Issues regarding sustainable agriculture as perceived by upper level undergraduate students involved in a student managed farm at Iowa State University

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Iowa State University

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Issues regarding sustainable agriculture as perceived by upper level undergraduate students involved in a student managed farm at Iowa State University

by

Awoke Desta Dollisso

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)

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2002

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Graduate College

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This is to certify that the doctoral dissertation of

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For the Major Program

For the Graduate College
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ABSTRACT

The purpose of this study was to identify the perceptions of agriculture students regarding sustainable agriculture practices, issues related to sustainable agriculture and learning/teaching processes. These students were enrolled in a capstone course that involved managing a 2000-acre operation. Fifty-seven students participated in this census study. Participants completed a survey questionnaire and a select group of students answered questions in a focus group interview.

The participants in this study perceived that the sustainable agriculture movement promotes environmental concerns about farming more than economic concerns. The participants were mildly interested in learning more about practicing sustainable agriculture practices and how to use them. The participants in this study were most concerned about expansion of large farms, urban use of farmland, soil erosion, and dependence on seed and chemical companies. Overall, the participants in this study were concerned about economic, environmental and social aspects of agriculture. Participants in this study indicated that they had long-term experiences using crop rotation practices while frequently using cultivation, leguminous plants and integrated pest management practices on their farms.

Participants in this study perceived that hands-on activities represent the most effective teaching and learning method. Demonstrations, field visits, face-to-face consultations and discussion represent effective methods for teaching and learning. Using a variety of teaching methods was considered effective. Family members and relatives were considered primary sources for agricultural information. Magazines, colleagues, seed and chemical companies and the Internet were frequently used sources for agricultural information. The Extension service was not perceived as a primary source of agricultural
information for these respondents. Magazines were the second most frequently used source of agricultural information for the respondents. Younger respondents tended to use the Internet, magazines, seed and chemical companies and family members more for agricultural information than older participants in the study do.

Overall, the participants in this study were concerned about economic, environmental and social aspects of sustainable agriculture, and they like to see equal emphasis be given to all aspects of sustainable agriculture. Agricultural educators should give equal emphasis to the economic, social and environmental aspects of sustainable agriculture curriculum design and delivery. Educators should also use hands-on teaching/learning methods and new computer technologies to enhance learning opportunities for students.
CHAPTER I. INTRODUCTION

The American food and fiber system has been described as a powerful industrial machine producing abundant food and robust exports. But cheap food and exports do not tell the whole story. The development and adoption of technologies for economic gain have frequently overlooked the environmental and social cost resulting from contemporary farming practices. The use of synthetic fertilizer and energy for cultivation, pesticides, and other practices has made agriculture dependent on fossil fuels. Soil erosion, contaminated water supplies, and health concerns have resulted from contemporary farming practices. Abundant food and hidden costs increasingly borne by the environment and society have placed American agriculture in a dilemma (Northwest Area Foundation. 1994).

A universal definition of sustainable agriculture does not exist. Definitions are commonly site-specific, depending upon who is doing the defining and the operational concepts and factors involved. One of the most comprehensive definitions was given in the 1990 U.S. Food, Agriculture, Conservation, and Trade Act (Farm Bill):

The term sustainable agriculture is an integrated system of plant and animal production practices having a site-specific application that will, over the long-term, satisfy human food and fiber needs; enhance the environmental quality and natural resources base upon which the agriculture economy depends; make the most efficient use of non-renewable resources, and on-farm resources and integrate, where appropriate, natural biological cycles and controls; sustain the economic viability of farm operations; and enhance the quality of life for farmers and society as a whole. (U.S. Congress. 1990, p.3)

The Council for Agricultural Science and Technology (1988) defined a long-term viable American agriculture system as one “...producing safe, abundant, and nutritious food supplies at reasonable cost to consumers while preserving the environment” (p. 10). The
outputs of such a system are economic returns, environmental protection, and social benefits, the outcomes supporting the philosophy of sustainable agriculture. "A shorthand definition for sustainability is 'forever'" (Keeney, 1989, p. 105).

An Experiment Station Committee on Organization and Policy (ECSOP) (1992) concluded that sustainable agriculture is important and foremost in the minds of the U.S. public. It envisioned an American food and fiber system that would be profitable for farmers, provide safe and abundant food for society, protect natural resources, depend more on renewable resources, support a high quality of life for farmers, protect the environment, support alternative production systems, and recognize the increasing global interdependencies of agriculture.

A Cooperative Extension Joint Committee on Sustainable Agriculture (1991) visualized sustainable agriculture as farming systems that are "economically sound, socially acceptable and environmentally benign" (p. 4). Thus, the long-term viability of America's food and fiber system can be divided into overlapping economic, environmental, and social dimensions.

The economic dimension of sustainable agriculture is concerned with profitability, farmers covering all costs and maintaining or even increasing output over the long run. To achieve this, special attention must be given to supply-demand balance, comparative advantage, commodity programs, and technology. Shifts in food consumption relating to the diet and health of consumers and quality assurance concerns will create instability and adjustment problems but do not threaten the long-term viability of American agriculture. Flexibility to respond to future food and fiber supply and demand is a sound strategy for economic viability. Greater attention must be given to the quality and marketing of
agricultural products in the future to maintain the global competitiveness of American agriculture (Council for Agricultural Science and Technology, 1988).

The environmental dimension is embedded in the fact that natural resources, along with science and technology, serve as a vital base for the American food and fiber system (Stansbury & Coulter, 1986). Environmental issues are a significant force in the need for agricultural sustainability. The Council for Agricultural Science and Technology (1988) concluded, “...The U. S. has a natural resource base to sustain a viable agricultural industry, but it is critical that new technologies and sound conservation practices be developed and employed to extend this viability to the long term” (p. 4). Attention must be given to not only proper use of natural resources but also to the “protection of land, air, water, and the resulting food products from contamination due to agricultural practices” (p. 3).

From a social perspective, the desired outcomes include a safe, abundant, and nutritious food supply at a reasonable cost while preserving the wholesomeness of our rural heritage. Benefits accruing to society and not just to the farm, consumer, or agency immediately affected are among the desired outcomes. e.g., application of pesticides significantly benefits producers and consumers in many instances but residues from chemical pesticides may lead to health concerns. “It is important for the public sector to monitor the food chain for residues harmful or potentially harmful to health because the market alone will not assure safety” (Council for Agricultural Science and Technology, 1988, p. 9).

The issue of agricultural sustainability has created a closer working dialog between the agricultural sector and the general public. The food and fiber system is beginning to recognize that it must provide not only what humanity needs today but also what future generations will require (Brady, 1990). The goal is to manage agricultural systems so that
inputs and returns are optimized while protecting the environment and responding to societal needs.

**Statement of the Problem**

Conventional farming practices have been successful in maximizing agricultural production, but in the meantime, conventional farming practices have compromising natural foundation of agriculture and jeopardizing sustainability of agriculture into the future.

Despite its success, however, our system of global food production is in the process of under-cutting the very foundation upon which it has been built. The techniques, innovations, practices and policies that have allowed increases in productivity have also undermined the basis for that productivity. They have overdrawn and degraded the natural resources upon which agriculture depends—soil, water resources, and natural genetic diversity. They have also created a dependence on nonrenewable fossil fuels and helped to forge a system ... In short, modern agriculture is unsustainable—it can't continue to produce enough food for the global population over the long term because it deteriorates the conditions that make agriculture possible. (Gliessman 1998. p.3)

Altieri (1998) identified multiple problems that are related to modern agricultural practices. Altieri stated that excessive reliance on crop specialization, inputs such as capital-intensive technology, pesticides and synthetic fertilizers have negatively impacted rural communities and the environment. Altieri called these problems "ecological diseases" that are associated with intensified food production and grouped them into two categories. The first has to do with basic resources of soil and water which may lead to soil erosion, loss of soil productivity, depletion of nutrient reserves, salinization, alkalinization, pollution of surface and ground water and loss of farm land to urban development. The problems in the second category are directly related to crops, animals and pests that may lead to crop loss, wild plants, and animal genetic resources, elimination of natural enemies, etc.
Pesticide detection in ground water due to normal agricultural practices is alarming. The committee on the role of Alternative Farming Methods in Modern Production Agriculture (1989) stated that USDA calculations showed that 1,437 counties, or 46 percent of all U.S. counties, contain ground water susceptible to contamination from agricultural pesticides and fertilizers. Fifty-four percent of the people who live in these counties depend on underground sources of water.

Duffy (1991) stated that in 1988, 96 percent of the corn and soybean fields were treated with herbicides in the United States. He further indicated that the average fertilizer application was 137 pounds of nitrogen, 63 pounds of phosphate, and 85 pounds of potash per acre. Duffy stated that the domination of input dependence is so great that many farmers don’t consider the contribution of the internal resources such as manure, soil structure, leguminous plants, etc.

Magdoff, Foster and Buttel (1998) stated that the immediate purpose of capitalist agribusiness food production “... is not human sustenance and well-being but the growth of profit” (p.3). They point out that the food system consists not of farmers only who produce food, but also huge industries that supply farmers seed and heavy machinery, and the mega-industries that process, package and distribute food. Basically, these conditions make farmers dependent on external forces and shape the design and activities of their farm operations.

Magdoff, Foster and Buttel (1998) identified the following agriculture related problems or issues: 1) growing popular fear over possible pesticide contamination and/or microbiological safety of food; 2) concentration of ownership and control in the production, processing, and marketing of food; 3) safety of farmers and farm-workers when using
pesticides; 4) the heavy dependence on nonrenewable resources; 5) the rush to use genetically modified plants, animals and microorganisms; 6) contamination of surface and ground waters with pesticides and nutrients; 7) low returns for most farmers; 8) low wages and poor working and living conditions for farm-workers; 9) cruel treatment of livestock; and 10) inadequate access to food by poor people.

The road to sustainability is not one and the same for all people. For example, Avery & Avery (1996) strongly argue that conventional farming practices are the best means to achieve agricultural sustainability. Their views are best expressed in their own words. Thus multiple quotes from their work help provide their views:

The large increase in world food needs during the next fifty years will amplify the consequences of any policies and practices that lower farm productivity. Today’s modern high-yield farming practices are continuing to change and improve in efficiency, safety, and sensitivity to the environment in direct proportion to our investments in agricultural research and technology. (Avery & Avery, 1996. p.1)

The leading threat to the world’s wildlife is the potential loss of habitat to low-yield farming. Agriculture dominates the world’s land use: already, one-third of the earth’s land surface is in agriculture and one-third is forest as “left over” from farming. (Avery & Avery, 1996. pp.3)

The best agricultural land also tends to have the least biodiversity. There is very little direct conflict between feeding the world and keeping the remaining wildlife as we triple world food output--if we continue to raise the yields per acre as we have for the past half-century. (Avery & Avery, 1996. p.4)

We are not certain that high-yield agriculture can feed everyone and save all the wildlife habitat. We are certain that low-yield agriculture cannot. The real myth is that low-yield farming sustains the environment. (Avery & Avery, 1996. p.7)

Agrochemicals are not a documented threat to the survival of a single species. They do not seriously threaten even the species we are deliberately trying to eradicate. Moreover, pesticide bans would cause yield reductions that would lead to significant loss of wildlife habitat. (Avery & Avery, 1996. p.10)

Chemicals make fruits and vegetables, our strongest weapon against cancer, cheaper and available for more of the year. Five servings per day will cut a person’s cancer
risk by 50 percent, dwarfing any theoretical cancer risk from pesticide residues. (Avery & Avery, 1996, p.11)

Plants absorb all nitrogen fertilizers in an inorganic form regardless of whether the nitrogen comes from organic or inorganic sources. This means that organic nitrogen fertilizers, such as manure, have no advantage over synthetic nitrogen from the plant’s perspective. (Avery & Avery, 1996, p.12)

Organic fertilizers are produced at a heavy cost – in land required for pasture or green manure crops. Because of this land requirement, synthetic nitrogen fertilizers are the only practical way to maintain soil fertility on the majority of the world’s fields. (Avery & Avery, 1996, p.13)

Farm programs have contributed to the increase in farm size and destabilization of rural communities: price supports and payments have encouraged farmers to use debt leverage to buy out neighbors’ farms. (Avery & Avery, 1996, p.15)

If Americans and the government are concerned about sustaining viable rural communities, we should work to eliminate international barriers to free trade in agricultural products, improve infrastructure, and protect farmers’ freedom to utilize competitive farming structures. (Avery & Avery, 1996, p.16)

Avery & Avery (1996) tend to equate low output agriculture and sustainable agriculture. One might ask if this linkage is appropriate. Obviously, not all authors agree.

Agunga (1995) indicated that a majority of the Extension educators surveyed in his study lacked understanding of sustainable agriculture concepts. Agunga recommended in-service training for Extension agents, in order to prepare them to educate farmers. He further proposed including sustainable agriculture in agricultural education curriculum in the land grant universities so that future Extension agents are prepared to educate farmers.

Just as research and education played a major role in developing the abundant food supply Americans now enjoy and share globally, research and education can also support the goals of producing food and fiber using practices and technologies that are not only profitable, but also environmentally sound and socially acceptable. Williams and Dollisso (1998) advanced that the discipline of agricultural education (teaching and learning in
agriculture) should be a partner in sustainable agriculture research and education. The processes of program planning, program delivery, and program evaluation are valuable tools agricultural education has to offer to a partnership with research and education organizations that focus on sustainable agriculture initiatives.

**Need for the Study**

Gliessman (1998) explains how one farmer's action could affect another farmer and society as a whole. Gliessman uses, for example, a farmer who lives upstream and the other farmer who lives downstream with each one taking care of their farms. Gliessman states, "One reason is that each individual farmer has less and less control over what flows into his or her pool from upstream. Many unwanted things come from upstream, including pesticides, weed seeds, diseases, and polluted water from other farms" (p.316). Gliessman points out that the problem is further muddied by legislated farm policies, unexpected effects of weather and the market, making the job of keeping an individual farm clean very difficult.

If agriculture is to continue as an economic activity into the long-term future, the economic context in which it is practiced must undergo a fundamental shift. We must recognize, first of all, that a healthy economy ultimately depends on a healthy environment—that agricultural production has an ecological foundation that can be destroyed. (Gliessman 1998, p.317)

The issues and problems that are related to agriculture are complex. The negative impacts of current agricultural practices are threatening sustainability of agriculture. The magnitude of these problems warrants change in the attitude and practice of all players in the agricultural industry: producers, processors and packagers, distributors and consumers. This study focused on producers/farmers. The best way to bring about change in attitude and practice is through education. Rachal in Merriam and Cunningham (1989) stated, "... adult
education can and should play an integral role in improving not only individuals' lives, but also in improving society; adult education can promote change as well as react to it" (p.4). However, the change has to be based on a research-based knowledge. Gliessman (1998) proposed changes on two fronts. First, Gliessman argues that change must occur in agricultural research institutions that are involved in expanding agricultural knowledge. “...We must learn to use more foresight in our analysis to avoid problems or negative changes before they occur. Our ability to solve the problems that our current agriculture faces has so far been extremely limited” (p.324). Second, farmers who make the transition to alternative farming practices are leading the way. “…The more examples we have of sustainable, ecologically viable farming, the more likely the possibility that our food production systems follow their lead” (p.324). Gliessman further stated that agricultural systems are a result of the “coevolution” that occurs between culture and environment, thus, humans have capacity to guide its direction.

