
</tbody>
</table>

Table 2. Distribution of Agricultural Extension Educators' Age (n=323)

<table>
<thead>
<tr>
<th>Age category (years)</th>
<th>24-29</th>
<th>30-35</th>
<th>36-40</th>
<th>41-45</th>
<th>46-50</th>
<th>51-55</th>
<th>56&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of respondents</td>
<td>8.4</td>
<td>7.8</td>
<td>16.2</td>
<td>19.3</td>
<td>16.8</td>
<td>16.2</td>
<td>15.3</td>
</tr>
</tbody>
</table>
extension service. Twenty-two percent of the respondents had less than 6 years experience in the extension service. Table 3 shows the summary of these data.

**Distribution of the Respondents’ Level of Education**

The majority (78.2%) of the respondents had either a masters or a doctoral degree while 21.7% of the respondents had only a bachelors degree. These findings are shown in the Table 4.

Table 3. Percentage distribution of agricultural extension educators’ years of experience in the extension service (n=323)

<table>
<thead>
<tr>
<th>Years of experience</th>
<th>1-5</th>
<th>6-10</th>
<th>11-15</th>
<th>16-20</th>
<th>21+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of Respondents</td>
<td>22.0</td>
<td>18.0</td>
<td>15.5</td>
<td>15.5</td>
<td>28.9</td>
</tr>
</tbody>
</table>

Table 4. Percentage distribution of agricultural extension educators’ levels of education (n=323)

<table>
<thead>
<tr>
<th>Levels of education</th>
<th>Bachelors’ Degree</th>
<th>Masters’ Degree</th>
<th>Doctoral Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of Respondents</td>
<td>21.7</td>
<td>68.6</td>
<td>9.6</td>
</tr>
</tbody>
</table>
Distribution of the Respondents' Area of Job Responsibility

Most of the agricultural extension educators in the sample had more than one area of job responsibility. For instance, 52.8% of the respondents were responsible for crops, horticulture, livestock and administration. Only 26.1% of the respondents had one job responsibility area such as crops, horticulture, livestock or natural resources. Over 12% of the respondents were responsible for natural resources in addition to their responsibility in crops, horticulture or livestock. Table 5 shows these findings.

Distribution of the Number of Sustainable Agriculture Related Inservice Training Programs Attended by the Respondents During the Last Five Years

About 47% of the respondents had attended 3 or more sustainable agriculture related inservice training programs during the last five years, while 36.3% of the respondents had attended one to two training programs. There were 16.1% of the respondents who did not attend any inservice training program related to sustainable agriculture during the last five years. Table 6 summarizes these findings.

Agricultural Extension Educators' Perceptions About Sustainable Agriculture Practices

A ten-item instrument was used to identify extension educators’ perceptions about sustainable agriculture practices. Five items of the instrument were positive statements while the remaining five items were negative statements about sustainable agriculture practices. Extension educators’ perceptions were obtained on a five-point Likert-type scale ranging from (1) strongly disagree to (5) strongly agree.
Table 5. Percentage distribution of the respondents’ area of job responsibility (n=323)

<table>
<thead>
<tr>
<th>Area of responsibility</th>
<th>Percentage of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crops, horticulture, livestock and administration</td>
<td>52.8%</td>
</tr>
<tr>
<td>Crops, horticulture or livestock with natural resources</td>
<td>12.1%</td>
</tr>
<tr>
<td>Livestock only</td>
<td>10.9%</td>
</tr>
<tr>
<td>Crops only</td>
<td>10.6%</td>
</tr>
<tr>
<td>Horticulture only</td>
<td>3.4%</td>
</tr>
<tr>
<td>Crops, horticulture and livestock</td>
<td>3.4%</td>
</tr>
<tr>
<td>Crops, horticulture, livestock, community development and 4H</td>
<td>3.1%</td>
</tr>
<tr>
<td>Farm management only</td>
<td>2.2%</td>
</tr>
<tr>
<td>Natural resources management only</td>
<td>1.2%</td>
</tr>
<tr>
<td>Agricultural engineering only</td>
<td>0.3%</td>
</tr>
</tbody>
</table>

Extension educators’ overall perceptions about sustainable agriculture practices were obtained by using seven items. The items “sustainable agriculture is an ambiguous term to me,” “I am not clear which agriculture practices are sustainable,” and “diffusion of sustainable agriculture practices such as IPM is more an educational process than a delivery of information about a technology” were excluded in obtaining the overall perceptions of extension educators about sustainable agriculture. These items were excluded in the analysis because these three items were considered possible factors in undermining the face validity of the instrument obtaining the overall perceptions of extension educators regarding the sustainable agriculture. Four items of the seven-item scale were positive statements while three items were negative statements about sustainable agriculture. Extension educators’
overall perceptions about sustainable agriculture practices were obtained by reversing the scale values of three negative statements and adding them together with the values received on the scale for four positive statements. The highest possible value in this scale was 35 and the lowest possible value was 7. Higher values indicate favorable perceptions toward sustainable agriculture practices. The Cronbach's reliability coefficient of this seven-item section of the instrument was .80.

Table 6. Distribution of the number of sustainable agriculture related inservice training programs attended by the respondents during the last five years (n=323)

<table>
<thead>
<tr>
<th>Number of inservice training</th>
<th>0</th>
<th>1-2</th>
<th>3-4</th>
<th>5-6</th>
<th>7&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of respondents</td>
<td>16.1%</td>
<td>36.3%</td>
<td>24.6%</td>
<td>12.6%</td>
<td>10.4%</td>
</tr>
</tbody>
</table>

The mean and standard deviation of the extension educators' general perceptions about sustainable agriculture were, respectively, 26.6 and 3.58 on this scale. This data indicates that the extension educators had a favorable perception toward sustainable agriculture practices. Mean values of the extension educators’ perceptions about each of the ten items on the instrument on the Likert-type scale (1=strongly disagree to 5=strongly agree) are given in the Table 7.

The highest mean value (4.0) was reported for the items “sustainable agriculture practices are useful to protect the environment” and “farmers should be educated to use sustainable agriculture practices” indicating that respondents agreed with these aspects of
sustainable agriculture practices. The second highest mean value (3.9) was reported for the statements “sustainable agriculture practices are beneficial to the whole community” and “sustainable agriculture is useful to maintain long-term productivity of farming systems”.

Table 7. Means and standard deviations regarding agricultural extension educators' perceptions about sustainable agriculture (n=323)

<table>
<thead>
<tr>
<th>Statement about sustainable agriculture</th>
<th>Mean*</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Farmers should be educated to use sustainable agriculture practices.</td>
<td>4.0</td>
<td>0.71</td>
</tr>
<tr>
<td>2. Sustainable agriculture practices are useful to protect the environment.</td>
<td>4.0</td>
<td>0.77</td>
</tr>
<tr>
<td>3. Sustainable agriculture is useful to maintain long-term productivity of farming systems.</td>
<td>3.9</td>
<td>0.78</td>
</tr>
<tr>
<td>4. Sustainable agriculture practices are beneficial to the whole community.</td>
<td>3.9</td>
<td>0.77</td>
</tr>
<tr>
<td>5. Diffusion of sustainable agriculture practices such as Integrated Pest Management (IPM) is more an educational process than a mere delivery of information about a technology.</td>
<td>3.6</td>
<td>0.81</td>
</tr>
<tr>
<td>6. Sustainable agriculture is an ambiguous term to me.</td>
<td>3.0</td>
<td>1.17</td>
</tr>
<tr>
<td>7. Sustainable agriculture practices are not easy to apply.</td>
<td>2.9</td>
<td>0.94</td>
</tr>
<tr>
<td>8. I am not clear which agriculture practices are sustainable.</td>
<td>2.9</td>
<td>1.09</td>
</tr>
<tr>
<td>9. Sustainable agriculture is not economically profitable.</td>
<td>2.3</td>
<td>0.84</td>
</tr>
<tr>
<td>10. Sustainable agriculture practices can be applied only on small family farms.</td>
<td>1.9</td>
<td>0.80</td>
</tr>
</tbody>
</table>

* Scale: 1=Strongly disagree to 5=Strongly agree
The mean value 3.9 indicates that respondents agreed with these statements about sustainable agriculture practices. Respondents moderately agreed (3.6) that the “diffusion of sustainable agriculture practices such as Integrated Pest Management (IPM) is more an educational process than a mere delivery of information about a technology”. The mean value was at the “neutral” point (3) on the five-point scale for the statement which says that “sustainable agriculture” is an ambiguous term for some people. Findings showed that 43.2% of the respondents agreed while 42.2% of the respondents disagreed with the statement which indicates the term “sustainable agriculture” is an ambiguous term. Respondents moderately disagreed with the statements “sustainable agriculture practices are not easy to apply” and “I am not clear which agriculture practices are sustainable”. Respondents disagreed with the statements “sustainable agriculture is not economically profitable” and “sustainable agriculture practices can be applied only on small family farms”. The lowest mean value (1.9) was reported for the statement “sustainable agriculture practices can be applied only on small family farms”.

Findings show that agricultural extension educators’ had a favorable perception toward sustainable agriculture practices. An independent sample t-test confirmed that agricultural extension educators’ perceptions did not significantly vary with their age, gender, levels of education, experience or inservice training programs attended (Table 8).