The Purpose of the Study

The purpose of this study was to identify and analyze the perceptions of students enrolled in Agricultural Education and Studies (AGEDS 450) class in the Fall 2000 and Spring 2001 regarding sustainable agriculture, issues related to sustainable agriculture and preferred learning/teaching methods for sustainable agriculture education. The findings of this study may provide research-based information to improve AGEDS 450 curriculum, and to develop and deliver sustainable agriculture education programs to farmers. Specific objectives of this study were to:

1. identify participants' perceptions regarding sustainable agriculture;
2. determine participants' level of concern regarding agricultural issues;
3. determine the extent to which participants had experiences with sustainable agriculture practices;
4. identify participants' perceptions regarding motivation to learn sustainable agriculture practices;
5. identify participants' perceptions regarding preferred teaching/learning methods for sustainable agriculture education;
6. identify sources of agricultural information used by these participants;
7. identify the demographic characteristics and conduct comparisons with selected variables in the study.

Until recently, the emphasis in agriculture has been on maximizing production. For the most part, this goal has been achieved using genetic innovations, scientific farming techniques, using new and advanced technologies, controlling diseases, pests and weeds with chemicals, and extensive use of fertilizers. However, relentless pursuit for production increases may have compromised ecological sustainability of food production systems, safety of produced foods for human consumption and welfare of the environment.

The challenge is influencing the attitudes and practices of those who are involved in the agricultural industry from production to consumption through education. This study was designed to contribute to our understanding of the participants' perceptions regarding sustainable agriculture concepts and practices. The findings may be helpful in program planning, implementation/delivery and evaluation.
Definitions of Terms

Adult Education — Educational opportunities organized for adult learners for the purpose of meeting individual, community and societal needs.

Ag 450 Farm — A farm that is used for a hands-on, experiential learning course where students are responsible for making management and operation decisions from planning and record keeping, to buying and selling the farm’s livestock, crops, and equipment.

Biomass — Living things and decaying matter in the soil (organic matter).

Cover crop - A crop that is grown to reduce erosion. increase organic matter. retain moisture. improve soil structure. etc.

Crop residues — The remains of crop plants left in the fields to protect soil erosion and supply organic matter.

Crop rotation — Alternating crops rather than planting the same crop in the same field again and again.

Cultivation — Breaking up the soil using mechanical tools to remove weeds and aerate the soil to facilitate successful growth of a crop plants.

Inputs — Commercial products purchased and used in farm operations to enhance productivity, control disease and supply energy.

Integrated Pest Management — A pest management system using mainly biological or natural control systems.

Low Intensity Animal Production — A livestock production system that makes a minimum capital investment on infrastructure. consumes no/minimal amount of purchased inputs. and less stressful to animals while it is environmentally friendly.

Motivation — A driving force/desire behind an action.
Output – Produce for commercial purposes from farming operations.

Participation – The mental awareness, understanding and interpretation of something/situation at any given time.

Pasture rotation - Rotation practice from one pasture to another to ensure soil protection and better use of pastures.

Pesticides – Purchased chemical inputs that are used by farm operators to control diseases, weeds and insects.

Sustainable Agriculture – Farming systems that are economically profitable, environmentally sound and socially acceptable.
CHAPTER II. LITERATURE REVIEW

The purpose of this study was to identify and analyze the perceptions of students enrolled in Agricultural Education and Studies (AGEDS 450) class in the Fall 2000 and Spring 2001 regarding sustainable agriculture practices, issues related to sustainable agriculture and preferred learning/teaching methods for sustainable agriculture education. The findings of this study may provide research-based information to improve AGEDS 450 curriculum and to develop and deliver sustainable agriculture education programs to farmers. Specific objectives of this study were to: 1) identify participants' perceptions regarding sustainable agriculture; 2) determine participants' level of concern regarding agricultural issues; 3) determine the extent to which participants had experiences with sustainable agriculture practices; 4) identify participants' perceptions regarding motivation to learn sustainable agriculture practices; 5) identify participants' perceptions regarding preferred teaching/learning methods for sustainable agriculture education; 6) identify sources of agricultural information used by these participants; 7) identify the demographic characteristics and conduct comparisons with selected variables in the study. The theoretical framework for this study was based on the principles of sustainable agriculture and adult and extension education.

Sustainable Agriculture

Sustainable agriculture ought to be based on sound agronomic principles. These principles include soil erosion control, weed management, maximum efficiency of on-farm and purchased inputs, minimal leaching of pollutants through the root zone, maintenance of soil fertility by proper addition of plant nutrients, and utilization of biological principles.
throughout the farming operations (Keeney, 1989). Soil building, organic matter management, tillage, careful use of synthetic chemicals, crop rotation, animal manure, and soil microorganisms and soil animals (nematodes, insects, earthworms, etc.) are especially important in the transition to more sustainable farming practices (Liebhardt & Werner, 1991). “Topsoil is particularly critical because of its slow rate of regeneration and its proven effect on crop yields, resistance to water stress, and degradation of pollutants” (Keeney, 1990. p. 282). Issues of nitrogen management, pesticide use on crops, soil erosion, crop rotations, and handling of animal waste are also key components of sustainable agriculture (Keeney, 1989).

The National Research Council identified the following four goals for sustainable agriculture:

a) Management of agricultural activities to protect air, soil, and water quality, and to conserve wildlife habitat and biodiversity, thereby increasing agriculture’s long-term productivity and profitability, as well as enhancing human health and well-being.
b) Achievement of viable farmers and farm communities.
c) Production of a safe, high-quality, and affordable supply of food and fiber in a manner that protects and conserves natural resources.
d) Creation of institutional incentives and funding arrangements that focus public and private research, education, and funding technology development on integrating agricultural productivity and profitability with environmental stewardship. (National Research Council, 1989. p. 8)

Pretty (1995) classified sustainable agriculture developments into four multifunctional technologies: (1) integrated pest management (IPM), (2) integrated plant nutrition, (3) soil conservation, and (4) water management. IPM mixes cultural and biological controls in systematic ways to control pests while minimizing harm to the environment. Establishment of acceptable economic thresholds for pest populations and constant field monitoring of the pest problem is crucial in this ecologically based approach to pest control (Iowa State University, 1995). IPM strategies identified by Pretty (1995) include:
(1) using resistant varieties and breeds, (2) using alternative natural pesticides, (3) using bacterial and viral pesticides, (4) cutting input use in industrialized systems, (5) using synthetic chemicals that disrupt pest reproduction, (6) releasing predators and parasites, (7) improving the habitat for natural enemies, and (8) rotation and multiple cropping.

Integrated plant nutrition includes use of fertilizers and adoption of alternative sources of plant nutrients. Practices and technologies currently being used or researched include: (1) tailoring fertilizer recommendations directly to each field and crop, (2) using livestock manure and compost, (3) growing legumes and green manure crops together with or before cereal crops, (4) growing algae on a water surface in rice or other fields to fix atmospheric nitrogen, and (5) using agro-forestry practices (Pretty, 1995).

Lowrance (1990) described alternative farming systems in two parts: alternative farming systems approach and alternative chemical management approach.

1. Alternative farming systems approach:
   - reduced reliance on or elimination of chemicals for pest control and chemical fertilizer for nitrogen management.
   - increased reliance on legumes, cover crops, crop rotations, and animal manure for fertility management.
   - increased reliance on crop rotations, tillage, cover crops, and biological control of insects, nematodes, diseases, and weeds.
   - a shift to alternative crops when previous management systems are unsuccessful for agronomic goals or environmental protection.
   - selection of crops based on market conditioned rotation requirements, land capabilities and pest pressures.

2. The alternative chemical management approach includes:
   - continued reliance on chemicals for pest control and fertilizer for nitrogen management.
   - application of chemicals based on more precise calculations of need and timing of need.
   - reliance on the development of new technologies for chemical application to retain hydrologically active chemicals in the root zone.
   - a shift to alternative chemicals when management of previous chemicals is unsuccessful for agronomic goals or environmental protection.
   - selection of crop-based conditions, and availability of chemical technologies. (p.52)
The idea of conserving soil and water is neither new nor outdated. Helms (1987, p. 175) described soil conservation as "an old-time religion." emphasizing the use of practices that support an enduring agriculture. Hess (1991, p. 66) in describing the importance of water management stated "not only our economic welfare, but also the quality of our lives depends on our ability to develop agricultural systems that produce efficiently while sustaining our natural water resources."

Publications by the Leopold Center for Sustainable Agriculture at Iowa State University (1995, 1996, 1997 & 1998) grouped its funded sustainable agriculture research projects into the following areas: 1) agroecology (impact of agricultural practices on the natural ecosystem), 2) animal and manure management, 3) integrated pest management, 4) cropping systems, 5) grazing and forage management, 6) integrated crop and livestock production systems, and 7) water and soil quality. Also featured were educational projects on fisheries and wildlife, training of fertilizer and agricultural chemical dealers on emerging practices consistent with sustainable agriculture principles, promotion of interaction between rural and urban dwellers, and biological components of soils.

Precision (or space age) agriculture is complementary to sustainable agriculture. Both use a systems approach to decision-making. Identification of variability within a field and managing the variability to increase production and profits is commonly called precision agriculture (Iowa State University, 1997). Its major objectives are to increase production efficiency, improve product quality, use of chemicals efficiently, conserve energy, and protect soil and groundwater (Roberson, 1998). Examples of precision agriculture strategies that are being researched and practiced include (1) monitoring yields using the Global Positioning System (GPS), (2) mapping yield data for fields, (3) using grid soil sampling, (4)
scouting for weeds, insects and diseases in crops, and (5) keeping records and analysis (Iowa State University, 1997). Precision agriculture may have the potential to improve farm profitability and reduce environmental spillover from agricultural practices (National Research Council, 1997).

Dillman (1986) connected the emergence of the American Extension system to three distinct eras: community control, mass society and the information age. In the community control era, extension agents knew and worked closely with leaders of the rural communities to bring about change. In the mass society era, the population grew, education and cities expanded and people became mobile. In this era, Extension adopted mass media to channel its educational programs. Today, we are in the midst of the information age where many options are provided to farmers and the public at large. Blackburn and Flaherty (1994) stated, "...once again, Extension faces renewed pressure to make some fundamental changes in order to remain relevant to the needs of the existing social order" (p. 10). Lanham & Cowan (1990) stated that the dominant resource currently in the world is information, thus, the scope, magnitude and dynamics of this information age makes education a difficult task.

Dollisso and Martin (2001) reported that farmers used magazines, neighbors and Extension as their main sources of agricultural information. Nieto and Henderson (1992) reported that ... farmers preferred veterinarians, county extension agents, and neighbors as information sources. Bruening and Martin (1992) found that field demonstrations and county meetings were useful information sources on groundwater, water quality and soil conservation. They further stated that extension and state universities were useful sources of educational information for farmers.
Bird et al. (1995) reported that although farmers use a variety of sources for agricultural information to make decisions, traditional ways of getting information through mass media has not been effectively utilized by sustainable agriculture farmers in Iowa. Survey findings by the North-West Area Foundation (1994) revealed that farmers who practice sustainable agriculture in Iowa don’t depend on experts for agricultural information related to sustainable agriculture. The study further indicated that two-thirds of the farmers in Iowa had not used Extension services. However, Padgitt and Lasley (1993) reported that educational agencies played a major role in providing educational information to farmers and had influence on farm operation decisions.

Lockie et al. (1995) stated that farmers have management options to choose such as: a) selection of species and varieties that are well suited to the site and the conditions on the farm; b) diversification of crops, livestock, and cultural practices to enhance the biological and economic stability of the farm; c) management of the soil to enhance and protect soil quality; d) efficient and humane use of inputs; and e) considerations of farmers’ goals and lifestyle choices.

Gardner et al. (1995) defined sustainable farmers as those who reduce dependency on synthetic, commercial fertilizers and pesticides in order to develop ecological practices such as crop rotations and livestock integration. Bultena et al. (1995) stated that farmers adopt sustainable agriculture practices for economic, environmental and health reasons. Farmers who adopt alternative farming systems often have productive and profitable operations, even though these farms usually function with relatively little help from commodity income and price support programs or Extension (National Research Council. 1989, p.8).
Overall, sustainable agriculture literature shows that the problems that have been arising from conventional farming practices call for sustainable agriculture research and education. Sustainable agriculture requires a systems and multidisciplinary approach to research and education. Sustainable agriculture may be achieved when the policy makers, researchers, educators and practitioners work together to the same end. The intended audiences for this study are researcher and educators. The literature indicates the need for education in sustainable agriculture. Educational efforts may succeed when they are established on sound learning and teaching processes. Thus, a focus on an adult education theoretical framework will provide the basis for study of the educational processes in relation to the use of sustainable agriculture practices.

**Adult and Extension Education**

Liveright and Haygood (1969) defined adult education as “A process whereby persons who no longer attend school on a regular full-time basis ...undertake sequential and organized activities with the conscious intention of bringing about changes in information. knowledge, understanding or skill. appreciation and attitudes; or for the purpose of identifying or solving personal or community problems.” (p. 8) Drakenwald and Merriam (1982) stated that adult education is “a process whereby persons whose major social roles are characteristic of adult status undertake systematic and sustained learning activities for the purpose of bringing about changes in knowledge, attitudes, values or skills.” (p. 9)

Bedar (1989) collapsed the purposes of adult education into four major categories: 1) to facilitate change in a dynamic society; 2) to support and maintain the good social order; 3) to promote productivity; and 4) to enhance personal growth (p. 39). Bedar further stated that
the above four purposes are interrelated; thus, any success or failure in achieving anyone of
the purposes affects all of them. To practice sustainable agriculture, farmers need to learn
and understand the concepts and practices of sustainable agriculture. Learning is a process.
and adult education principles provide that process.

Wain (1987) stated that “Lifelong education provides individuals and society with
opportunities not only to adapt to change but also to participate in change and to innovate.
Lifelong education is rooted in the community, which performs an important educative role:
life itself is seen as the major source of learning. The ultimate goal of lifelong education is to
maintain and improve the quality of life (Cited in Wain, 1987, p. 38).

Elias and Merriam (1980) pointed out:

Elements of progressive thoughts are found in the writings of all major theorists in the
field of adult education including Knowles, Rogers, Houle, Tyler, Lindeman,
Bergevin and Freire. Many forms of adult education were inspired by progressive
ideals: adult vocational education, extension education. ... and education for social
action. In addition some of the basic principles in adult education originated in
progressive thought: needs and interests, the scientific methods, problem solving
techniques, the centrality of experience, pragmatic and utilitarian goals, and the idea
of social responsibility, (p. 45)

Elias & Merriam (1980) further stated that progressives gave education a new focus
by broadening the view of education to include the personal experiences and interactions of
students—the learners with their personal needs, interests, experiences, and desires.

Lindeman (1926) laid a foundation for adult learning by stating that adults look for useful
knowledge to solve real life problems:

Every adult person finds himself in specific situations with respect to his work, his
recreation, his family-life, his community-life. et cetera-situations which call for
adjustments. Adult education begins at this point. Subject matter brought into
education, is put to work, when needed. Texts and teachers play a new and secondary
role in this type of education; they must give way to the primary importance of the
learner. (pp. 8-9)
Knowles (1977) stated that “a new idea was infused into Extension to give more emphasis on the full scope of life problems of all the people. problems that are related to agriculture, politics, social and moral issues” (p. 49). Knowles (1980) identified five characteristics of adult learners:

1. As a person matures, he or she becomes an independent and self-directed human being.
2. An adult has a reservoir of experience that can be used as a resource for learning.
3. An adult learner’s readiness to learn is related to the developmental task of his or her social role.
4. There is a change in time perspective as people mature for future application of knowledge to immediacy of application. Thus an adult is more problem-centered than subject-centered in learning. (Knowles. 1980. pp. 44-45).
5. Adults are motivated to learn by internal factors rather than external ones. (Knowles. 1984, p. 12)

Bergevin (1967) called for adult education to use problem-centered or situational approaches. Lindeman (1956, p. 160) and Benne (1957, p.149) asserted that adults learn not for the purpose of accumulation of knowledge but to solve problems that they face in real-life situations. Johnstone and Rivera’s (1965) findings show that adult learners prefer “practical over academic: applied over theoretical: and skill over knowledge or information” (p.3).

Mezirow (1985) described the process of learning and problem solving as instrumental learning, whereby adult learners use the new skill or knowledge to adapt to their changing environment.

Merriam and Caffarella (1991) described the voluntary nature of adult education that unlike pre-adult education, adult education has been mainly voluntary activity. They further stated that providers of adult education need to know who is and who is not involved, and why. Wlodkowski (1985) stated that when adults are given what they need and desire. "they
will tend to be highly motivated.” Merriam and Cunningham (1989) noted that the relationship between the adult learner and teacher is considered collaborative.

Gagne (1977) described a learning model that pertains to individuals of all ages elaborating on the problem-solving cycle. He stated that when farmers encounter a problem, they first observe the situation, formulate ideas about the problem, and in most cases identify the problem and immediately seek solutions for the problem. Gagne identified this stage as hypothesis testing. After alternative solutions to the problem are tested and the solution becomes clear, the problem is not considered a problem anymore. Mezirow (1981) stated that individuals become receptive to learning when a crisis occurs that conflicts with his/her experiences.

Rogers (1969) emphasized self-actualization of the learner as a goal of education and proposed an experiential learning theory asserting that learners depend on their past experiences to formulate the current situation. He stated that: 1) the learner must perceive the relevance of the subject matter; 2) learning involves a change in self-perception; 3) learning occurs when the self is not threatened; 4) learning is facilitated by doing; 5) learning is facilitated when the learner actively participates in the process and 6) self-directed learning involves the whole person.

Galbraith (1990) stated that educators should “Know and emphasize the felt needs of the learners throughout the instructional process. … When adults know from the beginning that their learning outcomes will be shared and available to their fellow learners, their motivation for the learning task is usually increased” (pp. 112-113).

Bruening and Martin (1991) documented the following principles for adult agricultural education: 1) knowledge and skills should be used in the “real world” soon after
learning; 2) the learning process should be applied; 3) instructors should be competent, enthusiastic and be able to communicate; 4) instructional process should have a clear objective and a definite evaluation component; 5) positive reinforcement is critical when application of knowledge and skills is correct; and 6) there should be interaction of participants.

Van den Ban and Hawkins (1996) argue that farmers will learn more when their experiences in their own fields are used as a learning situation rather than when they merely listen passively to the instructor. Brundage and Mackeracher (1980) contended that adult learning is facilitated when the learner’s interpretation of his or her own experience is accepted as valid and considered as a resource for future use. Brundage and Mackeracher further stated that adult education rendered adults the opportunity to discover, mature as individuals and contribute to the society at large.

Blackburn (1994) explained that program planners are concerned about a long-term goal, extension agents are concerned about what they need to do next month, and farmers are concerned whether or not the program is worth attending. Tough (1968) stated that each adult learner engages in a learning activity for multiple reasons, including the use of knowledge or skills to take action. An adult is more problem-centered than subject-centered in learning (Knowles, 1980), and adults are motivated to learn by internal factors rather than external ones (Knowles, 1984).

Knowles (1984) argued that the process of adult education program planning should carry the following: 1) creating an appropriate and comfortable physical environment; 2) mutual planning of the learner and program planner; 3) participation in the decision-making and identifying their own needs; 4) learners should identify their own learning objectives; 5)
individualizing instruction; 6) flexibility to adjust to conditions as they change; and finally, 7) learners should evaluate themselves comparing their achievements with the original objectives.

Waldron and Moore (1994) pointed out "...the social power of the new technologies does not reside in the technology itself but in the creative imagination of people in identifying a human need and harnessing the technology to serve that need. ... Good Extension has always been found in good programming and this continues to be the case. Nothing has changed with the new communications technologies except to emphasize this Extension principle" (pp. 169-170).

Educational programs serve as a medium by which scientific findings, skills, and knowledge are transferred from educational and research institutions to farmers to improve their productivity, profitability, and living standard. "Interest in the literature on systematic planning has remained high throughout the intervening years because of the need to design educational programs—a complex decision process...." (Marriam and Cunningham 1989. p. 233).

Rusmore (1995) promoted the use of participatory programming encouraging utilization of the available opportunities in the area by Extension and farmers themselves to initiate educational workshops, focus group priority setting, farm experimentation, and farm tours. Francis (1990) stated that farmers are the ones who decide what is best for their own condition; thus, research should provide credible results, and Extension should provide educational opportunities in a format that is easy to understand, apply and evaluate.

The first significant research in adult motivational orientation of participation was completed by Houle and published in *The Inquiring Mind* (1961. 1979). Houle found three
learning orientations held by adults he interviewed: the goal-oriented, the activity-oriented, and the learning-oriented. Cross (1981) identified the works of four scholars on the motivation for adult education as promising. Force-field analysis theory was developed based on Maslow’s “hierarchy of needs.” These needs are physiological, safety, belonging and love, esteem, and self-actualization. Maslow (1970) stated that people cannot be concerned about recognition, achievement and self-actualization until they meet their basic needs for survival, safety and belonging. The Expectancy-Valence paradigm theory was developed by Rubenson (1977, cited by Cross, 1981) stated that the “valence” depends on the anticipated consequences of participation: for example, “participation in adult education can lead to higher pay, but it can also mean seeing less of the family” (p. 116). “Human motivation is not unitary: it is a configuration of many components” (Warren, 1973. p. 2). Burgess’ (1971) survey results revealed seven motivational desires: to know. to reach a personal goal, to reach a social goal. to reach a religious goal. to escape. to take part in a social activity, and to comply with a formal requirement.

Brundage and Mackeracher (1980) reported that motives arise internally. They recommended the following four steps for educators to use to maintain a high level of learner motivation: 1) discovering, through consultation, what the prime motives and specific learning needs of each individual learner are; 2) assisting the learner to establish specific objectives which can be translated into specific behaviors and hence into specified feedback: 3) providing feedback on the basis of these decisions: and 4) allowing the feeling of success and satisfaction from these processes to be the major reinforcements of learning (p. 40). Keller and Suzuki (1988) and Keller and Kopp (1987) identified four motivational factors for learning: attention, relevance, confidence, and satisfaction.
Oaklief's and Oaklief's (1982) findings showed that adults participate in educational programs for non-economic benefits, that is, to gain skills to learn more. Hey (1976) stated that adult learners' motivation is related to basic human curiosity besides other factors.

Wlodkowski (1985) listed five critical assumptions about adult motivation to learn: 1) people are always motivated; 2) people are responsible for their own motivation; 3) if anything can be learned, it can be learned in a motivating manner; 4) there is no one best way to instruct; and 5) every instructional plan needs a motivational plan (pp. 12-15). Blackburn (1994) stated, “Indeed, those who apparently lack the motivation to apply the knowledge that is being dispersed often do not perceive their situation in the same way as those who attempt to teach them” (p. 27). Adult education literature indicates that adult learners are interested in practical knowledge.

Curriculum Development

The needs assessment practice in adult education for the purpose of program planning is based on the concept of the learner's needs because the adult learner is “a self-directing organism with initiative, intentions, choices, freedom, energy and responsibility” (Tough, 1971. p. 5). Tyler (1949) identified four fundamental steps for program/curriculum development and instruction: 1) identify educational purposes/objectives to be attain; 2) select learning experiences that are likely to be useful in attaining these objectives; 3) organize learning experiences for effective instruction; and 4) evaluate the effectiveness of learning experiences. Tyler further proposed an objectives-based, seven step approach to evaluation: 1) establish broad goals or objectives; 2) classify the goals or objectives; 3) define objectives in behavior terms; 4) find situations in which achievement of objectives can be
shown; 5) develop or select measurement techniques; 6) collect performance data; 7) compare performance data with behaviorally stated objectives.

Leopold (1949) had a broad vision for land stewardship that provided a base upon which the sustainable agriculture movement has been built. He advocated a land ethic where people are members of a community of interdependent parts including soil, water, plants, and animals, or, collectively, the land. Education was an integral part of Leopold’s vision, believing that well-informed citizens would be good stewards of the land, allowing for its self-renewal. In developing a rationale for research on including sustainable agriculture in the secondary school agricultural education curriculum, Williams and Dollisso (1998) stated that “sustainable agriculture embraces a multidisciplinary approach to developing new science and technology to solve problems facing the food and fiber system and society in general” (p. 54).

Agricultural education ... can help to develop the agricultural industry of the 21st century by incorporating sustainable agriculture into the curriculum. The aim of sustainable agriculture is to manage agricultural systems so that the environment is protected while inputs and returns are optimized. New areas of science and technology that address current issues in agriculture can energize the curriculum... (Williams L., 1997, pp.10-11)

Rather than studying small parts of agriculture or solving narrow production problems, the study of sustainability issues encourages the use of holistic and integrative approaches to education (Vehoviak. Adams. & Bruening. 1994). Multidisciplinary knowledge allows for curriculum organization based on societal "...problems and needs of students that demand personal and social understanding and action" (Tanner and Tanner. 1995, p. 391). In explaining a new agricultural curriculum, Lee & Thomas (1995) stated that science principles and application will continue to be very beneficial in the future.
There is a need for agricultural education to incorporate concepts of sustainable agriculture in the curriculum. Although formal curricula in sustainable agriculture are not yet offered at the college level, many agricultural science departments have begun to provide occasional courses that consider sustainability. (Borsari 2001. p. 336-8)

Shaw’s (1992) findings indicated that teachers were generally positive towards the integration of sustainable agriculture topics to agricultural courses in the production and natural resources oriented courses. Shaw’s (1992) findings identified alternative enterprises, rural community development, pasture rotation, range and brush control, water quality, and soil erosion as being the most highly emphasized topics. The findings further stated that when asked the reasons why students learn sustainable agriculture, the responses were overwhelmingly positive.

Summary

A common thread in the literature concerning adult learning is the premise that adult educators or program planners should respond to the needs, interests, and real-life problems of adult learners. Customers frequent a business that satisfies their needs. The same is true with adult learners.

Sustainable systems in agriculture are complex (interdisciplinary and holistic), requiring more education to understand and apply. Agricultural educators and Extension agents have a unique opportunity – and responsibility – to enrich the agricultural education curricula for future educators and expand educational opportunities for present farmers with sustainable agriculture concepts, technologies and practices. Such action will advance sustainability of food systems for present and future generations.
CHAPTER III. METHODS AND PROCEDURES

This purpose of this chapter is to describe the methods and procedures that were used to collect and analyze data for this study. The purpose of this study was to identify and analyze the perceptions of upper level undergraduate students enrolled in Agricultural Education and Studies (AGEDS 450) class in the Fall 2000 and Spring 2001 regarding sustainable agriculture practices, issues related to sustainable agriculture and preferred learning/teaching methods for sustainable agriculture education. The findings of this study may provide research-based information to improve the AGEDS 450 curriculum, and to perhaps have implications to develop and deliver sustainable agriculture education programs to future farmers taking this or similar courses. Specific objectives of this study were to: 1) identify participants' perceptions regarding sustainable agriculture; 2) determine participants' level of concern regarding agricultural issues; 3) determine the extent to which participants had experiences with sustainable agriculture practices; 4) identify participants' perceptions regarding motivation to learn sustainable agriculture practices; 5) identify participants' perceptions regarding preferred teaching/learning methods for sustainable agriculture education; 6) identify sources of agricultural information used by these participants; 7) identify the demographic characteristics and conduct comparisons with selected variables in the study.

Design

The research design used in this study was descriptive. Fraenkel and Wallen (1996) stated that “descriptive studies describe a given state of affairs as fully and carefully as possible” (p. 13). Marriam and Simpson (1984) precisely stated that “descriptive research is
the most common form of research used in adult education. Because of immediate need to define and describe the fields of practice, this methodology will continue to be important in advancing knowledge ... One obvious advantage or strength of the descriptive method is its ease of use. It produces data that are accurate and representative" (p. 63). Ary, Jacobs, and Razavieh (1990) stated that a descriptive study is directed towards determining the existing situation at the time of the study. The findings of this descriptive research/study may assist researchers and educators to understand the participants' perceptions regarding sustainable agriculture, issues related to sustainable agriculture and preferred learning/teaching processes.

**Population**

This was a census study. The population for this study consisted of students who were enrolled in a capstone farm business management course, Agricultural Education and Studies (AGEDS 450) class in the Fall 2000 and Spring 2001. The course, as defined in the Iowa State University catalog, is defined as follows:

AgEds 450. Farm Management and Operation
(1-6) Cr. 3. F.S.SS. Prereq: Econ 135, Econ 330, junior classification. Participation in the management and operation of a diversified Iowa farm. The class is responsible for the plans, records, and decisions for buying and selling the farm’s livestock, crops, and equipment. Special speakers on current topics. May be taken for credit 3 times at different times of the year by permission of the instructor. Non-major graduate credit.

Sustainable agriculture is an integral part of the mission statement of AG 450 Farm. The mission statement on AG 450 Farm web-site states the farm “To be a practical
educational resource for Iowa State University and the Department of Agricultural Education and Studies demonstrating quality and sustainable production agriculture in the Midwest.”

The researcher selected this population because the AG 450 farm resembles a typical Midwest farm, the mission includes sustainability of agriculture and over ninety-three percent of the participants came from a typical Midwest farm background. The course is designed so that students make both management and operation decisions. Because of their background, education and practical experiences in this course and agriculture in general, the researcher believed that members of this population would provide a valuable data source that could enhance our understanding of how to improve the course curriculum, extension programs for farmers and delivery processes for similar educational programs. The research design included both qualitative and quantitative methods of data collection. The researcher was interested in doing an in-depth study of the population, so quantitative data were collected with the use of a questionnaire for all members of the course and qualitative data collection from nineteen percent of the population using focus group interviews.