Principles Related to the Teaching-Learning Process Focused on Sustainable Agricultural Practices

Principles related to the teaching-learning process focused on three main areas, namely, educational program planning, delivery and evaluation.
## Table 8. Comparison of extension educators’ perceptions regarding sustainable agriculture based on age, gender, education, experience and inservice training (n=323)

<table>
<thead>
<tr>
<th>Character</th>
<th>Comparing levels</th>
<th>Mean of the general perception</th>
<th>t</th>
<th>p(2-tailed)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Less than 30 years</td>
<td>27.3</td>
<td>1.104</td>
<td>0.270</td>
</tr>
<tr>
<td></td>
<td>30 years or more</td>
<td>26.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>26.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>26.8</td>
<td>-0.258</td>
<td>0.797</td>
</tr>
<tr>
<td>Education</td>
<td>Bachelors degree only</td>
<td>26.1</td>
<td>-1.513</td>
<td>0.131</td>
</tr>
<tr>
<td></td>
<td>Masters or Ph.D.</td>
<td>26.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experience</td>
<td>Less than three years</td>
<td>27.6</td>
<td>-1.766</td>
<td>0.078</td>
</tr>
<tr>
<td></td>
<td>Three or more years</td>
<td>26.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inservice</td>
<td>No sustainable Ag. related inservice</td>
<td>26.6</td>
<td>-0.191</td>
<td>0.848</td>
</tr>
<tr>
<td></td>
<td>Had one or more related inservice</td>
<td>26.7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Significant Alpha = .05

When program planning is concerned, respondents agreed that training programs should be built on the target participants’ needs and interests to derive a positive learning outcome. This statement received the highest mean rating of 4.3 on the five-point Likert-type scale ranging from (1) strongly disagree to (5) strongly agree. They agreed that the change of attitude is the most difficult learning outcome to reach in teaching new agricultural practices. Respondents also agreed that follow-up to training programs is necessary to help participants resolve issues and concerns about new agricultural practices.
Where educational program delivery strategies are considered, respondents agreed that the experiential education programs and the problem solving approach are very effective in teaching about new agricultural practices. Respondents moderately agreed that a system approach is the best way to construct meaning when learning new agricultural practices. When program evaluation is taken into account, respondents moderately agreed that the evaluation of extension training should be based on the accomplishments of the participants’ learning objectives as identified by the participants. Table 9 indicates a summary of these findings.

Perceptions About Effective Teaching Methods and Tools for Providing Education Regarding Sustainable Agricultural Practices

The survey instrument focused on extension educators’ perceptions regarding effective teaching methods and tools useful in learning about sustainable agriculture practices. The most commonly used teaching methods and tools were included in the instrument. Respondents were asked to indicate how effective each of these teaching methods and tools were for educating farmers about sustainable agriculture practices on a five-point Likert-type scale ranging from 1- (not very effective) to 5-(very effective). In addition to these teaching methods and tools, respondents were asked to list any other teaching methods and tools that they would consider effective in teaching sustainable agriculture.
Table 9. Means and standard deviations for principles related to the teaching-learning process focused on sustainable agricultural practices as perceived by agricultural extension educators. (n=323)

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mean*</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training programs should be built on the target participants’ needs and interests to derive a positive learning outcome.</td>
<td>4.3</td>
<td>0.59</td>
</tr>
<tr>
<td>Change of attitude is the most difficult learning outcome to reach in teaching new agricultural practices.</td>
<td>4.1</td>
<td>0.80</td>
</tr>
<tr>
<td>Follow-up to training programs is necessary to help participants to resolve issues and concerns about new agricultural practices.</td>
<td>4.1</td>
<td>0.60</td>
</tr>
<tr>
<td>Experiential education programs are effective in learning about new agriculture practices.</td>
<td>4.1</td>
<td>0.69</td>
</tr>
<tr>
<td>The problem solving approach is very effective in teaching about new agricultural practices.</td>
<td>4.0</td>
<td>0.68</td>
</tr>
<tr>
<td>A systems approach is the best way to construct meaning when learning new agricultural practices.</td>
<td>3.7</td>
<td>0.76</td>
</tr>
<tr>
<td>Evaluation of extension training should be based on the accomplishments of the participants’ learning objectives as identified by the participants.</td>
<td>3.6</td>
<td>0.80</td>
</tr>
</tbody>
</table>

* Scale: 1=Strongly disagree to 5=Strongly agree

**Perceptions Regarding Teaching Methods**

The highest mean value (4.4) was indicated for one-on-one instruction and demonstrations. Group discussions (3.8) and seminars (3.3) were rated as moderately effective teaching methods. Two extension educators identified problem solving case studies as a very effective teaching method. One identified hands-on type experiential programs as a
very effective teaching method in educating farmers or extension educators about sustainable agriculture practices. The lowest mean value (2.8) was attributed to lectures. These findings are shown in the Table 10. Over 50% of the respondents perceived that the one-on-one instructional method is a very effective teaching method for educating farmers about sustainable agriculture practices.

Table 10. Means, standard deviations and percentages of extension educators' perceptions regarding the level of effectiveness of selected teaching methods for teaching sustainable agriculture practices (n=323)

<table>
<thead>
<tr>
<th>Teaching method</th>
<th>Mean* SD</th>
<th>1 %*</th>
<th>2 %*</th>
<th>3 %*</th>
<th>4 %*</th>
<th>5 %*</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-on-one instruction</td>
<td>4.4</td>
<td>0.71</td>
<td>0.3</td>
<td>1.2</td>
<td>7.8</td>
<td>38.8</td>
</tr>
<tr>
<td>Demonstrations</td>
<td>4.4</td>
<td>0.61</td>
<td>0.0</td>
<td>0.6</td>
<td>4.6</td>
<td>50.8</td>
</tr>
<tr>
<td>Group discussions</td>
<td>3.8</td>
<td>0.75</td>
<td>0.6</td>
<td>2.8</td>
<td>30.0</td>
<td>52.3</td>
</tr>
<tr>
<td>Seminars</td>
<td>3.3</td>
<td>0.70</td>
<td>0.3</td>
<td>11.5</td>
<td>52.0</td>
<td>34.1</td>
</tr>
<tr>
<td>Lectures</td>
<td>2.8</td>
<td>0.78</td>
<td>4.6</td>
<td>28.2</td>
<td>50.8</td>
<td>15.8</td>
</tr>
</tbody>
</table>

*Percentage of responses on the scale 1=not very effective to 5=very effective

Perceptions Regarding Teaching Tools

The highest mean value (4.1) was reported for field days. Twenty-eight percent of the respondents said field days were very effective for educating farmers about sustainable agriculture practices. The second highest mean value (3.8) was reported for “study tours” and “workshops”. Eighteen percent of the respondents indicated that “study tours” were “very effective” teaching tools for educating farmers about sustainable agriculture. The mean value of the “printed materials” on this Likert-type scale was 3.4. Computer programs were
identified as "somewhat effective" (3.0). "Slides" and "video tapes" received the lowest mean value (2.8). This information is shown in the Table 11.

**The Factors Limiting Learning about Sustainable Agriculture Practices**

Extension educators' responses were obtained for seven possible limiting factors based on the literature and the pilot-test results on a five-point Likert-type scale ranging from (1)-not at all to (5)-very much limit learning about sustainable agricultural practices. In addition to the seven listed factors, respondents were asked to list any other limiting factor and to rate the limitation on the given Likert-type scale.

Table 11. Means standard deviations and percentages of extension educators' perceptions regarding the levels of effectiveness of selected teaching tools (n=323)

<table>
<thead>
<tr>
<th>Teaching tool</th>
<th>Mean</th>
<th>SD</th>
<th>1 %*</th>
<th>2 %*</th>
<th>3 %*</th>
<th>4 %*</th>
<th>5 %*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field days</td>
<td>4.1</td>
<td>0.71</td>
<td>0.3</td>
<td>0.9</td>
<td>17.0</td>
<td>54.2</td>
<td>27.6</td>
</tr>
<tr>
<td>Study tours</td>
<td>3.8</td>
<td>0.78</td>
<td>0.9</td>
<td>2.8</td>
<td>25.0</td>
<td>53.4</td>
<td>17.8</td>
</tr>
<tr>
<td>Workshops</td>
<td>3.8</td>
<td>0.73</td>
<td>0.9</td>
<td>1.2</td>
<td>31.6</td>
<td>52.3</td>
<td>13.9</td>
</tr>
<tr>
<td>Printed materials</td>
<td>3.4</td>
<td>0.80</td>
<td>1.2</td>
<td>9.9</td>
<td>41.9</td>
<td>40.4</td>
<td>6.5</td>
</tr>
<tr>
<td>Web-sites</td>
<td>3.1</td>
<td>0.85</td>
<td>2.2</td>
<td>19.3</td>
<td>49.1</td>
<td>24.5</td>
<td>5.0</td>
</tr>
<tr>
<td>Computer programs</td>
<td>3.0</td>
<td>0.82</td>
<td>3.7</td>
<td>19.8</td>
<td>52.3</td>
<td>21.4</td>
<td>2.8</td>
</tr>
<tr>
<td>Slides</td>
<td>2.8</td>
<td>0.86</td>
<td>6.8</td>
<td>24.5</td>
<td>50.8</td>
<td>15.8</td>
<td>2.2</td>
</tr>
<tr>
<td>Video tapes</td>
<td>2.8</td>
<td>0.90</td>
<td>6.8</td>
<td>27.6</td>
<td>45.8</td>
<td>16.7</td>
<td>3.1</td>
</tr>
</tbody>
</table>