According to the class record, there were 32 students in Fall, 2000 class and 36 in the Spring, 2001 class. In comparing responses between the two groups, analysis of variance shows no significant difference in mean scores on the questionnaire responses between the Fall 2000 class and the Spring 2001 class. A combined total of 57 students out of 68 students participated in this study. Nine students were absent from the classes on the dates of data collection.
Instrumentation

Data for this study were collected using a questionnaire. The researcher developed the instrument for the study based on a literature review and suggestions from selected faculty members in the Iowa State University College of Agriculture. To help establish face and content validity of the instrument, the researcher’s Program of Study Committee, along with selected adult learners in agriculture served as a panel of experts.

The instrument was designed to measure participant perceptions regarding sustainable agriculture, motivation to learn sustainable agriculture, level of concern regarding agricultural issues, extent of experiences with sustainable farming practices, teaching learning processes and sources of agricultural information. Addressing the stated objectives required the collection of seven frames of data. The first frame consisted of data on perceptions regarding sustainable agriculture and had 9 questions. The second section consisted of data on motivation to learn sustainable agriculture concepts and practices and had 6 questions. The third section consisted of data on perceived levels of concern regarding agricultural issues and had 9 questions. The fourth section consisted of the extent to which participants had sustainable agriculture experiences and had 8 questions. The fifth section consisted of perceptions regarding teaching/learning methods for sustainable agriculture and had 7 questions. The sixth section consisted of perceptions regarding sources of agricultural information and had 11 questions. The last frame of data consisted of demographic characteristics of the participants and had 6 questions. The demographic questions included variables such as age, gender, type of farm, and participants’ career goals. The instrument included a 10 question interview schedule for a focus group interview.
The questions in sections one and two consisted of items to be addressed on a six-point Likert-type scale items with 1 = strongly disagree, 2 = disagree, 3 = mildly disagree, 4 = mildly agree, 5 = agree and 6 = strongly agree. The questions in section consisted of items to be addressed on a four-point Likert-type scale with 1 = not concerned, 2 = mildly concerned, 3 = concerned and 4 = very concerned. The questions in section four consisted of items to be addressed on a four-point, Likert-type scale with 1 = never, 2 = sometimes, 3 = frequently and 4 = always. The questions in section five consisted of items to be addressed on a four-point Likert-type scale with 1 = not effective, 2 = somewhat effective, 3 = effective and 4 = very effective. The questions in section six consisted of items to be addressed on a five-point Likert-type scale with 1 = never, 2 = rarely, 3 = sometimes, 4 = frequently and 5 = always. The instrument was four pages and contained a total of 56 questions.

The Committee on the Use of Human Subjects in Research at Iowa State University reviewed and approved the data collection instrument (Appendix B). The reliability of the instrument was tested using selected adult learners in agriculture not included in the study. The alpha coefficient for the sections one and two was .84, for sections three, four and five .83; and for section six .79.

**Data Collection**

The researcher administered the questionnaires at the end of the AGEDS 450 class session on December 7, 2000, for the Fall semester class and February 13, 2001, for the Spring semester class. A cover letter on the first page of the survey instrument explained the nature of the study and assured anonymity of personal responses. Participants were asked to complete the questionnaires. There was no identification code on the questionnaire because
there was no need for follow-up since the data were collected at one location in a given time from all participants.

Qualitative data were collected by conducting a focus group interview with six selected members of the class on December 7, 2000. The six participants represented diversity in gender, views and experiences. Five students from the Spring 2001, AGEDS 450 class participated in the second focus group interview on February 13, 2001. The researcher guaranteed the confidentiality of the individuals and conducted the 30-minute on each day and taped and transcribed the interview to determine major ideas and themes discussed by the participants.

Data Analysis

The Statistical Package for the Social Sciences (SPSS) computer program was used on February 24, 2000, to analyze the data with a 0.05 significance level set a priori. Descriptive statistics consisting of means, standard deviations, percentages and analysis of variance were used to describe the population. A post-hoc reliability test was used to test internal reliability of the items in the instrument using Cronbach's alpha reliability. The data were tested using frequencies to check completeness of the modified data. One-way ANOVA was conducted to evaluate differences between the means. There was no significant difference in means between the Fall 2000 graduates and Spring 2001 graduates. The Tukey method was used for pair-wise comparisons of means. Open-ended questions on the instrument were organized by main themes and their significance to the study assessed.
Limitations

The study was subject to the following limitations:

1. This was a census study, and the findings may not be generalized beyond this population.
2. The data is biased towards the views of the young 21 to 23-year-old men because of their disproportionate representation in this population.
3. The data is biased towards views of males because there were only 3 women as opposed to 54 men in this population.
4. A vast majority of the members of this population came from a farm background. Therefore views expressed are primarily rural and farm oriented.

The purpose of this study was to identify and analyze the perceptions of students enrolled in Agricultural Education and Studies (AGEDS 450) class in the Fall 2000 and Spring 2001 regarding sustainable agriculture practices, issues related to sustainable agriculture and preferred learning/teaching methods for sustainable agriculture education. The findings of this study may provide research-based information to improve the AGEDS 450 curriculum, and to develop and deliver sustainable agriculture education programs to young farmers.

Assumptions

For the purpose of this study, the following assumptions were made:

1. Participant responses were honest and accurate on each item in the questionnaire:
2. The most appropriate questions were asked in each section of the instrument:
3. Participants in this study were knowledgeable about agriculture in general.
CHAPTER IV. FINDINGS

The purpose of this study was to identify and analyze the perceptions of students enrolled in Agricultural Education and Studies (AGEDS 450) class in the Fall 2000 and Spring 2001 regarding sustainable agriculture practices, issues related to sustainable agriculture and preferred learning/teaching methods for sustainable agriculture education. The findings of this study may provide research-based information to improve AGEDS 450 curriculum, and to develop and deliver sustainable agriculture education programs to young farmers. Specific objectives of this study were to: 1) identify participants' perceptions regarding sustainable agriculture; 2) determine participants' level of concern regarding agricultural issues; 3) determine the extent to which participants had experiences with sustainable agriculture practices; 4) identify participants' perceptions regarding motivation to learn sustainable agriculture practices; 5) identify participants' perceptions regarding preferred teaching/learning methods for sustainable agriculture education; 6) identify sources of agricultural information used by these participants; 7) identify the demographic characteristics and conduct comparisons with selected variables in the study. The findings of this study are presented in nine sections:

1. Participants' profile:
2. Perceptions regarding sustainable agriculture:
3. Level of concern regarding agricultural issues:
4. Experiences with sustainable agriculture practices:
5. Perceptions regarding motivation to learn sustainable agriculture practices:
6. Perceptions regarding preferred teaching/learning methods for sustainable agriculture education:
7. Sources of agricultural information used by these participants;
8. General qualitative comments; and
9. Focus group interview findings.

The demographic characteristics of the participants are described in terms of their age, gender, farm experience, type of farm they operate and their career goals. Fifty-seven participants provided usable data for this study.

Quantitative Findings

The distribution of participants by age is reported in Figure 1. A majority (88%) of the participants were between the ages of 21 and 23. The remaining twelve percent of the participants were between the ages of 24 and 27.

![Figure 1. The distribution of participants by age (N = 57).](image-url)
Ninety-five percent (N=54) of the participants were male, and five percent (3) were female.

A majority (93%) of the participants grew-up on a farm. The remaining seven-percent of the participants did not grow up on a farm.

A majority (83%) of the participants were involved in both crop and livestock operations. The remaining 13% had only crops while 4% of the participants had only livestock operations.

Nearly two-thirds of the participants intended to pursue full-time/part-time farming. A significant number (30%) of the participants intended to pursue careers or employment in other agriculture industries. The remaining (9%) participants intended to pursue teaching jobs (figure 2).

![Career goal](image)

Figure 2. The distribution of participants by career goals (N = 57).
Data in Table 1 indicate the mean ratings and standard deviations of the perception statements regarding sustainable agriculture. The item "sustainable agriculture promotes continuity of agriculture for future generations" received the highest rating with a mean rating of 4.98 on a 6-point scale. The item stating that sustainable agriculture enhances food safety received the lowest mean rating of 4.35. The data in Table 1 show that the participants in this study agreed with the ecological statements that sustainable agriculture promotes ecological harmony, diversity and preserves natural resources for future generations. Participants mildly agreed that sustainable agriculture promotes profitability and efficiency. Participants also perceived that sustainable agriculture enhances air quality.

Table 1. Mean ratings and standard deviations of perceptions statements regarding sustainable agriculture

<table>
<thead>
<tr>
<th>Items</th>
<th>N</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainable agriculture promotes continuity of agriculture for future generations</td>
<td>56</td>
<td>4.98</td>
<td>1.10</td>
</tr>
<tr>
<td>Sustainable agriculture preserves natural resources</td>
<td>57</td>
<td>4.96</td>
<td>0.84</td>
</tr>
<tr>
<td>Sustainable agriculture promotes diversified farming practices</td>
<td>57</td>
<td>4.91</td>
<td>0.89</td>
</tr>
<tr>
<td>Sustainable agriculture promotes ecological harmony</td>
<td>57</td>
<td>4.89</td>
<td>0.89</td>
</tr>
<tr>
<td>Sustainable agriculture enhances water and air quality</td>
<td>57</td>
<td>4.74</td>
<td>1.13</td>
</tr>
<tr>
<td>Sustainable agriculture promotes productivity</td>
<td>57</td>
<td>4.70</td>
<td>1.00</td>
</tr>
<tr>
<td>Sustainable agriculture promotes profitability</td>
<td>57</td>
<td>4.46</td>
<td>1.12</td>
</tr>
<tr>
<td>Sustainable agriculture promotes efficiency</td>
<td>57</td>
<td>4.39</td>
<td>1.21</td>
</tr>
<tr>
<td>Sustainable agriculture enhances food safety</td>
<td>57</td>
<td>4.35</td>
<td>1.16</td>
</tr>
</tbody>
</table>

Level of agreement scale: 1 = Strongly disagree; 6 = Strongly agree
Data in Table 2 indicate the mean ratings and standard deviations for the perception statements regarding participants’ interest/motivation to learn about sustainable agriculture. Participants mildly agreed with the statements: I would like to learn more about sustainable agriculture concepts; I would like to practice sustainable agriculture; sustainable agriculture has a bright future; and, I would like to participate in sustainable agriculture educational programs with the means ranging from 3.88 to 4.37, respectively, on a 6 point scale. Participants mildly disagreed with the statements: sustainable agriculture concepts are not clear to me; and I don’t have the necessary experience to practice sustainable agriculture with mean ratings of: 2.84 and 2.70, respectively.

Table 2. Mean ratings and standard deviation of statements regarding motivation to learn sustainable agriculture concepts and practices

<table>
<thead>
<tr>
<th>Items</th>
<th>N</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>I would like to learn more about sustainable agriculture concepts</td>
<td>57</td>
<td>4.37</td>
<td>1.13</td>
</tr>
<tr>
<td>I would like to practice sustainable agriculture</td>
<td>56</td>
<td>4.32</td>
<td>1.04</td>
</tr>
<tr>
<td>Sustainable agriculture has a bright future</td>
<td>56</td>
<td>4.25</td>
<td>1.01</td>
</tr>
<tr>
<td>I would like to participate in sustainable ag. educational programs</td>
<td>56</td>
<td>3.88</td>
<td>1.15</td>
</tr>
<tr>
<td>Sustainable agriculture concepts are not clear to me</td>
<td>57</td>
<td>2.84</td>
<td>1.22</td>
</tr>
<tr>
<td>I don’t have necessary experience to practice sustainable ag.</td>
<td>57</td>
<td>2.70</td>
<td>1.34</td>
</tr>
</tbody>
</table>

Level of agreement scale: 1 = Strongly disagree; 6 = Strongly agree
Data in Table 3 indicate the mean ratings and standard deviations of the perceived level of concern regarding issues related to sustainable agriculture. The participants were very concerned about the expansion of large farms at the expense of small farms with a mean rating of 3.42 on a 4-point scale while mildly concerned about food safety with a mean rating of 2.30.

Table 3. Mean ratings and standard deviations of perceived level of concern statements regarding sustainable agriculture issues

<table>
<thead>
<tr>
<th>Items</th>
<th>N</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expansion of large farms at the expense of small farms</td>
<td>57</td>
<td>3.42</td>
<td>0.78</td>
</tr>
<tr>
<td>Expansion of cities on farmland</td>
<td>57</td>
<td>3.30</td>
<td>0.78</td>
</tr>
<tr>
<td>Soil erosion</td>
<td>57</td>
<td>3.04</td>
<td>0.82</td>
</tr>
<tr>
<td>Dependence on chemical and seed companies</td>
<td>57</td>
<td>2.95</td>
<td>0.91</td>
</tr>
<tr>
<td>Water quality</td>
<td>57</td>
<td>2.74</td>
<td>0.86</td>
</tr>
<tr>
<td>Destruction of the ecosystem</td>
<td>57</td>
<td>2.72</td>
<td>0.90</td>
</tr>
<tr>
<td>Air quality</td>
<td>57</td>
<td>2.56</td>
<td>0.91</td>
</tr>
<tr>
<td>Deforestation</td>
<td>57</td>
<td>2.49</td>
<td>0.95</td>
</tr>
<tr>
<td>Food safety</td>
<td>57</td>
<td>2.30</td>
<td>1.02</td>
</tr>
</tbody>
</table>

Level of concern scale: 1 = Not concerned; 2 = Mildly concerned; 3 = Concerned; 4 = Very concerned

Data in Table 4 indicate the mean ratings and standard deviations of the participants perceived level of experience with specific sustainable farming practices. Crop rotation received the highest mean rating of 3.65 while no tillage received the lowest mean rating of 2.16 on a 4-point scale.
Table 4. Mean ratings and standard deviations of extent of experiences with specific farming practices statements by participants

<table>
<thead>
<tr>
<th>Items</th>
<th>N</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop rotation</td>
<td>57</td>
<td>3.56</td>
<td>0.71</td>
</tr>
<tr>
<td>Cultivation</td>
<td>57</td>
<td>3.25</td>
<td>0.85</td>
</tr>
<tr>
<td>Leguminous crops</td>
<td>57</td>
<td>3.14</td>
<td>0.93</td>
</tr>
<tr>
<td>Integrated pest management</td>
<td>57</td>
<td>2.67</td>
<td>0.97</td>
</tr>
<tr>
<td>Cover crops</td>
<td>57</td>
<td>2.44</td>
<td>1.07</td>
</tr>
<tr>
<td>Low intensity livestock production</td>
<td>57</td>
<td>2.39</td>
<td>0.92</td>
</tr>
<tr>
<td>Pasture rotation</td>
<td>57</td>
<td>2.25</td>
<td>1.12</td>
</tr>
<tr>
<td>No tillage</td>
<td>57</td>
<td>2.16</td>
<td>0.94</td>
</tr>
</tbody>
</table>

Experience scale: 1 = Never; 2 = Sometimes; 3 = Frequently; 4 = Always

Data in Table 5 indicate the mean ratings and standard deviations of the perceived effectiveness of specific teaching/learning methods for sustainable agricultural education.

Hands-on activities received the highest ratings with mean ratings of 3.54 while lecture received a mean rating of 2.19 on a 4-point scale.

Table 5. Mean ratings and standard deviations of perceived effectiveness of each teaching/learning methods by participants

<table>
<thead>
<tr>
<th>Items</th>
<th>N</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hands-on activities</td>
<td>57</td>
<td>3.54</td>
<td>0.57</td>
</tr>
<tr>
<td>Demonstrations</td>
<td>57</td>
<td>3.32</td>
<td>0.60</td>
</tr>
<tr>
<td>Field visits</td>
<td>57</td>
<td>3.19</td>
<td>0.67</td>
</tr>
<tr>
<td>Variety of methods</td>
<td>57</td>
<td>3.09</td>
<td>0.54</td>
</tr>
<tr>
<td>Face to face consultation with experts</td>
<td>57</td>
<td>2.91</td>
<td>0.81</td>
</tr>
<tr>
<td>Group discussion</td>
<td>57</td>
<td>2.75</td>
<td>0.66</td>
</tr>
<tr>
<td>Lectures</td>
<td>57</td>
<td>2.19</td>
<td>0.61</td>
</tr>
</tbody>
</table>

Perception scale: 1 = Not effective; 2 = Somewhat effective; 3 = Effective; 4 = Very effective
Data in Table 6 indicate the mean ratings and standard deviations of the perceived extent of use of specific agricultural information sources. Family members/relatives as a source of agricultural information received the highest mean rating of 4.02, while videotapes received the lowest mean rating of 2.60 on a 5-point scale.

Table 6. Mean ratings and standard deviations of perceived extent of use of specific agricultural information sources by participants

<table>
<thead>
<tr>
<th>Items</th>
<th>N</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family members/relatives</td>
<td>57</td>
<td>4.02</td>
<td>0.81</td>
</tr>
<tr>
<td>Magazines</td>
<td>57</td>
<td>3.81</td>
<td>0.83</td>
</tr>
<tr>
<td>Colleagues</td>
<td>57</td>
<td>3.79</td>
<td>0.94</td>
</tr>
<tr>
<td>Seed and chemical dealers</td>
<td>57</td>
<td>3.63</td>
<td>0.98</td>
</tr>
<tr>
<td>Internet/web</td>
<td>57</td>
<td>3.51</td>
<td>0.97</td>
</tr>
<tr>
<td>Course materials</td>
<td>57</td>
<td>3.30</td>
<td>0.78</td>
</tr>
<tr>
<td>Television</td>
<td>57</td>
<td>3.26</td>
<td>0.94</td>
</tr>
<tr>
<td>DTN (Data Transmission Network)</td>
<td>57</td>
<td>3.18</td>
<td>1.09</td>
</tr>
<tr>
<td>Extension service</td>
<td>57</td>
<td>3.14</td>
<td>0.93</td>
</tr>
<tr>
<td>Radio</td>
<td>57</td>
<td>3.09</td>
<td>1.02</td>
</tr>
<tr>
<td>Video tapes</td>
<td>57</td>
<td>2.60</td>
<td>0.82</td>
</tr>
</tbody>
</table>

Perception scale: 1 = Never; 5 = Always

One-way analysis of variance was conducted to evaluate the relationship between age level and the change in participants' perceptions regarding sustainable agriculture. The independent variable, age of the participants, had four age groups: age group 21, 22, 23 and 24. For data analysis purposes, age 24 included all participants who were 24 years old and older. The findings show no significant differences in mean ratings among the age groups. Analysis of variance conducted using gender and farm background also did not show any significant differences between the group means for the perceptions statements regarding sustainable agriculture in Table 1.
The analysis of variance showed no significant differences on the basis of gender, age or farm background for the motivation to learn statements regarding sustainable agriculture in Table 2. The analysis of variance showed no significant differences on the basis of gender, age or farm background for the level of concern statements regarding issues related to sustainable agriculture in Table 3.

The ANOVAs for crop rotation, cultivation and leguminous plants were significant with the p-values < .001, .01 and .01, respectively. The ANOVA showed that age was significant factor in gaining experiences in integrated pest management where p = .03. The Tukey's post hoc test indicated that the mean for age group 23 was significantly higher than the mean for age group 24 years old and older.

The ANOVAs show significant difference in means among the age groups of 21, 22 and 24 and older. The participants in age group 22 and 24 and older perceived the lecture method as more effective for teaching/learning than participants in age group 21 did. However, ANOVAs indicate no significant differences between the participants perception in age group 23 and age groups of 21, 22, 24 and older.

Analysis of variance showed that having a farm background was a significant factor in using magazines, family members and television as agricultural information sources with the p values of 0.01, 0.01 and 0.02, respectively. ANOVA results indicated that the DTN mean for male participants was significantly higher than the DTN mean for female participants with the p = 0.05. Because of the number of women (3) in the study as opposed to 54 men, the differences in mean scores may not reflect the real perception differences between the two groups.
Written Comments

Participants were asked to provide a written response to two open-ended questions at the end of the questionnaire. Twenty-six participants provided a written response to the first question while forty-two responded to the second question. The responses for the first question are grouped into three themes: 1) skeptical comments. 2) positive comments and 3) comments regarding teaching and learning processes.

1. Do you have any comments about sustainable agriculture in general?

Skeptical comments

- Our generation has to clean up the mess that the last generation made.
- I think that people should not be so worried about farmers and be more worried about human beings polluting our waters and land.
- All politics.
- Good idea. but is it profitable?
- It is good in theory.
- I think it has its place in filling smaller, niche-type markets, but don’t think it is feasible on the large scale needed to feed the world population.
- A good concept but needs more testing on some issues.

Positive comments

- Good idea but needs to be promoted with economic support and rewards to farmers that choose this route.
- It’s an excellent idea, but to use today’s technological advances we need to streamline uses for adequate crop production. not go right into organic farming or other crazy methods.
- I want to pursue it.
• It is good to provide for future generations.

• I think it is a way to maintain profitability and a strong future in agriculture.

• It is needed to keep the soil healthy.

• It could become important in the future.

• For agriculture production to be profitable, sustainable methods must be developed.

• I think agriculture should and will have to focus more on it as population grows and less land can produce food.

• I believe it is a good goal to work toward. I would like buying my meat directly from producers. I don’t think it would work unless it can be profitable and without farmers giving up their freedom to their farms/livestock.

• I feel that sustainable agriculture will be necessary for farming to continue.

• I hope progress from what I see personally comes faster than it has in the past.

• I love the idea and will integrate CRP and wild life restoration on all of my land.

Teaching/Learning processes

• Give some examples and show how it could be profitable.

• There is hope, but only through education and information.

• Help make farmers want it. ... Not push it.

• We will need to be more aware of it.

• Not familiar with the practice. I would like to learn more about it.

• There is not enough accurate information available to farmers.
2. In your view, where is the agricultural industry headed?

- Hard times right now, once all the mergers get done we will see some turn around.

- Agriculture is headed towards corporate run. Large farms are going to take over small family farms.

- It is leaning towards large farms and corporations, which I believe is wrong.

- Larger corporate farms have little concern for land and resources if something is not done to preserve family farms.

- Unfortunately, I think towards larger and larger scale farms that are more specialized. U.S. should apply more stringent anti-trust rules to agricultural conglomerates, as they mistakenly did to Microsoft without hesitation.

- The damage of crop farming has destroyed a lot of wildlife habitat and it is disgusting to think of all the land that is ruined in raising crops.

- I think agriculture is headed towards larger acre farms that are more efficient and self-sufficient possibly having hog confinements for fertilizer.

- Vertically integrated.

- To fulltime farm.

- To bigger outfits which farms more land and take less care of the soil. Small farms take better care of the land, in general, than large farmers.

- I think the small family farm will be gone in the next 50 years. It is really too bad.

- Towards a big business approach which is too bad.

- Not towards sustainable agriculture, but to more intensive chemical and tillage agriculture.

- Corporate owned farms.

- Farmers are going to have to be willing to change and specialize diversity.
• Bright future.

• Larger operations and mergers and narrower margins in profits/unit.

• It looks like it's headed to all the small farms being pushed out for the big farms, but hopefully it doesn't go that way.

• Hard to say, could go variety of different directions in the few years.

• Going in the wrong direction. Bigger is not better.

• Large farms.

• Unknown.

• Big and specialized.

• Big corporate farms more EPA control.

• Bigger and better, technology will run the world.

• To technological advancement. incorporating the sustainable agriculture practices at levels that are the most profitable.

• Hopefully not to be industrialized.

• Big operations.

• It has to get worse before it gets better. And now I think it is worse. We are looking into a depression in the next 10 years.

• Larger.

• Larger operations then they will break farm into small operations.

• More intensive. great use of technology.

• Larger farms owned by large corporations (such as ADM and Cargill).

• Totally corporate.

• More important to market commodities through value added processing to gain premiums.
• Factory farming, big get bigger small get smaller.

• Bigger, less individual control.

• Depends on govt. and financial markets.

• Big get even bigger. small get out of the way. Hobby farming.

• It is over running the small guys with mass production.

• Farms and businesses are getting too large, too fast.

• To larger farmers more commercial.

Qualitative Findings

Focus-Group Interview

1. What does sustainable agriculture mean to you?

It is using natural crops to benefit and complement one another. for example using beans/ legumes as a larger green manure source. Sustainable agriculture is kind of towards organic but not quite that far and extreme. Sustainable farmers use some herbicides and some fertilizers but not in extreme amount. not farming every piece of ground you can get over, but farming the flat fields but not the ditches and the bottom lands and leaving the wet lands out of production.

It is taking care of your farms and soils by terracing them and keeping them all up to working capability and keeping them as fertile as possible and reducing soil loss.

It is a land stewardship. Basically the owner takes pride in his land and maintains his land to the best of his ability. You don't go to the extremes like organic farming totally organic. Basically trying to use least amount of chemicals or herbicides to make the best crops.

It is managing your inputs and use management practices whether it is no till or strip till or some other method to build soil structure to preserve the land for future generations rather than how much can I get out of it right now. It means you use your land so that it stays productive for a long period of time. Today, a lot of farmers are using corn on corn. That is not productive. I think you are losing a lot of topsoil.
Don't use more traditional methods that are used in the past such as deep plowing and working the ground five times a year.

It is a production agriculture that is still being productive in the future.

2. Do farmers use sustainable farming practices?

I think they try to. They don't all necessarily have the same view of it or the same practice of it because each one is different. But for the most part, they have some knowledge of it and some use of it but there is always more to be said than done based on each farm.

Most of them do because they have to be compliant to get benefit from government programs.

I don't think that very many farmers are using it. I say maybe only a quarter of farmers would be classified as sustainable because they are adherent to the government programs and regulations. But I still think they are losing so much soil that it is not going to be sustainable in the long run. It is getting there but it is not quite there yet I don't think it actually is fully sustainable.

I think small farmers use it more than large farmers. Small farmers take better care of what they have. Large farmers just go in and try to get as much land cover as they can. A lot of times, that means a little abuse to the ground and also the equipment trying to get it all tilled flying in and flying out. They may not own the land themselves. That is a big part of the problem.

I guess they are forced to do that in my area because of the erosion problems in southern Iowa grounds. You can't do a traditional tillage as people do up here. The rains could wash your topsoil away easily.

I don't see many farmers using it. It has gotten better. There has been one farmer in our area that went away from traditional farming to more organic type farming.

It looks like they are using it to some extent in my area in eastern Iowa. It depends on the type of operation. It has to do with what kind of land you farm and livestock operation. There is some diversification in farming as compared to central Iowa where farmers grow mainly corn and beans. People are warming up with the idea and starting to use practices that are sustainable with few modifications. We are headed to sustainable agriculture.

Every body's farm is different. One farmer uses no-till method and the other farmer uses deep till.
3. What agricultural issues concern you most?

The size of the farms is the biggest issue. Regarding agriculture, I am concerned about the number of farmers that are out there. It seems like you just got to have so many acres. I just wish farms could be two or three hundred acres large instead of two or three thousand to run profitably. I don’t believe you can make a full living out of two and three hundred acres but two or three thousand you can in my opinion. As far as the environmental concerns, I suppose probably soil loss and water quality concern me. I think there is a lot more said than done. Water quality is a big concern of mine. When the soil is lost I think eventually there would not be much crop growing on the land, but it would be a long time, probably over a hundred years before that happens.

My concerns are consolidation. Bigger companies or businesses are owning more and more farms to make a profit at a cheaper rate. I also worry about EPA restrictions some of them are set in place and are good but some are getting a little carried away, like herbicide use. We need to make people aware that it is going to benefit them not going to harm them. It is a proven fact.

There are a lot of people out there that normally don’t know what is going on. If you plant BT corn, you got to know where you can sell it. what you can feed it to. If your are going to plant starchy corn, you know you can’t sell it to the elevator because you got to know if it grows and you got to know where you are selling and what your are buying. Just a lot of people don’t know. A lot of people are undereducated. They need to know what they are planting and what they are using and where they go with it at the end. That is a problem because many people don’t understand what they got.

Do not force people into different ways. You want to make it so that it is something what the farmers want to do. Make some kind of incentive to make them want to do instead of saying you can’t do this or you can’t do that, or you have to do this or that. Don’t force it because you are going to get the opposite reaction when you start to force things and if you want to make it appealing to the farmers, make it something that they are going to want to do. There is a lot better chance of people buying into the system and start doing things.

The way we are handling the Genetically Modified Organisms (GMO) issue is the biggest concern to me. Personally, I feel that in America, we have been trying to force it down other countries’ throats. If you look at it from a pure sales point of view, you are trying to produce what your customer wants. If you don’t produce what your customer wants, somebody is going to do that. I
think we are shooting ourselves in the foot. That is the wrong thing to do. We may need to re-look our focus as far as that goes.

I see companies merging and buying out small ones. It seems that this is taking away farms from farmers. Someday, they (big companies such as IBP and Tyson) may be contracting out acres to farmers and tell you how many cattle to raise and tell you this is the way it is going to be done and this is what you get for it.

Transfer of land. It is going to be very hot topic for the next 20 years transferring land to younger generations. How it is done and when it is done. The age of landowners is increasing. Who is going to control the land plays a big role in the number of new and young farmers get into farming.

Mine is wildlife. Wildlife area is getting destroyed.

4. What specific farming practices do you consider sustainable?

No-till.

Strip Cropping.

I think everybody is sort of leaning more towards to no-till cultivation. especially, down here we got more hills. but up north where it is flatter. they make everything black. Where I live. there are some guys who tear everything up. However. I would have to say that 60% of the farmers use no-till. It saves money on times over the field and saves you money in lot of different places. It also uses all the residues on top so that when it rains the soil does not run down the hill and the residue decomposes helping the topsoil.

I think some type of crop rotation that includes like a meadow facilitates sustainable practices. Because most of them are corn and soybeans I think if they added some oats or meadow rotation, they would be lot more sustainable.