*Percentage of responses on the scale 1=not very effective to 5=very effective
Findings indicate that availability of time was the most significant limiting factor for the respondents to learn about sustainable agriculture. The mean rating for this factor was 4.0 and it was the highest mean value. Opportunity to interact with researchers was identified as the second most important limiting factor in learning about sustainable agricultural practices with the mean rating of 3.1. Factors such as training opportunities, networking opportunities, access to research information and clarity about the use of new agricultural technology were identified as somewhat limiting factors in learning about sustainable agricultural practices. Access to instructional materials was identified as the least limiting factor by the mean rating of 2.8 (Table 12). By responding to the open-ended question on the instrument, nine extension educators indicated negative attitudes toward sustainable agriculture as a considerable limitation to learning about sustainable agricultural practices. Seven respondents mentioned confusion about the definition of sustainable agriculture as a significant limitation to learning about sustainable agriculture. Lack of interest about sustainable agriculture was another factor limiting learning about sustainable agricultural practices as identified by five respondents. Five respondents mentioned that the lack of clients’ demand as an important limitation. One respondent mentioned the lack of opportunities to gain first-hand experience as a limitation to learning about sustainable agricultural practices.

The Factors That Influence Agricultural Extension Educators’ Motivation

The factors that influence agricultural extension educators’ motivation were identified by using a nine-item instrument. Extension educators were asked to indicate how influential each of these items were in motivating them for extension work on a five-point Likert scale ranging from (1) very low to (5) very high. The Cronbach’s reliability coefficient of this part
of the instrument was .86. Respondents identified professional commitment and positive attitudes toward the program as highly motivating factors for their extension work by a mean rating of 4.1 on the five-point Likert-type scale. Personal satisfaction was identified as a motivating factor for extension work.

Table 12. Means and standard deviations of the factors that limit extension educators learning about sustainable agriculture practices

<table>
<thead>
<tr>
<th>Limiting factors</th>
<th>n</th>
<th>Mean*</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Availability of time</td>
<td>321</td>
<td>4.0</td>
<td>0.99</td>
</tr>
<tr>
<td>2. Opportunity to interact with researchers</td>
<td>321</td>
<td>3.1</td>
<td>0.96</td>
</tr>
<tr>
<td>3. Training opportunities</td>
<td>322</td>
<td>3.0</td>
<td>0.96</td>
</tr>
<tr>
<td>4. Networking opportunities</td>
<td>322</td>
<td>3.0</td>
<td>0.95</td>
</tr>
<tr>
<td>5. Access to research information</td>
<td>321</td>
<td>3.0</td>
<td>1.02</td>
</tr>
<tr>
<td>6. Clarity about the use of new agricultural technology</td>
<td>322</td>
<td>3.0</td>
<td>0.92</td>
</tr>
<tr>
<td>7. Access to instructional materials</td>
<td>322</td>
<td>2.8</td>
<td>0.89</td>
</tr>
</tbody>
</table>

Factors identified by the respondents

Negative attitudes toward sustainable agriculture 9 4.2 -

Confusion about the definition of sustainable agriculture 7 4.3 -

Lack of interest about sustainable agriculture 5 4.2 -

Lack of clients’ demand 4 4.5 -

Lack of opportunities for first-hand experience 1 4.0 -

* Scale: 1=Not at all to 5=Very much limit learning about sustainable agriculture
The next highest mean values were reported, respectively, for technical competency (3.7), appreciation of extension educators' work (3.6) and availability of technical support (3.6). Respondents identified extension council interest as a motivating factor with a mean value of 3.4. Extension educators perceived administrative support and appreciation of their work as moderately motivating factors (Table 13).

**Motivation for Extension Work and Learning about Sustainable Agriculture**

Extension educators were asked to indicate their level of self-perceived motivation for extension work and learning about sustainable agriculture on a five point Likert-type scale:

* Scale: 1=Very low to 5=Very high

<table>
<thead>
<tr>
<th>Factor</th>
<th>Mean*</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional commitment</td>
<td>4.1</td>
<td>0.71</td>
</tr>
<tr>
<td>Positive attitudes toward the program</td>
<td>4.1</td>
<td>0.74</td>
</tr>
<tr>
<td>Personal satisfaction</td>
<td>4.0</td>
<td>0.83</td>
</tr>
<tr>
<td>Technical competency</td>
<td>3.7</td>
<td>0.81</td>
</tr>
<tr>
<td>Appreciation of work</td>
<td>3.6</td>
<td>0.87</td>
</tr>
<tr>
<td>Available technical support</td>
<td>3.6</td>
<td>0.79</td>
</tr>
<tr>
<td>Extension council interests</td>
<td>3.4</td>
<td>0.94</td>
</tr>
<tr>
<td>Administrative support</td>
<td>3.2</td>
<td>0.92</td>
</tr>
<tr>
<td>Recognition of work</td>
<td>3.1</td>
<td>0.96</td>
</tr>
</tbody>
</table>

* Scale: 1=Very low to 5=Very high
scale ranging from 1=very low to 5=very high. Respondents perceived that they had a high level of motivation for extension work with a mean rating on the five-point scale of 4.2.

The mean rating for extension educators' self perceived motivation for learning about sustainable agriculture was 3.6, indicating that it was at a moderately high level (Table 14). No one perceived the level of motivation for their work at a very low level. However, five percent of the respondents perceived their motivation for learning more about sustainable agriculture at a low level. About 32% of the respondents perceived their motivation for extension work at a very high level. However, only 11.5% of the respondents perceived their level of motivation for learning about sustainable agriculture at a very high level.

Table 14. Means standard deviations and percentages regarding motivation for extension work and learning about sustainable agriculture as perceived by agricultural extension educators (n=323)

<table>
<thead>
<tr>
<th>Motivation for</th>
<th>Mean* SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Very low%</td>
<td>Low%</td>
<td>Moderate%</td>
<td>High%</td>
<td>Very high%</td>
</tr>
<tr>
<td>Extension work</td>
<td>4.2</td>
<td>0.0</td>
<td>0.6</td>
<td>8.2</td>
<td>58.9</td>
<td>32.3</td>
</tr>
<tr>
<td>Learning about sustainable agriculture</td>
<td>3.6</td>
<td>0.3</td>
<td>4.7</td>
<td>38.2</td>
<td>45.3</td>
<td>11.5</td>
</tr>
</tbody>
</table>

* Scale: 1=Very low to 5=Very high
Relationship Between Extension Educators' Perceptions and Their Motivation for Learning About Sustainable Agriculture

Correlation analysis was conducted to reveal the relationships between extension educators' motivation for learning with variables such as extension educators' perceptions about sustainable agriculture, age, years of experience, levels of education, number of inservice training programs attended and motivation for work (Table 15).

The relationship between extension educators' general perceptions about sustainable agriculture and motivation for learning about sustainable agriculture was positive and highly significant. Additionally, the relationships between the extension educators' motivation for learning and other variables are as follows:

Table 15. Correlation between extension educators’ motivation for learning with other variables (n=323)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pearson correlation coefficient</th>
<th>2-tailed p</th>
</tr>
</thead>
<tbody>
<tr>
<td>General perception toward sustainable agriculture</td>
<td>.406**</td>
<td>.000</td>
</tr>
<tr>
<td>Motivation for work</td>
<td>.304**</td>
<td>.000</td>
</tr>
<tr>
<td>Number of inservice training programs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>related to sustainable agriculture</td>
<td>.182**</td>
<td>.001</td>
</tr>
<tr>
<td>Levels of education</td>
<td>.139*</td>
<td>.012</td>
</tr>
<tr>
<td>Age</td>
<td>.029</td>
<td>.605</td>
</tr>
<tr>
<td>Years of experience in the extension</td>
<td>-.005</td>
<td>.926</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)
learning about sustainable agriculture and the variables such as motivation for work and the number of inservice training programs related to sustainable agriculture in which they participated were positive and highly significant. The relationship between extension educators' motivation for learning about sustainable agriculture and their levels of education was positive and significant. There was no relationship between extension educators' motivation for learning about sustainable agriculture and the variables such as age and years of experience in extension service.

Correlation analysis showed that there was a positive correlation between extension educators' motivation for learning about sustainable agriculture and variables such as general perceptions about sustainable agriculture, motivation for work, number of inservice training programs attended and years of experience in extension service. Therefore, a partial correlation analysis was conducted to control the effects of the other three variables and elicit the correlation between the extension educators' general perceptions about sustainable agriculture and their motivation for learning about sustainable agriculture (Table 16).

Table 16. Partial correlation coefficient between extension educators' perceptions and their motivation for learning about sustainable agriculture. (n=323)

<table>
<thead>
<tr>
<th>General perceptions about sustainable agriculture</th>
<th>Motivation for learning about sustainable agriculture</th>
<th>2-tailed p</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Partial correlation coefficient*)</td>
<td>.383**</td>
<td>.000</td>
</tr>
</tbody>
</table>

** Partial correlation is significant at the 0.01 level (2-tailed) * Controlled for three variables namely “motivation for work,” “number of inservice training programs related to sustainable agriculture,” and “levels of education”
Findings confirmed that there was a strong positive correlation between extension educators’ general perceptions about sustainable agriculture and their motivation for learning more about sustainable agriculture.

**Suggestions to Improve Inservice Programs**

The suggestions made by the respondents to improve the inservice training programs related to sustainable agriculture were summarized into 21 categories (Table 17). The most common suggestion was to define the term – sustainable agriculture - in order to overcome the ambiguity associated with it. Forty-six respondents stressed the necessity of adopting a widely acceptable common definition for sustainable agriculture to focus the training effort. Twenty-three respondents indicated the importance of reviewing and highlighting the economic aspects of sustainable agriculture in order to enhance adoption. There were 20 respondents indicating the importance of providing scientific research-based unbiased information to validate the sustainable agricultural practices. Sixteen respondents suggested the use of farm demonstrations with producers who have success stories about using sustainable agricultural practices. There was a common suggestion to use a systems approach in teaching about sustainable agricultural practices. Ten respondents mentioned that they need more training programs related to sustainable agriculture. Respondents indicated the necessity of providing localized training programs enabling them to manage their time and limited travel funds. Respondents pointed out the necessity of building a comprehensive training plan in advance with diverse extension input. Hands-on field training and field days were suggested as useful teaching tools in education about sustainable agricultural practices. Some respondents suggested the necessity of focusing inservice programs on the subject
matter as well as on training how to teach. Some respondents identified study tours as an effective teaching tool. Three respondents suggested that problem-solving case studies were appropriate to educate about sustainable agricultural practices. There was a suggestion for follow-up to inservice training programs. Two respondents mentioned that they need more technical support from state specialists regarding sustainable agricultural practices. Another suggestion was the use of web-based programs to complement inservice programs. Two respondents suggested that building a communication network among extension professionals is necessary to upgrade knowledge and issues. One respondent suggested to incorporate farmers’ needs into the inservice training programs for wider acceptance. Another suggestion was to include farmers in the planning process to get their perspective. One respondent suggested that evaluation of inservice training should be focused on learner outcomes rather than satisfaction.

Table 17. Suggestions to improve inservice training focused on sustainable agriculture

<table>
<thead>
<tr>
<th>Suggestion</th>
<th>Number of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. There are different interpretations for sustainable agriculture.</td>
<td>46</td>
</tr>
<tr>
<td>Therefore, it is important to clearly define the term - sustainable</td>
<td></td>
</tr>
<tr>
<td>agriculture for wider acceptance and focus training effort.</td>
<td></td>
</tr>
<tr>
<td>2. It is important to review and highlight the economic aspects of</td>
<td>23</td>
</tr>
<tr>
<td>sustainable agricultural practices in order to convince the participants.</td>
<td></td>
</tr>
<tr>
<td>3. Need scientific research based information to validate the application</td>
<td>20</td>
</tr>
<tr>
<td>of sustainable agriculture practices.</td>
<td></td>
</tr>
<tr>
<td>4. Use of farm demonstrations with producers who have success stories</td>
<td>16</td>
</tr>
<tr>
<td>about using sustainable agricultural practices.</td>
<td></td>
</tr>
<tr>
<td>5. Systems approach to training.</td>
<td>14</td>
</tr>
</tbody>
</table>
Table 17. (Continued)

<table>
<thead>
<tr>
<th>Suggestion</th>
<th>Number of responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. Need more sustainable agriculture related training.</td>
<td>10</td>
</tr>
<tr>
<td>7. Need localized training programs to address travel time and fund limitations of extension educators.</td>
<td>9</td>
</tr>
<tr>
<td>8. It is necessary to develop a comprehensive training plan in advance with diverse extension input.</td>
<td>6</td>
</tr>
<tr>
<td>9. Hands-on field training and field days.</td>
<td>6</td>
</tr>
<tr>
<td>10. Inservice should be focused on subject matter as well as on training how to teach.</td>
<td>6</td>
</tr>
<tr>
<td>11. Tours are excellent training tools.</td>
<td>4</td>
</tr>
<tr>
<td>12. Problem solving case studies are appropriate to educate about sustainable agricultural practices.</td>
<td>3</td>
</tr>
<tr>
<td>13. Need follow-ups for inservice training programs.</td>
<td>3</td>
</tr>
<tr>
<td>14. Need more technical support from state specialists.</td>
<td>2</td>
</tr>
<tr>
<td>15. Web-based programs are useful to complement inservice programs.</td>
<td>2</td>
</tr>
<tr>
<td>16. Building a communication network among the extension professionals is necessary to upgrade knowledge and issues.</td>
<td>2</td>
</tr>
<tr>
<td>17. It is important to incorporate farmers’ needs into the Inservice training programs for wider acceptance.</td>
<td>1</td>
</tr>
<tr>
<td>18. Evaluation of inservice training should be focused on learner outcomes rather than satisfaction.</td>
<td>1</td>
</tr>
<tr>
<td>19. Bring farmer into the planning process. They bring great dimensions.</td>
<td>1</td>
</tr>
<tr>
<td>20. Organizing training programs during off season times or harvest time.</td>
<td>1</td>
</tr>
</tbody>
</table>
CHAPTER V

DISCUSSION

The main purpose of this study was to determine extension educators' perceptions regarding the teaching-learning process focused on sustainable agricultural practices, and the relationship between extension educators' perceptions and their motivation for learning about sustainable agriculture. The study sought to draw implications for designing an in-service training model for extension educators focused on sustainable agriculture practices. The specific objectives of the study were to: 1) determine agricultural extension agents' perceptions about sustainable agriculture; 2) determine agricultural extension agents' perceptions regarding the principles related to the teaching-learning process focused on sustainable agricultural practices; 3) determine effective teaching tools and methods for providing education regarding sustainable agriculture practices; 4) determine the factors limit extension educators learning about sustainable agriculture practices; 5) determine the factors that influence agricultural extension agents' motivation for extension work; 6) determine the relationship between the extension educators' perceptions about sustainable agriculture and their level of motivation for learning more about sustainable agriculture; and 7) develop an in-service training model for extension educators focused on sustainable agriculture practices.

The agricultural extension educators in the 12 states of the North Central Region of the United States was the target population of this study. There were 897 agricultural extension educators in the target population. A proportionate random sample of 415 agricultural extension educators was selected for the study.
This chapter presents a discussion of the major findings of the study. The discussion is presented under the following topics based on the objectives of the study. These topics are 1) demographic information; 2) perceptions about sustainable agriculture; 3) perceptions regarding the principles related to the teaching-learning process; 4) effective teaching tools and methods for providing education regarding sustainable agriculture practices; 5) factors limit extension educators learning about sustainable agriculture practices; 6) factors that influence agricultural extension agents' motivation for extension work; 7) relationship between the extension educators' perceptions about sustainable agriculture and their level of motivation for learning more about sustainable agriculture; and 8) a description of an in-service training model for extension educators focused on sustainable agriculture practices.

### Demographic Information

Most (89.5%) of the agricultural extension educators in the sample were males. There were only about 10.5% female agricultural extension educators in the sample. Agricultural extension educators' mean age was 45 years. About 32% of the agricultural extension educators were older than 50 years. About 36% of the respondents were between 41 and 50 years. Only about 8% of the agricultural extension educators were less than 30 years of age indicating that the agricultural extension educators were mainly a middle-aged group of people. The mean of extension educators’ experience in the extension service was 15 years. Only about 22% of the extension educators had less than six years of experience in the extension service. This data indicates that most of the respondents in the sample were well-experienced agricultural extension educators. The mean number of sustainable agriculture
related inservice training programs attended by the extension educators during the last five years was 3.2, indicating that they had been reasonably exposed to the subject.

Most (78.2%) of the agricultural extension educators had a graduate level degree while 21.1% of the agricultural extension educators had only a bachelors’ degree. However, there were 9.6% of the agricultural extension educators who had doctoral degrees. The distribution based on levels of education indicates that the sample consisted of well-educated agricultural extension professionals.

Most of the agricultural educators in the sample had been assigned more than one job responsibility area. For instance, 52.8% of the respondents were responsible for crops, horticulture, livestock and administration. Only 26.1% of the respondents had one job responsibility area such as crops, horticulture, livestock or natural resources. A fraction (12.1%) of the respondents was responsible for natural resources in addition to their responsibility in crops, horticulture or livestock. This information confirms that most of the agricultural extension educators were busy with many responsibilities.

**Perceptions about Sustainable Agriculture**

The first objective of this study was to determine the perceptions of agricultural extension educators about sustainable agriculture. A seven-item instrument was used to identify agricultural extension educators’ overall perceptions about sustainable agricultural practices. The highest possible value on this scale was 35 and the lowest possible value was 7. Higher values on this scale indicate favorable perceptions toward sustainable agricultural practices. The mean and the standard deviation of the agricultural extension educators’ general perceptions about sustainable agricultural practices were, respectively, 26.4 and 3.58.
The mean value of 26.4 on this scale indicates that the agricultural extension educators in the sample had favorable perceptions regarding sustainable agricultural practices. In contrast to this finding, Agunga (1995) reported that Ohio extension agents' attitude toward sustainable agriculture was not positive.