The biggest one for me is seeing no-till farming practices. Too many farmers are going out and working up the ground too hard. Less work in the ground would be good from soil conservation point of view.

I think crop rotation is a big one. Again depending on the make up of the operators in the area, livestock production. crop rotation, alfalfa, pasture rotation.
5. Do you think you need to learn more to really understand and practice sustainable agriculture?

Yes, I think so. I think sustainable agriculture could be profitable. Where I come from, for twenty years they planted corn on corn and they come out saying 'plant soybean in rotation you get so much better corn because of it.' There are all sorts of ways to make it profitable. Just one little simple thing like that can make a difference.

Twenty years ago you could go out look at fields running up and down the hill instead of around the hills. That caused so much soil to run away. Everybody goes around the hills now so that practice improved a lot in the last few years.

It is just going to take a lot of time for people. I mean like the older farmers have been setting up their ways of farming and no matter how many years they farm, they really don’t want to change. It is just going to take them some time to change to new practices and new ideas and they want to make sure every thing is going to work before they switch over.

I think they got a lot more to learn. maybe farmers in general about interaction. how soil works, how you build up soil structure and soil pores and how that helps crops grow and the interactions between corn and soybeans oats meadow how they can all interact to produce profitable crops. Interaction of nature should be better understood.

I definitely have to. If I just walk out and try sustainable agriculture. I would probably fail. I need some kind of education.

I think you always need education for anything. It depends what you call education. Formal education I guess, probably a lot guys are practicing sustainable agriculture out of formal education. There are also farmers who taught themselves through trial and error who practice sustainable agriculture.

6. What methods are best to learn sustainable agriculture practices? Why?

Extension meetings have maybe a certain specific deal on sustainable agriculture that comply with government programs. The government regulations may make you change lots of stuff. We got farms that we are not even allowed to go in and till on because they are too steep spots. I think there are a lot of ways: Magazines can be a source for sustainable agriculture. You can talk to your neighbors and see what they are doing and what is working. There are all sorts of ways you can learn about sustainable agriculture. It is going to take time to get it out: to get it across the border.
I think field days are important where people can go out and actually see it. 

Personally I think there should be little bit of everything in a classroom situation. The best to learn myself is showing me. Have a setting like this an educational forum. You may tell me how you do it all day long. I am probably not going to understand it. Show people hands on how it is done. Let them go out and practice little bit under some supervision and kind of go from there with it.

I like the idea on the survey you have the field days and stuff like that. I also like the idea meeting people face to face; you can talk to them and show them about it. Not everybody is going to come out for a field day. Talk to individual farmers.

What works in one place may not necessarily work in another. So, you might need to tailor to individual farmers need. Farmer may not be able to implement your new idea. Individual interaction may help farmer to make easier transition. If the farmer experiences a rough transition, you might have hard time selling your on this practice. They might say forget it and walk off.

For me, a combination of everything is good. A good mix of lecture has its place. Showing hands on, demonstrations also.

7. Do farmers use Extension services?

I don’t think they do that much. I just don’t think they know what is out there. Even myself, in doing my class reports. I see a lot of extension publications, which I did not know before. I know extension has a lot more to offer now that I have been in college than what I did when I came to school. I just don’t think they know what is out there.

I think some of them are thinking that Extension is basically 4-H. but it isn’t. When you come up here, there are all sorts of extension publications that would be useful to farmers, and they can go to their extension offices and pick them up. All they have to do is go in and ask.

I think farmers follow what they believe in. Every time Extension does something, they may listen to it but they had their minds made up. Basically, they have set ways of doing things and that is the attitude they have.

I think some farmers, more towards the older generation; I think they have set ways. This is how my dad did it and this is how his dad did it. They kind of go more to how it was done as opposed to some one showing the numbers telling them this way is better. Especially when they hear about the technological breakthroughs, they say no, stay away.
My grandfather did this way and my dad did this way and made money. Why should I change my mind? How can you tell somebody who has been farming or any kind of business who made money for twenty years telling them all you are doing is wrong?

For me it is a combination. We look at some Extension publication for some things and others for other things. The biggest thing from extension is that most of their data comes from nine farms across Iowa, whatever many experiment stations there are. It is a matter of how you interpret the extension bulletins and advice. They are usually conservative. They want to make you money. They don’t tend to be real risky in their recommendations. We use a lot of stuff, freezing dates and stuff like that as rules of thumb and apply to your own operations. My grandfather did not go to extension, but my dad has, and I will use extension as a resource. Specially, if I am teaching practices that are 180 degrees different, for example, if you are going from conventional tillage to no-till, I would definitely use extension resources.

In our area, they did research on crop rotation corn and soybeans. They had such a good results, crop rotation was spread by word of mouth. Because they do good job up there. people listen mainly because they came from bottom up.

I worked for Iowa State Research farm in which Extension was involved in couple projects. One of them was beef cattle project. We put in limestone in their diet supposedly to lower pH in the rumen and increase rate of gain. But we had record number of bloats. I take that for what it is worth. We were also working in organic production. We were working on some chickens and we had chicken night. We had different kinds of chickens like organic and others like grocery store and we had panel of people come in and test to see what they like. Organic chicken was right at the bottom. So, you know, it is good to see though organic is going to work if that is what people want.

8. What potential strategies and solutions do you recommend to deal with the problems that are related to conventional farming practices?

I think that getting the word out and letting people know as an alternative is important. Farmers can always use no till and then they can switch to a conventional method. You just show them that it is going to work. You just get the sustainable agriculture out there and let them know that it works. That is the biggest problem and a lot of people are uneducated what sustainable agriculture really is.

Lots of people are too hard headed to change like there are lots of guys in our area that say, their grandpa did it that way or their dad did it this way, and I know they are going to do that way, too. They won’t listen to anybody. I know we work with a guy we sold a different brand seed corn than he does.
We beat him every time and every field. yet he still won’t buy seed corn from us. That is silly?

Make sure that farmers know what it is. Reemphasize the facts just to give it a chance. We have been no-till on our farm for 11 years now, and we have done a lot of field days so that people come out and see it. They may say I want to do this on my farm so they go out and try it. The first year coming out of the conventional till or no till is not the greatest thing in the world. After that first failure, they scrap it. ‘That is a terrible idea how can this ever work.’ So they go back to their old ways. It is something that takes time to develop; it takes time to get your farm in that shape and use that kind of crops under no till conditions. Weather it is till or no-till, give it a time to work. Give it a chance and let it go through its process. It is not just a quick thing.

It will be hard to change from conventional tillage. In Iowa the ground varies all across the state. hills verses flat ground. Some soil types pack more than the others encouraging farmers to break the ground so that they get aeration into the soil, which is understandable. So it will be hard to get those guys to do it.

I wish I had a good answer for you. I think you know as the time goes by you will have better means to approach these issues we are having. As opposed to our parents generation, we might be more flexible because things are changing faster we have to adapt faster. I think by approaching our generation, a lot of these issues could be taken care of.

9. What role do you believe Agricultural Extension should play in promoting sustainable agriculture practices?

Maybe besides having pamphlets on research and information available and have meetings. There is an Extension office in every county. Invite somebody who does sustainable agriculture to the meetings and have him/her explain and do the talking, instead of a guy from research institute out there talking and telling them what to do. They can turn their nose up and turn to the other way. I think if they actually get a farmer who is successful in sustainable agriculture explain, people will be willing to listen to him and try things.

I think it would be a good idea to put out more newsletters in order to get them into the meetings. Like where I am coming from, there are hardly any newsletters on what the extension is doing. Need more information on getting out to the farmers about what they are doing. They can get the newsletter out, like a monthly newsletter on what is going on in the community.
Have some field-days so that farmers could interact with each other and Extension agents maybe toward June and summer. Farmers enjoy free meal and music so you get them come out and look at it.

I don’t know how much Extension staff goes out to actually individual farms and talks to the farmer. I know they used to do a lot more of it. I know some counties still do but even up in my own county, I don’t think they have done that through the years. Direct farm visit is one way to reach farmers. This gives farmers opportunities to ask questions about specific insects or something like that to help bring knowledge to the farmers. Farmers are not going to mind going to things but they have time constraints.

I think they have to be careful not to alienate themselves any further than they already have. They have to do their homework before they make a lot of recommendations like that. And also their data might show what we should be doing but they have to have their methods down how to approach people and how they are going to display that data that shows it would be a good idea to do. I think they have to have their ducks in a row and make sure they that they are ready to do it before they start saying this is the way the future. We found out that a lot of things if you get too fast you might not be able to stop.

I like to see Extension recommendation made more specific counties. The research data might come from all over Iowa, but it may not have some thing to do with specific area. I like to see research done in area that is specific to us. I think that would mean a lot more, personally.

I think they try to do that though. They do have experiment station in Northwest Iowa, East Iowa, etc. I think the method they get their messages across they should work on.

They need to listen before they tell people what they need to do, first. Base their research on what farmers want. Use farmers, as an asset rather than telling farmers what to do. listen and look what their records look like.

If everybody turned in their own data, they will have a vested interest in what is going on rather than one farmer putting in his/her data. Just one farmer putting in his data does not mean anything to anybody.

10. What role do you believe an individual farmer should play in promoting sustainable farming practices?

Try it on a hundred acres and see what they think of it instead of dropping it immediately. Not necessarily have to implement it on two thousand acres at a
time but give them a chance to see on a little bit and see if they like it. May be they will completely change over.

Just doing it.

Talk to your neighbors, talk to other farmers if something is working let them know. Get the word out. Go to the coffee shop something like that and communication I guess.

Lead by example. I thought sustainable agriculture is on a smaller scale. I read some of the Leopold Center recent news that there is a farmer who is practicing sustainable agriculture and running 3500 acres and has beef cattle operation. This shows me that this can be done in a sustainable level. I look at innovators and cutting edge people to see what they are doing.

Farmers have to care about the future and their children. We got a land that produced consistently five year average 180 bushel corn per acre we put it in a ten year program to set it aside. A lot of people think that is crazy. We justify that it will be here building the topsoil for future. Get rid of that greed attitude and start caring about future. You gain about 2% in topsoil a year.

We use conventional farming methods. We use manure fertilizer on half of our land. The production stayed consistent for the most part.

It has to do with the definition of profitability. For some, wildlife and natural environment hundred years from now is very important and be able to get 180 bushels per acre. Is profitability, money alone or ecological rewards you get out of it? Right now, they are still searching a way to put a dollar figure to put on all that. I think the new farm bill is going to address some of that.

**Summary**

The findings of this study indicated that participants agreed with the statements that sustainable agriculture promotes continuity of agriculture for future generations, preserves natural resources and promotes diversified farming practices. Participants mildly agreed with the statements: I like to learn more about sustainable agriculture, like to practice sustainable agriculture and sustainable agriculture has bright future in part two of the questionnaire.

Participants’ ratings in part three of the questionnaire show that these participants are
concerned or very concerned about expansion of large farms, expansion of cities on farmlands, soil erosion and dependence on seed and chemical companies. The ratings indicate that these participants were mildly concerned about water quality, air quality, ecosystems, deforestation and food safety.

The findings show that these participants have used crop rotation, cultivation, leguminous plants and integrated pest management systems on their farms frequently or always. Participants hands-on activities, demonstrations, field visits, variety of methods, face to face consultation and group discussion as effective or very effective teaching/learning methods. Lecture method was rated as somewhat ineffective. Participants of this study indicated that they frequently or always use family members or relatives, magazines, colleagues, seed and chemical companies and the Internet sources for agricultural information.

Participants gave a mixed response to the open-ended question that asked for their general comments regarding sustainable agriculture. A number of participants stated that sustainable agriculture is a good concept and practice and that they have been using it or would like to pursue it. On the contrary, a number of participants were skeptical about its practicality and profitability. Regarding the future direction of the agricultural industry, almost all participants stated that large farms are going to takeover smaller farms and expressed concern.

The qualitative findings indicate that these participants have a good but limited understanding of sustainable agriculture concepts, and they agree that it is a good concept. The findings show that these participants are willing to pursue sustainable agriculture practices, but they have reservations about economic competitiveness in today’s agriculture.
They believed sustainable agriculture is a long-term goal that may be achieved through education, economic and legislative incentives to those who are willing to try it.
CHAPTER V. DISCUSSION

The purpose of this chapter is to discuss the findings of this study. The purpose of this study was to identify and analyze the perceptions of students enrolled in Agricultural Education and Studies (AGEDS 450) course in Fall 2000 and Spring 2001, regarding sustainable agriculture, issues related to sustainable agriculture and preferred learning/teaching methods for sustainable agriculture education. The findings of this study may provide research-based information to improve AGEDS 450 curriculum and to develop and deliver sustainable agriculture education programs to farmers. Specific objectives of this study were to: 1) identify perceptions regarding sustainable agriculture; 2) determine participants' level of concern regarding agricultural issues; 3) determine the extent of experience with sustainable agriculture practices; 4) identify participants' perceptions regarding motivation to learn sustainable agriculture practices; 5) identify perceptions regarding preferred teaching/learning methods for sustainable agriculture education; 6) identify sources of agricultural information; 7) identify the demographic characteristics and conduct comparisons with selected variables in the study.

Discussion of Quantitative Findings

The participants of this study perceived that sustainable agriculture promotes environmental aspects of agriculture more than productivity and efficiency. The mean ratings for the environmental statements [sustainable agriculture promotes the needs of future generations: preserves natural resources: promotes diversity and ecological harmony] reflect the highest approval for these items. This information shows that the participants of this study believed that the primary goal of sustainable agriculture is environmental protection.
However, the participants in this study gave relatively high ratings to the economic aspects of sustainable agriculture, as well. Again, this reflects that an economic aspect of sustainable agriculture is a significant goal.

Dunlap et al. (1992) reported that farmers and faculty members have different views regarding sustainability. Farmers indicated that they seek sustainability for economic and social reasons rather than ecological reasons. Farmers viewed sustainability as a way to improve the economy, health and well being of rural residents, revitalizing rural areas, simplifying food systems and increasing number of farms. On the contrary, faculty members viewed ecological factors as necessary in sustainable agriculture. The findings of the AgEdS 450 farm study showed the exact opposite of the Dunlap et al. (1992) findings. For these young farmers, sustainable agriculture was more inclined towards promoting environmental goals.

Parr (1991) stated that most sustainable agriculture definitions comprise economic and environmental components. Agricultural practices may be profitable but that does not necessarily mean that they are sustainable. In order to be sustainable, agricultural practices need to be economically profitable, environmentally sound and socially acceptable. Failure in one is failure in all.

Sustainability can also be thought of as a long-term goal that needs to overcome the problems and constraints that afflicts both U.S. agriculture and agriculture worldwide. How and where this goal is achieved depends on the development of alternative management practices that are resource conserving, energy saving, economically viable, environmentally sound, and protecting of human and animal health. (Parr 1991: p. 377)

The fundamental concepts of sustainable agriculture need to be clearly understood by these or other farmers if there is any hope for sustainable agriculture to become realty. How
one understands the concepts and practices of sustainable agriculture determines how one perceives and practices or rejects sustainable agriculture. If farmers perceive that sustainable agriculture concepts are overly tilted towards the wellbeing of the environment and ignore their economic challenges, they may immediately begin resisting sustainable agriculture. However, if people believe that sustainable agriculture genuinely strives for economic, environmental and social wellbeing of farmers and the whole society, then they may be more motivated to consider it. What people believe and value determines their ultimate actions. Milbrath (1984) stated that “The values are fundamental to everything we do. What people value governs the way they behave and what they expect from their society.” (p. 116). Longworth & Davies (1996) stated that “the broadening of personal horizons to encompass issues and events outside of mere self-interest is often one of the most difficult learning tasks. and yet to create this in people is also the mission of learning” (p. 10).