Review of each mean value of the ten perception items in the instrument confirmed that agricultural extension educators in the sample had a favorable perception about the sustainable agricultural practices. The highest mean value (4) was reported for the items “sustainable agriculture practices are useful to protect the environment” and “farmers should be educated to use sustainable agriculture practices” indicating that respondents agreed with these aspects of sustainable agriculture practices. The second highest mean value (3.9) was reported for the statements “sustainable agriculture practices are beneficial to the whole community” and “sustainable agriculture is useful to maintain long-term productivity of farming systems”. These relatively high mean values indicate that agricultural extension educators had a favorable perception toward the benefits associated with sustainable agricultural practices.

Agricultural extension educators in the sample moderately agreed that the “diffusion of sustainable agriculture practices such as Integrated Pest Management (IPM) is more an educational process than a mere delivery of information about a technology”. This finding indicates that agricultural extension educators perceived diffusion of sustainable agriculture practices such as IPM is an educational process rather than just a transmission of information. Agricultural extension educators in the sample disagreed with the items negatively stated about sustainable agricultural practices indicating that they had a positive perception regarding sustainable agricultural practices.
However, findings indicate that the agricultural extension educators were not very clear about the meaning of the term—“sustainable agriculture”. The mean value was at the “neutral” point (3) on the five-point scale for the statement, which indicates that “sustainable agriculture is an ambiguous term”. Findings showed that 43.2% of the respondents agreed while 42.2% of the respondents disagreed with the statement, which indicates sustainable agriculture is an ambiguous term. This data indicates that a considerable percentage of the agricultural extension educators in the sample were not clear about the meaning of the term—sustainable agriculture. Agunga (1995), Conner and Kolodinsky (1997) and Minarovic (1995) also reported that extension agents were confused about the definition of sustainable agriculture.

Findings show that the agricultural extension educators’ had a favorable perception of sustainable agriculture practices. An independent sample t-test confirmed that agricultural extension educators’ perceptions toward sustainable agricultural practices did not significantly vary with their age, gender, level of education, experience or inservice training programs attended.

**Perceptions Regarding the Principles Related to the Teaching-Learning Process**

The second objective of this study was to determine agricultural extension educators’ perceptions regarding the principles related to the teaching and learning process focused on sustainable agricultural practices. Agricultural extension educators agreed that training programs should be built on the target participants’ needs and interests to derive a positive learning outcome. This finding implies the need for building inservice training programs based on target participants’ needs in order to make training programs effective. Agricultural
extension educators agreed that change of attitude is the most difficult learning outcome to reach in teaching new agricultural practices. They also agreed that follow-up to training programs is necessary to help participants to resolve issues and concerns about new agricultural practices. In addition, agricultural extension educators agreed that experiential education programs are effective in learning about new agricultural practices. Agricultural extension educators agreed that a problem solving approach is very effective in teaching about new agricultural practices. They also agreed that a systems approach is the best way to construct meaning when learning new agricultural practices. These findings indicate that agricultural extension educators perceived change of attitude toward new agricultural practices as the most difficult learning outcome. They also perceived the experiential learning approach, problem solving approach and systems approach as effective educational concepts in teaching about new agricultural practices such as sustainable agricultural practices. The findings also highlighted the necessity of building training programs based on the learners' needs. Agricultural extension educators moderately agreed that evaluation of extension training programs should be based on the accomplishments of the participants' learning objectives as identified by the participants. Agricultural extension educators' agreement with this perception statement implies the significance of allowing learners to evaluate the effectiveness of training programs by comparing their own learning achievements versus their learning needs and objectives. In addition to that, agricultural extension educators' perceived the necessity of follow-up to training programs in helping participants to resolve issues and concerns about new agricultural practices.
Effective Teaching Methods and Tools for Providing Education Regarding Sustainable Agriculture Practices

The third objective of this study was to determine agricultural extension educators’ perceptions about effective teaching methods and tools for providing education regarding sustainable agricultural practices. Agricultural extension educators perceived demonstrations, group discussions and one-on-one instruction as effective teaching methods for providing education regarding sustainable agricultural practices. Similar to this finding, Shinn (1997) reported that demonstrations and group discussions are effective teaching methods in teaching agriculture. Problem solving case studies and hands-on type experiential programs were identified as very effective teaching methods by a few respondents. However, agricultural extension educators perceived lectures as an ineffective teaching method for providing education regarding sustainable agricultural practices.

Agricultural extension educators perceived field days, study tours and workshops as effective teaching tools for providing education regarding sustainable agricultural practices. Printed materials was perceived as a moderately effective teaching tool. The respondents were neutral about the effectiveness of web-sites and computer programs for providing education regarding sustainable agricultural practices. This neutral perception about the effectiveness of web-sites and computer programs may be due to respondents’ little or no familiarity with these teaching tools. In contrast to this finding, Rothman (2000) reported that non-traditional computer-based instruction in science significantly improved students’ attitudes toward science learning. Similar to this finding, Macdonald (2000) reported computer simulation as an effective teaching tool in educating evolutionary concepts to preservice science teachers. This discrepancy indicates the need for further research related
to the effectiveness of web-sites and computer programs for learning about sustainable agricultural practices.

Factors Limit Extension Educators Learning About Sustainable Agriculture Practices

The fourth objective of this study was to determine the factors that limit extension educators learning about sustainable agriculture practices. Respondents perceived lack of opportunity to interact with researchers as a somewhat limiting factor for them in learning about sustainable agricultural practices. Similar to this finding, Minarovic, and Muellerwere (2000) reported that there were barriers to working collaboratively with research and extension for promoting sustainable agriculture and articulated the need for professional networking. Training opportunities, networking opportunities, access to research information, clarity about the use of new agricultural technology and access to instructional materials were considered to be somewhat limiting factors to learning about sustainable agricultural practices. Some respondents identified a negative attitude toward sustainable agriculture as an important factor in limiting their learning about sustainable agricultural practices. A study done in Ohio revealed a similar finding that indicated extension agents’ negative attitudes toward sustainable agriculture steered them away from planning extension programs for promoting sustainable agricultural practices (Agung, 1995). Confusion about the definition of sustainable agriculture was identified as a very important limiting factor in learning about sustainable agricultural practices as it was reported by previous research studies (Agung, 1995; Conner and Kolodinsky, 1997). Additionally, some of the respondents identified that lack of clients’ demand and a lack of interest about sustainable agriculture as significant limiting factors in learning about sustainable agricultural practices.
One respondent identified the lack of opportunities for sharing first-hand experience as an important limiting factor in learning about sustainable agricultural practices.

**Factors That Influence Agricultural Extension Educators' Motivation**

Wlodkowski (1999) mentioned that every instructional plan needs a motivational plan to motivate adult learners. This statement implies the importance of understanding the factors that influence agricultural extension educators’ motivation. Agricultural extension educators’ perceived their professional commitment, positive attitudes toward the program and the personal satisfaction as highly motivating factors for them to get involved in extension programs. Respondents also perceived that their technical competency, appreciation of their work, and available technical support for them as significant motivating factors for them to get involved in extension programs. Similar to these findings, Lindner (1998) reported appreciation of extension educators’ work as a highly motivating factor. The respondents also perceived extension council interests, administrative support and recognition of work as moderately motivating factors for them to conduct extension programs.

**Motivation for Extension Work and Learning about Sustainable Agriculture**

It was found that agricultural extension educators’ had a high level of self perceived motivation for extension work. Additionally, findings clearly indicate that agricultural extension educators’ motivation for learning about sustainable agriculture was lower than their motivation for extension work.
Relationship Between Extension Educators' Perceptions and Their Motivation for Learning about Sustainable Agriculture

Correlation analysis revealed that there was a strong positive correlation between agricultural extension educators' perception toward sustainable agriculture and their motivation for learning about sustainable agriculture. The partial correlation coefficient was .383 indicating that there was a strong positive correlation between these two variables even after controlling the effects of other correlating variables such as motivation for work, number of inservice training programs and levels of education. This information implies that the stronger the perception toward sustainable agriculture the higher the motivation for learning about sustainable agriculture. Parallel to this finding, Conner and Kolodinsky (1997) reported that when extension agents have a skeptical view toward sustainable agriculture, they may not gain demonstrable learning experience from a training program on sustainable agriculture. In contrast, those who had favorable attitudes of sustainable agriculture were able to derive noticeable learning benefits from the training program on sustainable agriculture. Based on these findings, Conner and Kolodinsky (1997) concluded that extension agents with different attitudes about sustainable agriculture have different training needs. This may be the reason for a strong positive correlation between the extension agents' perception and their motivation for learning about sustainable agriculture.

Additionally, it was found that variables such as agricultural extension educators' motivation for extension work, number of inservice training programs attended related to sustainable agriculture and levels of education had a significant positive correlation with motivation for learning about sustainable agriculture. This implies that inservice programs and education can make a difference in agricultural extension educators' motivation for
learning about sustainable agriculture. Findings also indicated that highly motivated extension educators showed a high level of motivation for learning about sustainable agriculture. However, there was no relationship between extension educators’ motivation for learning about sustainable agriculture and the variables such as age and years of experience in extension service. These data indicate that age and experience were not important variables in determining motivation for learning about sustainable agriculture.

An In-Service Program Model for Extension Educators Focused on Sustainable Agricultural Practices

Based on the findings of this study and the review of literature, an In-Service Training Model for Extension Educators Focused on Sustainable Agricultural Practices was developed. This model is presented in Figure 2.

Needs Assessment

Findings clearly support the notion that inservice training programs should be developed based on the training needs identified by the extension educators and extension clients in order to make training programs meaningful to users. Agricultural extension educators mentioned not only the needs of extension educators, but also the needs of the client groups should be identified and addressed in order to make training programs meaningful to the target audience. Therefore, the first step of this model is needs assessment with extension educators and their client groups. Then, learning objectives should be identified in order to meet the training needs.
Figure 2. An inservice program model for agricultural extension educators to learn about sustainable agricultural practices
Program Development

Educational programs should be developed based on the learning objectives. Learning objectives can not be achieved unless the barriers to learning are identified and addressed. Therefore, it is necessary to identify potential barriers to learning about sustainable agriculture. This study revealed time, lack of opportunity to interact with researchers and negative attitudes as significant barriers to learning about sustainable agriculture. Therefore it is important to address these issues. For instance, respondents suggested localized training programs to save travel time and overcome time limitations. Identification of barriers should be done with extension educators. Educational program should be developed based on the adult learning principles for creating an environment for active learning. Especially, adults' intrinsic and extrinsic motivational factors for learning should be taken into account. This is necessary to ensure adult learners' active participation in the learning process.

Selection of appropriate delivery mechanisms is crucial for effectiveness of learning. Findings confirmed that a systems approach, a problem solving approach and an experiential learning approach are effective delivery mechanisms in learning about sustainable agricultural practices. Therefore, it is important to apply these delivery mechanisms for better understanding of sustainable agricultural practices. The problem solving approach can be used to analyze the agriculture related problems and find solutions. The systems approach could be used to relate the multi-facets of agriculture related problems with other areas of concern such as environment, community, business and policies. Application of a systems approach to teaching sustainable agriculture is significant because of its ability to visualize the composite picture of the complicated interactions between agriculture sector and other
sectors. This holistic understanding is useful to analyze sustainable agriculture issues meaningfully.

During the program development stage, instructional materials should be developed in order to provide learning resources for agricultural extension educators. Instructional material development should be focused on subject matter as well as the educational process. Respondents indicated that they need to learn about teaching adults. Therefore, it is important to provide instructional materials related to adult education.

**Program Delivery**

Once the educational program is developed in terms of content and delivery mechanisms based on adult education principles, it is ready to deliver. The application of effective teaching methods and teaching tools is crucial for the successful delivery of an educational program. This study revealed that teaching methods such as demonstrations, group discussions and one-on-one instruction are effective in teaching sustainable agricultural practices. Additionally, it was found that field days, study tours and workshops are effective teaching tools for educating about sustainable agricultural practices. Printed material was identified as somewhat of an effective teaching tool. Therefore, it is important to apply these effective teaching methods and teaching tools for successful delivery of educational programs on sustainable agriculture.

It was found that sustainable agriculture is an ambiguous term and this ambiguity has a negative effect on learning about sustainable agricultural practices. Previous research (Agunga, 1995; Conner & Kolodinsky, 1997; Minarovic 1995) also supports this finding. Therefore, it is very important to develop an acceptable working definition about sustainable
agriculture in order to overcome misunderstandings and establish a common understanding about sustainable agriculture among the participants in the program. This common understanding will lay a broad foundation to deliver the rest of the educational program about sustainable agriculture.

This study revealed that there was a strong positive correlation between the agricultural extension educators’ perceptions about sustainable agriculture and their motivation for learning about sustainable agriculture. This finding indicates the necessity of enabling learners to develop a favorable perception toward sustainable agriculture. Development of a favorable perception toward sustainable agriculture can be considered as a prerequisite condition for intrinsically motivating agricultural extension educators to engage the learning process. Respondents suggested using activities such as sharing success stories, bringing first-hand experience with sustainable agriculture, sharing scientific research-based information and showing economic analysis of using sustainable agricultural practices in order to help learners to develop a favorable perception of sustainable agriculture.

Development of professional linkages is vital for participants to engage in a mutual learning process leading to the development of a better understanding of sustainable agriculture practices. Therefore, during the delivery process it is important to help participants establish professional linkages enabling them to share experience, knowledge and information.

**Program Evaluation**

Program evaluation should be carried out to assess the impact of the professional development program. Respondents indicated that evaluation is meaningful if the participants
are guided to assess the impact in terms of achieving their learning objectives. Therefore, it is important to design an evaluation system that enables participants to compare their own learning achievements with the educational objectives. It is also very important to identify participants' concerns, issues, problems and suggestions related to the program in order to facilitate a continuous learning process toward the understanding and use of sustainable agriculture practices.

Follow-up and Feedback

Finally, evaluation findings should be used to do follow-ups and to solicit feedback for helping participants to overcome problems and to resolve issues and concerns. This follow-up and feedback information should be incorporated into a needs assessment process for further development of the participants’ professional capacity related to sustainable agriculture. Additionally, follow-up and feedback information should be shared with participants and their client groups for use in program planning.
CHAPTER VI
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

Conventional agriculture is criticized for its contribution to social and environmental problems (Handler, 1970; McNairn & Mitchell, 1992; Pimentel, 1990). Therefore, there is a need for the development, diffusion, and adoption of sustainable agricultural practices as alternatives to the conventional agriculture as articulated in the literature (Marshall & Herring, 1991). There is an impressive body of scientific knowledge relating to all aspects of sustainable agriculture (Harsch, 1991). However, “an important issue facing sustainable agriculture is the lack of widespread adoption of proven sustainable practices” (Duffy, 1994, p. 9). Duffy (1994) further articulated that despite decades of research and extension efforts, the adoption of many of these practices is remarkably low.

Related past studies (Agunga, 1995; Conner and Kolodinsky, 1997; Paulson, 1995) revealed that extension educators' perceptions toward sustainable agriculture were not very positive and they were skeptical of the application of sustainable agricultural practices. However, none of these past studies focused on extension educators' perceptions regarding the teaching learning processes related to sustainable agriculture.

The purpose of this study was to determine agricultural extension educators' perceptions regarding the teaching-learning processes related to sustainable agricultural practices, and determine the relationships between extension educators' perceptions and their motivation for learning about sustainable agriculture. The study sought to draw implications
for designing an in-service training model for extension educators focused on sustainable agriculture practices.

The specific objectives of the study were as follows

1. Determine agricultural extension agents' perceptions about sustainable agriculture.
2. Determine agricultural extension agents' perceptions regarding the principles related to the teaching-learning processes focused on sustainable agricultural practices.
3. Determine effective teaching tools and methods for providing education regarding sustainable agriculture practices.
4. Determine the factors that limit extension educators learning about sustainable agriculture practices.
5. Determine the factors that influence agricultural extension agents' motivation for extension work.
6. Determine the relationships between the extension educators' perceptions about sustainable agriculture and their level of motivation for learning more about sustainable agriculture.
7. Develop an in-service training model for extension educators focused on sustainable agriculture practices.

The study population comprised of 897 agricultural extension educators in the 12 states of the North Central region of the United States. A stratified random sample of 415 agricultural extension educators was selected from the study population. There was an 81%
A mailed questionnaire was used to collect data for the study. There were six main sections in the instrument related to the specific objectives of the study. Validity and reliability of the instrument were established by conducting a pilot-study with a subset of extension educators. The Cronbach's reliability coefficient for the instrument ranged from .81 to .90 showing that the instrument was adequately reliable for the study.

SPSS computer software package was used to analyze the data. Means, standard deviations and correlation analysis were carried out in order to meet the objectives of the study.

Demographic data revealed that 89.5% of the respondents were male. The respondents’ mean age was 45 years. Their average experience in the extension service was 15 years. The mean number of in-service training programs respondents attended during the last five years related to sustainable agriculture was three programs. The majority of the respondents had a master's or a doctoral degree. Most of the respondents were responsible for administration in addition to their primary responsibility in areas such as crops, horticulture and livestock extension.

Agricultural extension educators’ overall perceptions regarding sustainable agriculture was obtained by using a seven-item instrument. Four items in the instrument were positive statements about sustainable agriculture while three of them were negative about sustainable agriculture. Responses were obtained for these statements on a five-point Likert-type scale ranging from 1=strongly disagree to 5=strongly agree. Reverse values received for negative statements were added to the values received for positive statements to get the value.
for the overall perceptions regarding sustainable agriculture. This value ranged from 7 to 35. Higher values in this scale indicate the favorable perceptions regarding sustainable agriculture.