The findings indicate that these participants mildly agreed with the statements regarding learning about sustainable agriculture. The participants’ ratings of the items indicate that these participants had a mild desire to learn and practice sustainable agriculture. Overall, the findings indicate that these participants had some understanding of sustainable agriculture concepts and practice and desired to learn more. Blackburn (1994) stated that people/farmers who lack motivation to learn and apply the knowledge that is being offered to them do not perceive their-own situations in the same way as those who attempt to provide educational opportunities. The mild agreement with the items on the questionnaire shows some interest in learning more about sustainable agriculture. It is much better than a total lack of interest in sustainable agriculture. However, there may be some underlying factors that may be influencing the perceptions of these participants to respond the way they did.
Deci and Ryan (1985) stated that "Human beings act on their internal and external environments to be effective and to satisfy the full range of their needs. In the process, behavior is influenced by internal structures that are being continually elaborated and refined to reflect ongoing experiences" (p. 8). This information indicates that humans are intrinsically motivated to achieve their desired goals.

On the other hand, rewards could motivate a person to engage in activities in which he or she otherwise might not actively participate. Cherrington and Wixom (1983) stated that people do what they are reinforced or rewarded for doing. A project funded by the Leopold Center for Sustainable Agriculture to encourage producers to adopt environmentally sound management practices to improve water quality paid education-based small incentives ($220) per participant for three years to motivate farmers to pursue best management practices (Miller, 2000). The project was partially successful. Miller's findings indicated that the modest incentive payment was not sufficient in itself to attract participants. Twenty-three percent of the first group dropped out of the program before the end of the first season. Forty-four percent of the second group dropped out before the end of the first year. However, those who stayed in the program to some degree implemented the best management practices. Baker (1997) pointed out that "Our understanding of how learning affects behavior seems to be intimately connected to our understanding of what motivates our behavior." (p. 287)

Participants' responses in the AgEdS 450 farm study indicated some level of concern on all items. However, they rated expansion of large farms, expansion of cities on farmland, soil erosion, dependence on seed and chemical companies as leading reasons for concern. The ratings for water quality, destruction of ecosystems and air quality show a significant
level of concern, also. Nevertheless, the concerns regarding deforestation and food safety were mild. The findings indicate that these respondents were concerned about the expansion of large commercial farms. The concern is coming from the worries that small farmers may not be able to compete with the large farms and will be forced out of business. The participants' concerns regarding soil erosion, dependence on seed companies, water quality and ecosystems show that the participants of this study care about the sustainability of agriculture. The 1990 Farm Bill (United States Department of Agriculture) stated that environmental and health concerns are emerging as some of the highest priority issues that must be addressed by agriculture producers and consumers. The USDA provides leadership and support for research in the area of food safety, water quality, global change and environmental and natural resource education. Sustainable agriculture practices are recognized as a means to address these environmental concerns by integrating them into the land-grant college and university system.

Many farmers share concerns about the future of the food and fiber system and some are taking action to improve their operations. "Without abandoning the quest for efficiency, they are trying to farm within more responsible boundaries. They want a farm that is not only profitable, but durable. The kind of agriculture they aspire to is usually termed 'sustainable agriculture'" (Northwest Area Foundation. 1994, p.2).

The findings in the AgEdS 450 study show that participants used crop rotation farming practices on their farms. The ratings for cultivation, leguminous plants and integrated pest management indicated that the participants of this study frequently used them on their farms. The ratings for cover crops, low intensity livestock production and pasture
rotation indicate that these participants sometimes practiced sustainable farming methods on their farms.

Findings in this study indicate that participants with a farm background had significant experience with crop rotation cultivation, leguminous plants and no-tillage farming practices. Given the fact that a majority of this population came from a farm background, the findings indicate that, overall, the participants of this study had some degree of experience with sustainable agriculture practices. Duffy (1991) pointed out that most farmers are already using some sustainable agriculture practices. He further identified that most Iowa farmers had some experience and practice some level of soil testing, crop rotation, manure application, mechanical cultivation, planting legumes, ... tillage, and non-conventional products. Actually, they are thinking about it in their own terms and practicing it to some degree.

Sustainable agriculture requires systems management. Those who understand the concepts and have experiences with sustainable agriculture practices have better chances to succeed. "... It involves managing the interrelationships among animals, plants, and soil. The animals influence the plants, the plants influence the animals, and both influence the site – in terms of soil and water quality and wildlife habitat. These interrelationships are continually changing and are strongly influenced by the management practices used" (Iowa State University Extension, 1998. p. 5).

The ratings for hands-on activities indicate that the AgEdS 450 students believed hands-on methods are very effective for teaching/learning purposes for themselves and farmers in general. Respondents rated demonstrations, field visits, using a variety of methods, face-to-face consultations and group discussion as effective teaching/learning
methods. The lecture method was perceived as somewhat ineffective. Overall, these participants preferred teaching/learning approaches that allow them to touch and feel, try for themselves, see, observe and interact with people and activities to be involved rather than sit and listen to pre-prepared lectures. However, the findings indicate significant differences between those who were 21 years old and 24 years old and older. The participants who were 21 years old perceived that lecture method is not effective. On the contrary, the participants who were 24 years old and older perceived that the lecture method is somewhat effective or effective. This information suggests that age may not be the only factor that influences their perceptions regarding the use of the lecture method since the age difference between them is minimal. Overall, the age range for this population was small (21 – 27 years). Thus, perceptions of the participants could be influenced by other factors such as learning styles, personal experiences, etc. In practical terms, age may not be significant, but it does raise interest in investigating these other issues in the future studies.

The AgEdS 450 students gave the highest rating for family members or relatives as a frequently used source of agricultural information. The respondents also rated magazines, colleagues, seed and chemical companies and the Internet as frequently used sources of agricultural information. Dollisso and Martin (2001) found that magazines were the most frequently used source of agricultural information by Iowa young farmers. However, the findings of this study show that magazines were the second most frequently used source of agricultural information after family members. This is probably because these participants are younger and working closely with their parents or grandparents. Dollisso and Martin (2001) found that the Internet was the least frequently used source of agricultural information by Iowa young farmers. Since the participants in the AgEdS 450 study were soon to be
university graduates, they had a better chance to gain experience with the Internet as opposed to farmers who might have graduated a while ago. The findings indicated that these participants sometimes used course materials, television, the data transmission network, Extension service, radio and videotapes for agricultural information. In AgEdS 450 study, as a source of agricultural information, the Extension service was not considered a significant source of information. Dollisso and Martin (2001) found young farmers perceived Extension as a more important source of along with magazines and neighbors.

Age is a factor in use of source of information from the Internet, magazines, seed and chemical companies and family members or relatives. The findings indicated that younger respondents used the Internet more than older participants. This may be because the younger generation have had more exposure to information technology and that they are more comfortable with it. This information indicates that the Internet is becoming an increasingly important source for agricultural and other information. Participants who were younger used magazines for agricultural information more than those who were older, older also. The researcher expected that those who used the Internet for information might not use magazines as much. However, the findings indicated that younger participants used both the Internet and magazines more than older participants did.

Younger respondents used seed and chemical companies for agricultural information more than participants who were older. Respondents who were younger used their family members/relatives as agricultural information source more than participants who were older. Overall, the findings suggest that the younger respondents in this study were more likely to seek out agricultural information from a variety of sources than those who had been in the farming business for a while.
Information based on farm background indicated significant differences between the means ratings of participants with farm background and those without. Participants who had a farm background used magazines, family members and television more than those who didn’t have direct farm background. It is logical for the respondents who have had farm backgrounds to use magazines and family members for agricultural information. However, the difference that was reflected regarding television use was interesting. What programs do the participants watch to get agricultural information? Who provides those programs? How effective are these programs? Those are just a few interesting questions for further research.

**Discussion of Qualitative Findings**

One of the questions on the questionnaire was, “Do you have any comments about sustainable agriculture in general?” Forty-six percent of the participants gave a written response to this question. The responses fell into three categories: skeptical comments, positive comments and comments regarding educational processes. Thirty-one percent of the comments expressed skepticism towards sustainable agriculture. Participants who expressed skepticism perceived that sustainable agriculture is an unrealistic theory that is being used for political purposes while others perceived that they are dealing with the mess previous generations left behind. Other skeptics perceived that sustainable agriculture is a good idea but not tested or proven to be successful.

Forty-six percent of the comments revealed a positive attitude towards sustainable agriculture. The comments covered all three aspects of sustainable agriculture: profitability, environmental soundness and social acceptability. Overall, comments in this category
indicated that a significant number of these participants were interested in pursuing sustainable agriculture for economic, ecological and/or social purposes.

Twenty-three percent of the comments were focused on educational processes. The comments indicated the need for more educational efforts. The results in this section indicated that participants who contributed the comments were already in favor of sustainable agriculture. Their comments were mainly focused on how to go about providing educational programs rather than questioning sustainable agriculture practices.

The second question was “In your view, where is the agricultural industry headed?” The overwhelming majority of the respondents stated that agriculture is headed towards larger, specialized and a corporate structure. Respondents were worried that small farmers will be squeezed out of the farming business. These respondents believed that bigger farms have little concern for the land and farm heritage because their primary goal is maximizing profit.

Participants in the focus group sessions seemed to have a fairly good understanding of sustainable agriculture concepts. However, they emphasized the ecological aspects of sustainable agriculture. They defined sustainable agriculture as a process of taking care of the land using farming practices such as no-till, crop rotation, etc. They were aware that sustainable agriculture calls for carefully managed use of inputs. These participants perceived that organic agriculture is an extreme farming practice, and their expressions indicated that they were not in favor of organic farming.

When these participants were asked if farmers were using sustainable practices or not, they perceived that farmers use sustainable agriculture practices with variation depending on their needs and understandings. Participants who came from eastern Iowa indicated that
farmers in their area had no choice but to practice sustainable agriculture because of the landscape. Skeptics pointed out that farmers who practice sustainable agriculture are doing it because they benefit from government programs rather than a desire and commitment to practice sustainable agriculture. The respondents perceived that farmers who operate large and specialized farms are less sustainable as opposed to farmers who operate diversified and small farms.

Regarding agricultural issues that concern them most, respondents identified multiple issues. Consolidation of farmland into fewer large farms was a concern for some because it may eventually eliminate family farms. Soil loss and water quality concerns were directly linked to the consolidation of farms. Concern over genetically modified organisms is directly linked to that concern. When farmers don't know if they have a market for their product or not, they are taking a bigger risk. Others were concerned about approaches by government or Extension services imposing new ideas and practices on farmers. They believed that the best approach is getting farmers interested/motivated about the new practice rather than telling them what to do. Sustainable agriculture practices should not be imposed, but rather educational opportunities expanded.

The participants in this study agreed that education is needed to understand and practice sustainable agriculture. Although improvements have been made over the years, AgEdS 450 students believed that farmers need more education in the natural interactions of soil, animals and plants and how these components are connected to productivity of the land. Most farmers have developed ways of doing their business over time, and it is difficult for them to change easily.
Regarding methods that are best to learn sustainable agriculture, AgEdS 450 students indicated that using a variety of methods is effective. All agreed that there should be a show-and-tell hands-on approach. Field days were identified as important learning opportunities for farmers because they afford them a chance for interaction with each other. Individual face-to-face contact or visits were suggested for those who don’t come out to the meetings and field days. Some suggested publishing educational materials in magazines.

AgEdS 450 students had varying perceptions regarding Extension services. Some indicated that farmers have set ways of doing things. They are comfortable with it as long as it makes them money. They resist any change. Others indicated that farmers are unaware of the extent and magnitude of the Extension services. Respondents with this view perceived that farmers equate Extension services to 4-H programs, and they don’t know other publications and resources that are available to them. Others perceived that Extension is providing good educational services such as crop rotation and no-till farming methods that are beneficial to farmers. On the contrary, some perceived that Extension has a credibility problem and gave examples of failed research findings that they were advised to use by Extension.

Some respondents in this study believed that farmers don’t have a good understanding of sustainable agriculture: therefore, they suggest that educational opportunities should be expanded. Others perceived that change takes a long time for the process to take place. Thus, they suggested persistent education and patience for the process to work. The respondents suggested working with the younger generation as a potential strategy assuming that members of younger generations are more open and flexible for change.
Participants in this study suggested the following Extension to promote sustainable agriculture:

- Have more educational opportunities;
- Invite speakers who have practiced sustainable agriculture;
- Promote sustainable agriculture opportunities through newsletters and other media;
- Organize field days (free meals and music);
- Visit farmers directly on their own farms;
- Should do their homework before recommending new practices;
- Make localized and specific recommendations to individual counties and farms;
- Listen to farmers before telling them what to do; and.
- Involve farmers/consider them as assets

Regarding the role individual farmers play. AgEdS 450 students believed that individual farmers who pursue sustainable agriculture should lead by example. Individual farmers should also share what they know and do with their neighbors. Some respondents believed that there should be a dollar value on natural beauty and healthy environment that may bring added benefits to farmers and their families. Respondents further suggested that farmers experiment with sustainable agriculture on a smaller scale rather than totally switching to it abruptly.
CHAPTER VI. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents a summary of the study, research methods, major findings, conclusions, recommendations based on the findings of the study, and the educational implications of the findings.

Summary

The purpose of this study was to identify and analyze the perceptions of students enrolled in Agricultural Education and Studies 450 (AGEDS 450) course in Fall 2000 and Spring 2001 regarding sustainable agriculture, issues related to sustainable agriculture and preferred learning/teaching methods for sustainable agriculture education. The findings of this study may provide research-based information to improve the AGEDS 450 curriculum and to develop and deliver sustainable agriculture education programs to farmers. Specific objectives of this study were to: 1) identify perceptions regarding sustainable agriculture; 2) determine level of concern regarding agricultural issues; 3) determine the extent experience with sustainable agriculture practices; 4) identify participants’ perceptions regarding motivation to learn sustainable agriculture practices; 5) identify perceptions regarding preferred teaching/learning methods for sustainable agriculture education; 6) identify sources of agricultural information; 7) identify the demographic characteristics and conduct comparisons with selected variables in the study.
Summary of Methods

The research design used in this study was descriptive. Fraenkel and Wallen (1996) stated that “descriptive studies describe a given state of affairs fully and carefully as possible” (p. 13). This was a census study. The population for this study consisted of junior and senior students who were enrolled in an Agricultural Education and Studies 450 (AGEDS 450) course during Fall 2000 and Spring 2001. Data for this study were collected using a questionnaire. The instrument was designed to measure participant perceptions regarding sustainable agriculture, motivation to learn sustainable agriculture, level of concern regarding agricultural issues, extent of experiences with sustainable farming practices, teaching learning processes and sources of agricultural information. The Committee on the Use of Human Subjects in Research at Iowa State University reviewed and approved the data collection instrument. The Statistical Package for the Social Sciences (SPSS) computer program was used to analyze the data with a 0.05 significance level set a priori. Descriptive statistics consisting of means, standard deviations, percentages and analysis of variance were used to analyze the data. Qualitative data were collected by conducting a focus group interview of six members of the class on December 7, 2000 and five students on February 13, 2001 after the completion of the quantitative portion of the study.