Findings indicated that extension educators’ general perceptions regarding sustainable agricultural practices were favorable. Respondents agreed with the benefits associated with sustainable agricultural practices. They also agreed that the diffusion of sustainable agricultural practices is more an educational process than a mere delivery of information about a technology. However sustainable agriculture was an ambiguous term to 43.2% of the extension educators in the sample. Respondents’ general perceptions about sustainable agriculture did not vary with their gender, age, levels of education, years of experience and number of inservice programs attended related to sustainable agriculture.

Extension educators’ perceptions regarding the teaching-learning process related to sustainable agriculture was identified on a five-point Likert-type scale ranging from 1=strongly disagree to 5=strongly agree. Respondents agreed that training programs should be built on the target participants’ needs and interests to derive a positive learning outcome. They agreed that a change of attitude is the most difficult learning outcome in teaching new agricultural practices. Experiential education programs, problem solving approaches and systems approaches were identified as effective teaching strategies to educate about sustainable agricultural practices. Respondents agreed that follow-ups to training programs are necessary to help participants. Respondents moderately agreed that extension education programs should be evaluated based on the accomplishments of the participants’ learning objectives as identified by the participants.
Agricultural extension educators’ perceptions regarding effective teaching methods and teaching tools were determined on a five-point Likert-type scale ranging from 1=not very effective to 5=very effective. Respondents perceived one-on-one instruction and demonstrations as effective teaching methods in educating farmers about sustainable agricultural practices. Group discussions and seminars were identified as moderately effective teaching methods. Field days, study tours and workshops were identified as effective teaching tools in educating people about sustainable agricultural practices. Respondents perceived slides and video-tapes as less effective teaching tools in educating people about sustainable agricultural practices.

Limitations to learning more about sustainable agriculture were indicated on a five-point Likert-type scale ranging from 1=not at all to 5=very much limiting. Respondents perceived availability of time as the most limiting factor for learning about sustainable agricultural practices. Training opportunities, networking opportunities, access to research information and clarity about the use of new agricultural technology were identified as somewhat limiting factors in learning about sustainable agricultural practices. A limited number of respondents identified negative attitudes toward sustainable agriculture, confusion about the definition of sustainable agriculture, lack of interest and demand for sustainable agriculture as important limiting factors for learning about sustainable agriculture.

Agricultural extension educators’ perceptions regarding the factors that influence their motivation for conducting extension programs were indicated on a five-point Likert scale ranging from 1=very low to 5=very high. Respondents perceived that professional commitment, positive attitudes toward the program, personal satisfaction, technical competency, appreciation of work and available technical support as highly motivating
factors for conducting extension programs. Respondents also perceived extension council interests, administrative support, and recognition of work as moderately motivating factors for conducting extension programs.

Agricultural extension educators’ self perceived motivation for extension work and learning about sustainable agriculture was obtained on a five-point Likert-type scale ranging from 1=very low to 5=very high. Findings show that agricultural extension educators’ motivation for extension work and learning about sustainable agriculture was high. However, findings show that respondents’ motivation for learning about sustainable agriculture was less than their motivation for extension work.

Correlation analysis revealed that there was a positive significant correlation between extension educators’ motivation for learning about sustainable agriculture and variables such as general perception about sustainable agriculture, motivation for work, number of inservice training programs attended and years of experience in the extension service. Therefore, partial correlation analysis was carried out to control the effects of the other three variables and elicit the correlation between the extension educators’ general perceptions about sustainable agriculture and their motivation for learning about sustainable agriculture.

Partial correlation analysis confirmed that there was a strong highly significant positive correlation between extension educators’ general perceptions about sustainable agriculture and their motivation for learning more about sustainable agriculture.
Conclusions

The findings of this study lead to following conclusions:

1. Agricultural extension educators in the North Central region of the United States were mainly a middle-aged group of people. Most of the respondents had extensive experience in the extension service. Predominantly, agricultural extension educators were found to be males. Relatively few inservice programs related to sustainable agriculture had been attended by most of the agricultural extension educators during the last five years.

2. Agricultural extension educators had a positive perception of sustainable agriculture. Their perceptions of sustainable agriculture did not vary with their age, gender, years of service in the extension system, number of inservice programs attended related to sustainable agriculture or levels of education. Agricultural extension educators perceived diffusion of sustainable agricultural practices such as integrated pest management as more an educational process than a mere delivery of information. However, sustainable agriculture was a confusing term for many agricultural extension educators.

3. Training programs should be built on the target participants’ needs and interests to derive a positive learning outcome.

4. Change of attitude was identified as the most difficult learning outcome to be reached.

5. Experiential learning approach, problem solving approach and a systems approach have been identified as effective delivery mechanisms in teaching concepts related to sustainable agriculture.

6. Follow-up to training programs was identified as a requirement for helping participants to resolve their learning problems.
7. One-on-one instruction, demonstrations and group discussions were considered most effective teaching methods and field trips, study tours and workshops were considered most effective teaching tools in educating farmers about sustainable agriculture.

8. Availability of time was the most limiting factor for agricultural extension educators learning about sustainable agriculture. Lack of client demand, negative attitudes toward sustainable agriculture and confusion about the definition of sustainable agriculture were also considered as significant constraints to learning about sustainable agriculture.

9. Agricultural extension educators perceived that they were highly motivated for extension work. Professional commitment, positive attitudes toward the program, personal satisfaction, technical competency, appreciation of work, and available technical support were important factors in determining agricultural extension educators’ motivation for extension work.

10. There was a strong positive correlation between the agricultural extension educators’ perceptions regarding sustainable agriculture and their motivation for learning about sustainable agriculture.

**Recommendations**

The following recommendations are based on the findings and conclusions of this study:

1. Well-designed educational programs grounded in adult learning principles should be used in order to facilitate the adoption and diffusion of sustainable agricultural practices.
2. It is necessary to facilitate the development of positive perceptions toward sustainable agriculture for motivating agricultural extension educators to learn more about sustainable agriculture.

3. Development of an acceptable working definition for sustainable agriculture should be considered as an important teaching-learning activity for building a common agreement toward the meaning of sustainable agriculture among agricultural extension educators.

4. Inservice educational programs should be built on the target participants’ needs and interests in order to derive positive learning outcomes.

5. Special emphasis should be made during educational programs in order to facilitate a change of attitude regarding sustainable agriculture.

6. An experiential learning approach, problem solving approach, and a systems approach should be considered as effective delivery mechanisms in teaching sustainable agricultural practices.

7. Time is the most important factor, which limits agricultural extension educators learning about sustainable agriculture. Therefore, it is necessary to pay special attention to minimizing travel time when inservice education programs are developed. Localized inservice programs may be an alternative.

8. In order to motivate agricultural extension educators in their extension work it is necessary to appreciate their work and help them develop technical competency by providing necessary technical support.

9. Extension professionals should make sure that they learn more about selected teaching methods and tools if sustainable agriculture topics are to be effectively presented to farmers.
Recommendations for Further Research

1. This study identified the relationship between perceptions about sustainable agriculture and participants' motivation for learning more about sustainable agriculture. Further research is needed to understand the causal relationship between the perceptions and learning motivation.

2. A similar study of farmers regarding their perceptions about appropriate learning processes should be conducted to identify preferred learning methods and barriers to learning about sustainable agriculture.

3. Internet and computer based educational programs in teaching farmers about sustainable agricultural practices should be studied in order to determine their effectiveness and appropriateness.

Implications and Educational Significance of the Study

The main purpose of this study was to identify agricultural extension educators' perceptions regarding the teaching learning processes related to sustainable agriculture with implications for agricultural extension education. Findings of this study can be generalized to the agricultural extension educators in the North Central region of the United States. Additionally, the findings may have implications to other regions in the United States. There are implications from this study for planning and delivery of extension education programs focused on sustainable agriculture.

Attempts to diffuse sustainable agricultural practices, such as integrated pest management, require an educational process. Diffusion of these practices can not occur by
merely delivering information on the subject. Therefore, it is necessary to develop well-designed educational programs focused on sustainable agriculture. Extension programs focused on sustainable agriculture should be developed based on the participants’ needs and interests.

According to this study and the review of literature, sustainable agriculture was an ambiguous term for agricultural extension educators. This implies the need for resolving the ambiguity over the meaning of sustainable agriculture. Therefore, it is important to help learners develop an acceptable working definition for sustainable agriculture. Additionally, the study clearly supports the notion that development of positive perceptions toward sustainable agriculture is a prerequisite for motivating extension educators to learn more about sustainable agriculture. Therefore, it is essential to design a favorable learning environment for participants to develop a positive perception toward sustainable agriculture. The controversy over the definition of sustainable agriculture has to be resolved at the beginning of the educational event in order to facilitate the learning process related to sustainable agricultural practices.
APPENDIX A. HUMAN SUBJECT APPROVAL FORM
### Checklist for Attachments and Time Schedule

The following are attached (please check):

12. X Letter or written statement to subjects indicating clearly:
   a) the 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
   d) if applicable, the location of the research activity
   e) how you will ensure confidentiality
   f) in a longitudinal study, when and how you will contact subjects later
   g) that participation is voluntary; nonparticipation will not affect evaluations of the subject

13. ☐ Signed consent form (if applicable)

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

15. X Data gathering instruments

16. Anticipated dates for contact with subjects:

<table>
<thead>
<tr>
<th>First contact</th>
<th>Last contact</th>
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<tr>
<td>01/20/2000</td>
<td>02/28/2000</td>
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</table>

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

<table>
<thead>
<tr>
<th>Date</th>
<th>Month/Day/Year</th>
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<tbody>
<tr>
<td>03/15/2000</td>
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</table>

18. Signature of Departmental Executive Officer

[Signature]

01/10/00

Agricultural Education & Studies

19. Decision of the University Human Subjects Review Committee:

☑ Project approved

☐ Project not approved

☐ No action required

Name of Human Subjects in Research Committee Chair

Patricia M. Keith

11/3/2000

[Signature]

http://www.grad-college.iastate.edu/forms/HumanSubjects.doc
APENDIX B. COVER LETTER AND QUESTIONNAIRE
Agricultural Extension Educators’ Perceptions Regarding the Teaching/Learning Process Used in Educating Farmers About Sustainable Agriculture Practices

Definition of Sustainable Agriculture

Sustainable agriculture is a farming system that is economically profitable, environmentally sound, and socially responsible (USDA, 1998).
Dear Extension Educator

There is a growing public concern over the environmental issues related to agriculture. Due to this public concern, policy-makers, researchers and educators have paid significant attention to sustainable agriculture related issues. Considerable public resources have been allocated for sustainable agriculture related research and extension work. There are many research and educational programs focused on sustainable agriculture throughout the United States.

However, very little information is available concerning the role of the teaching-learning process in extension education programs focused on sustainable agriculture practices. The purpose of this study is to identify perceptions regarding the role of the teaching-learning process in educating farmers about sustainable agricultural practices.

We are collecting information from Agricultural Extension Educators within the central states region of the U. S. A. We hope that you will help us in identifying the important aspects related to the teaching-learning process in delivering new agricultural practices such as sustainable agriculture. Your response to this questionnaire is very important.

Your response will be held in strict confidence and used for statistical purposes only. We are interested in group data only. The code number assigned to the questionnaire will be used only to identify non-respondents so that we can request them to return the survey form. All numbers are removed upon receipt of the questionnaires. Please consider that your participation in this research is voluntary and you are free to withdraw your participation at any time during the study. All instruments will be destroyed after the data is collected. Data from this study will be used to complete a Ph.D. dissertation. We greatly appreciate your cooperation in this study.

The questionnaire will take from 10-15 minutes to complete. Please return the questionnaire in the stamped, self-addressed envelope by April 21st.

Thank you for your cooperation.

Sincerely,

K. S. U. Jayaratne
Graduate Assistant

Robert A Martin
Professor & Head

Jerry Dewitt
Coordinator

Extension Sustainable Agriculture
I - Perceptions

Please indicate your level of agreement with each of the following statements about sustainable agriculture by circling the appropriate number on a 5-point scale (1=Strongly Disagree to 5=Strongly Agree).

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sustainable agriculture is an ambiguous term to me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td>2. Sustainable agriculture is useful to maintain long-term productivity of farming systems.</td>
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<tr>
<td>3. Farmers should be educated to use sustainable agriculture practices.</td>
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<td>4</td>
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<tr>
<td>4. Sustainable agriculture is not economically profitable.</td>
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<td>2</td>
<td>3</td>
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<td>5</td>
</tr>
<tr>
<td>5. Sustainable agriculture practices are useful to protect the environment.</td>
<td>1</td>
<td>2</td>
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</tr>
<tr>
<td>6. Sustainable agriculture practices are not easy to apply.</td>
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<td>2</td>
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<tr>
<td>7. Diffusion of a sustainable agriculture practice such as IPM is more an educational process than a delivery of information about a technology.</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<td>5</td>
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<tr>
<td>8. Sustainable agriculture practices can be applied only on small family farms.</td>
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<tr>
<td>9. Sustainable agriculture practices are beneficial to the whole community.</td>
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</tr>
<tr>
<td>10. I am not clear which agriculture practices are sustainable</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
II - Perceptions About the Teaching-Learning Process

Please indicate your level of agreement with each of the following statements about the teaching-learning process (The educational process by which knowledge, attitudes and skills are changed.) as it impacts acceptance of new agricultural practices such as integrated pest management (IPM) by circling the appropriate number on a 5-point scale (1=Strongly Disagree to 5=Strongly Agree).

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Training programs should be built around the target participants' needs and interests to derive a positive learning outcome.</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<td>5</td>
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<tr>
<td>2. A systems approach is the best way to construct a meaning when learning new agriculture practices.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3. Experiential educational programs are effective in learning about new agriculture practices.</td>
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<td>2</td>
<td>3</td>
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<td>5</td>
</tr>
<tr>
<td>4. The problem solving approach is very effective in teaching about new agricultural practices.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5. Change of attitude is the most difficult learning outcome to reach in teaching new agricultural practices.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6. Evaluation of extension training should be based on the accomplishment of the participants' learning objectives as identified by the participants.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7. Follow-ups to training programs are necessary to help participants to resolve issues and concerns about new agricultural practices.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
III - Limitations to Learning About Sustainable Agriculture Practices

To what extent do the following factors limit your learning about sustainable agricultural practices? (Please circle the appropriate number)

<table>
<thead>
<tr>
<th>Factor</th>
<th>Not at all</th>
<th>Very Little</th>
<th>Somewhat</th>
<th>Much</th>
<th>Very Much</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Access to instructional materials.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2. Access to research information.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3. Opportunity to interact with researchers.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4. Clarity about the use of new agricultural technology.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5. Training opportunities.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6. Networking opportunities.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7. Availability of time</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8. Other (Specify)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

IV - Teaching Methods and Tools:
How effective is each of the following teaching methods and tools in teaching and learning about new agricultural technology such as Integrated Pest Management?

<table>
<thead>
<tr>
<th>Teaching Methods</th>
<th>Not Very Effective</th>
<th>Somewhat Effective</th>
<th>Very Effective</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Group discussions</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>b. Lectures</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>c. Seminars</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>d. One-on-one instruction</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>e. Demonstrations</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>f. Other (Specify)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Teaching Tools</th>
<th>Not Very Effective</th>
<th>Somewhat Effective</th>
<th>Very Effective</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Field days</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>b. Study Tours</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>c. Workshops</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>d. Video tapes</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>e. Slides</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>f. Computer programs</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>g. Printed materials</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>h. Web-sites</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>i. Other (Specify)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
V - Motivation
To what extent do the following factors influence your motivation for conducting extension programs.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Very Low</th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
<th>Very High</th>
</tr>
</thead>
<tbody>
<tr>
<td>My technical competency.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Appreciation of my work.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Recognition of my work.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Administrative support.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Extension council interest.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Available technical support.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Personal satisfaction.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>My professional commitment.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>My positive attitudes toward the program.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Overall motivation

| 1. Indicate the level of motivation that you have for your work. | 1 | 2 | 3 | 4 | 5 |
| 2. Indicate your level of motivation for learning more about sustainable agriculture. | 1 | 2 | 3 | 4 | 5 |

VI. Demographic Information

1. What is your age? ____________ Years

2. What is your gender? (a) Male (b) Female

3. What is your highest educational attainment?
   (a) B.S. (b) M.S. (c) Ph.D.

4. What was your undergraduate major?
   (a) Agronomy (b) Animal science (c) Horticulture
   (d) Agricultural Education
   (e) Other (Specify)______________________________

5. How many years of experience do you have in the extension service? __________
6. What best described your area/areas of extension responsibility? (Please check all that applied to you)
   a. Crops
   b. Horticulture
   c. Livestock
   d. Natural resources
   e. Community Development
   f. Youth & 4H
   g. Administration
   h. Others (please specify) ______________________________________________________

7. How many times have you attended inservice training programs related to teaching about sustainable agriculture during the last five years? ______

VII. Suggestions to Improve Inservice

1. What specific suggestions do you have to improve inservice training programs on teaching about sustainable agriculture?
   ______________________________________________________
   ______________________________________________________
   ______________________________________________________
   ______________________________________________________

2. General comments
   ______________________________________________________
   ______________________________________________________
   ______________________________________________________
   ______
Thank you for your response. We appreciate your contribution to this study. Please return your questionnaire to following address (Please use the enclosed stamped envelop).

K.S.U. Jayaratne
Graduate Student

Robert A. Martin
Head/Professor
Department of Agricultural Education & Studies
Room 201
Iowa State University
Ames, IA 50011
APPENDIX C. FOLLOW-UP LETTER
Dear Extension Educator

We are collecting information from Agricultural Extension Educators within the North Central states region of the U. S. A. You were randomly selected to participate in this study. Two weeks ago, we mailed a survey questionnaire titled "Extension Educators’ Perceptions Regarding the Teaching-Learning Process Used in Educating Farmers About Sustainable Agriculture". We have yet to hear from you. We would really appreciate your input.

Please return the questionnaire by May 8th. If you already returned the questionnaire, please disregard this request.

Thank you for your cooperation.

Sincerely,

K. S. U. Jayaratne
Graduate Assistant

Robert A Martin
Professor & Head

Jerry Dewitt
Extension Sustainable Agriculture Coordinator
REFERENCES


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