Summary of the Findings

In this study, the researcher collected and analyzed both quantitative and qualitative data. Analysis of the quantitative data revealed the following findings:

1. The majority (88%) of the participants were between the ages of 21 and 23.
2. The majority (95%) of the participants were male.
3. The majority (93%) of the participants grew up on farms.

4. The majority (83%) of the participants had experience in both livestock and crop operations.

5. The majority (61%) of the participants intended to pursue a career in farming while 30% of the participants intended to seek employment in other areas of the agricultural industry.

6. The participants in this study perceived that sustainable agriculture promotes environmental aspects of farming more than production and efficiency.

7. The participants were mildly interested in learning and practicing sustainable agriculture.

8. Overall, the participants had some degree of sustainable agriculture knowledge, although limited.

9. The participants were most concerned about expansion of large farms, urban use of farmland, soil erosion, and dependence on seed and chemical companies.

10. The participants were mildly concerned about deforestation and food safety.

11. The participants were more concerned about water and air quality than food safety.

12. Overall, the participants in this study were concerned about economic, environmental and social aspects of agriculture.

13. The respondents used crop rotation practices on their farms.

14. The respondents frequently used cultivation, leguminous plants and integrated pest management practices on their farms.
15. Overall, a majority of the participants in this study had some degree of sustainable agriculture experience.

16. The respondents perceived that hands-on activities are the most effective teaching and learning method.

17. The respondents perceived demonstrations, field visits, using a variety of methods, face-to-face consultations and group discussion as effective methods for teaching and learning.

18. The respondents perceived that the lecture method is somewhat ineffective for teaching and learning.

19. The respondents identified family members/relatives as their primary source for agricultural information.

20. The respondents identified magazines, colleagues, seed and chemical companies and the Internet as frequently used sources for agricultural information.

21. The Extension service was not a primary source of agricultural information for these participants.

22. Magazines were ranked the second most frequently used source for agricultural information.

23. Younger respondents used the Internet, magazines, seed and chemical companies and family members more than older respondents did.

24. Male respondents used DTN more than female participants did.

25. Students with a farm background used magazines, family members and television for agricultural information more than students who did not have a farm background.
The comments written on the questionnaire were summarized as follows:

1. Thirty-one percent of the written comments expressed skepticism towards sustainable agriculture. These respondents perceived that sustainable agriculture is an unproven theory that is being used for political purposes.

2. Forty-six percent of the written comments expressed a positive and favorable attitude towards sustainable agriculture.

3. Twenty-three percent of the written comments focused on ways of providing educational opportunities in sustainable agriculture.

4. The respondents were worried that large farm operators will push small farmers out of business.

5. The respondents believed that large farm operators care less for the land and may use practices that are not sustainable as long as they make money.

6. The participants in this study believed that small farmers take good care of their land.

The following statements represent a summary of the focus group interview. The respondents...

1. defined sustainable agriculture as a process of taking care of the land using soil conservation methods such as no-till and crop rotation farming methods.

2. perceived that organic agriculture is an extreme farming practice.

3. understood that sustainable agriculture promotes a managed use of inputs.

4. perceived that the degree of need for sustainable agriculture varies from region to region and indicated that farmers in southeastern Iowa use it more than farmers in central or northern Iowa.
5. perceived that farmers who practice sustainable agriculture are doing it because of the benefits they get from the government rather than for the purpose of caring for the land.

6. expressed that they were most concerned about consolidation of farmland to a few large farms, water contamination, soil loss and ignorance/unawareness of farmers about overall agricultural industry systems.

7. were concerned about government and the Extension service imposing changes in agriculture.

8. believed that farmers need more education to understand natural interactions among soil, water, animals, plants and farming in general.

9. believed that using a variety of teaching/learning methods such as a show-and-tell hands on approach, field visits, individual face-to-face consultations and published materials are effective.

10. had three different perceptions regarding Extension services. Some perceived that farmers are unaware of the depth and breadth of Extension services. Others perceived that farmers are using and benefiting from Extension services. And others believed that Extension has credibility problems.

11. suggested that the Extension service should provide more educational programs, invite speakers who have practiced sustainable agriculture, promote sustainable agriculture, organize field days, visit farmers on their individual farms, be careful about recommending new practices, make specific and localized recommendations and involve and listen to farmers before telling them what to do.
12. suggested experimenting with sustainable agriculture on a smaller scale before accepting it.

Conclusions

The overall purpose of this study was to identify and analyze the perceptions of agriculture students regarding concepts and practices of sustainable agriculture, interest/motivation to learn sustainable agriculture concepts and practices and preferred learning methods for sustainable agriculture education with an intent to provide research-based information to improve planning, delivery and evaluation of sustainable agriculture education programs. Based on the findings of this study, the following conclusions have been drawn:

Conclusions based on quantitative findings:

1. Students in the AgEdS 450 course indicated a belief that those who promote sustainable agriculture are biased towards environmental concerns.

2. Students in the AgEdS 450 course indicated a belief that large farms will be the only viable farms in the future.

3. The participants in this study were sincerely concerned about the future of agriculture. We can conclude that these participants care for the future of agriculture, but because of a competitive business environment, they are being realistic.

4. These participants in this study knew/understood and had some practical experience using sustainable agriculture practices although they did not necessarily call it sustainable agriculture.
5. Based on the findings, we can conclude that students in the AgEdS 450 course perceived that hands-on, show-and-tell approaches to learning are effective.

6. Family and relatives are valued agricultural information sources according to the participants in this study.

7. Students in the AgEdS 450 course, for the most part, used traditional sources of agricultural information. However, because of their age, education and exposure, they tended to use new technologies for agricultural information.

8. A large portion of the participants in this study expressed a favorable view towards sustainable agriculture. However, a significant portion of the participants had reservations about sustainable agriculture theoretically.

Conclusions based on qualitative findings:

9. Respondents appeared to equate sustainable agriculture and soil conservation.

10. The respondents believed that farmers who take part in government conservation programs are doing it to collect financial benefits rather than out of concern for the land.

11. The participants in this study believed that there is need for education to help farmers to understand natural interactions among soil, water, animals, plants and farming.

12. The participants held varied perceptions regarding Extension services ranging from total unawareness about what Extension does for people to those who frequently use the Extension services.

13. The participants were desirous to see Extension promoting sustainable agriculture and providing educational programs.
Recommendations

The following recommendations were made based on the findings and conclusions drawn from this study.

1. Students in the AgEdS 450 course perceived that sustainable agriculture focuses on mainly environmental concerns of agriculture. To tackle this misunderstanding/misrepresentation, instructors of the AGEDS 450 course and agriculture educators at Iowa State University should put equal emphasis on and present information regarding economical and social aspects of sustainable agriculture in courses and Extension programs.

2. Agricultural educators/Extension professionals at Iowa State University should use hands-on activities, demonstrations, field visits, a variety of delivery methods, face-to-face consultations and group discussion methods to deliver sustainable agriculture education programs.

3. Extension should target programs for young farmers to assist them with knowledge and skills on using sustainable agriculture practices.

4. Extension programs should focus on farmers using sustainable agriculture practices as demonstration farms and learning laboratories.

5. Extension production programs should be organized on sustainable agriculture practices that are geared towards local needs and situations.

6. University Extension should provide educational programs to farmers on the impact of interactions of animals, plants, water, soil and human activities on sustainability of agriculture, for example, use of machinery on the environment and productivity.
7. Agricultural educators should conduct further studies that focus on the best educational processes that should be used to introduce new technologies related to sustainable agriculture.

Implications and Educational Significance of the Study

The findings of this study have educational significance for curriculum development, learning/teaching processes, program planning, delivery and evaluation of educational programs on sustainable agriculture. The findings provide insight to educators regarding appropriate methods to use in teaching technical subject matter in agriculture, for example, sustainable agriculture. The findings of this study suggest encourage a balanced approach should be taken in dedicating curriculum content, time and resources to the three (economical, environmental and social) aspects of sustainable agriculture to tackle the misconception that sustainable agriculture predominantly considers environmental issues.

The findings of this study will be beneficial for researchers in Agricultural Education. This study identified the sustainable agriculture issues that are of most concern to these participants. One of the main concerns focused on educational practices

Making the right choices for delivery methods is as important as making the right content choices. The findings of this study provide some useful insights to what methods to use to deliver subject matter to create a favorable learning environment and appropriate learning opportunities. This applies to both formal and non-formal education settings. Overall, educators, researchers and policy makers may benefit from the findings of this study.
Educators should integrate hands-on, show and tell approach to teach sustainable agriculture. AgEdS 450 farm is an excellent educational laboratory. Educators should dedicate more time and effort to use AgEdS 450 farm and other similar Iowa State farms to provide hands-on educational opportunities to students, particularly in agricultural fields. Emphasis on practical methods of teaching may enhance student learning while expanding research opportunities for agricultural educators and researchers. Police makers should allocate resources to expand practical, hands-on educational and research opportunities for potentially better results.

**Sustainable Agriculture Education Model**

Based on the review of literature on sustainable agriculture and the teaching/learning processes and the findings of this study, a model for education about sustainable agriculture (Figure 4) was developed. The model should assist in development, delivery, and evaluation of educational programs in sustainable agriculture. The model has relevance to the population studied because it describes the process educators need to follow in developing educational programs/curricula for young adults studying sustainable agriculture. The model begins with the foundation philosophy of sustainable agriculture practices. It is widely stated that a sustainable agriculture system is one that promotes economically profitable, environmentally sound and socially acceptable farming practices. These philosophical components should be evaluated in terms of societal values, needs and rights as well as individual interests, values, needs and rights and responsibilities.
<table>
<thead>
<tr>
<th>Curriculum Organization/Settings...</th>
<th>Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-12</td>
<td>Colleges</td>
</tr>
<tr>
<td>Agricultural companies/industry</td>
<td>Non-profits</td>
</tr>
<tr>
<td>Applied</td>
<td>Social</td>
</tr>
<tr>
<td>Psychological</td>
<td>Anthropological</td>
</tr>
<tr>
<td>Completion: local and global</td>
<td>Limited resources</td>
</tr>
<tr>
<td>Prices</td>
<td>Soil erosion</td>
</tr>
<tr>
<td>Profit margins</td>
<td>Shrinking forests</td>
</tr>
<tr>
<td>Cost of operation Policies</td>
<td>Global warming</td>
</tr>
<tr>
<td>Policies</td>
<td>Water contamination</td>
</tr>
<tr>
<td></td>
<td>Air pollution, etc.</td>
</tr>
<tr>
<td>Opportunities/Challenges</td>
<td>Growing population</td>
</tr>
<tr>
<td></td>
<td>Expanding cities</td>
</tr>
<tr>
<td></td>
<td>Materialistic culture</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Efficiency</th>
<th>Profitability</th>
<th>Productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diversity</td>
<td>Harmony</td>
<td>Conservation</td>
</tr>
<tr>
<td>Beauty</td>
<td>Safe food</td>
<td>Safe water</td>
</tr>
<tr>
<td></td>
<td>Clean air</td>
<td>Continuity</td>
</tr>
</tbody>
</table>

**Figure 4. Educational Model for Sustainable Agriculture**
Agriculture is not only a means for food production, but it is a way of life for millions of people around the world. It is a human experience that is closely related to people's survival and success. It is our heritage.

The need for food production is increasing as the population grows. The fundamental objective of agriculture is meeting this need. However, the need to maximize profits may cause problems. When farming is driven by nothing but profit, it may undermine natural resources and community structures.

We have the responsibility to pass on an agriculture system that is sustainable to the next generation. We have the right to use available resources in a responsible way as long as we don't misuse and abuse these resources. It is essential to maintain a good balance among environmental, economical and social aspects of agriculture.

After evaluating individual components of sustainable agriculture in terms of societal values, needs and rights, we need to identify and define the purposes or objectives of each component. Each objective needs to be assessed in terms of its measurability, compatibility and feasibility. Having measurable objectives would minimize confusion and provide clear activities for action. Compatibility will assist us to evaluate our objectives and activities in terms of overall sustainable agriculture philosophy. Feasibility evaluation will assist us to see if the objectives are achievable within given resources.

Each major area of sustainable agriculture needs further refinement through a reality assessment. What are the economic realities today? What do farmers have to know and do to run a successful agricultural enterprise? Economical aspects have to be evaluated in terms of competition, prices, profit margins and cost of operation to maximize profits. On the other hand, environmental aspects have to be considered to determine the limitations of
natural resources, loss of topsoil, contamination of water resources, etc. Furthermore, the
need for safe food, clean water and air, continuity of agriculture, etc. should be seen in the
current realities of population growth, expansion of cities and materialistic/consumer
oriented culture, etc. When we compare and screen each component against the other, there
are dilemmas or conflicts. For example, the idea of achieving safe food and clean water may
be practical for environmental and health purposes, but when it is seen in the light of growing
population and need to maximize food production to meet the needs of humans, using
synthetic fertilizers, herbicides, pesticides, etc., become a necessary action. We need to
evaluate the opportunities and challenges that are in front of us. How do we deal with these
perpetuating problems? Where do we start? Here is where the research plays an important
role to help us find potential solutions.

In view of the fact that sustainable agriculture issues are complex and require a
systemic approach, we need to consider research to help us identify the problems and provide
potential solutions. Because sustainable agriculture considers economic, environmental and
social aspects of farming, research should be designed with an interdisciplinary approach.
Applied scientific research has already helped us maximize our productivity and will
continue to do so. It is important to do social and educational/psychological research to help
us understand the interrelationships of the economic, environmental and social forces that
drive farmers’ decisions and agricultural practices. We need to evaluate the ongoing research
and the new research agenda to make sure it is in line with sustainable agriculture
philosophy, purposes and current realities.

However, a change in perception precedes a change in action. If there is any hope for
sustainable agriculture to establish roots and grow, it is through education. At the present
time, K – 12 institutions and colleges are the main formal education providers. Non-formal Extension programs represents other sources. Nonetheless, agricultural companies and non-profit organizations also play significant roles through formal and non-formal education opportunities. What roles do these institutions play in promoting sustainable agriculture? How could we maximize their efforts toward a sustainable agriculture system? We need to evaluate the mission of educational and research institutions. The research agenda and educational opportunities should reflect the economic, social and environmental aspects and needs of agriculture. Public universities are entrusted to provide unbiased scientific knowledge to the public. Research activities and educational opportunities should be free from bias. It is possible that researchers/educators have biased views towards any one of the three aspects of sustainable agriculture. Thinking and acting within the bounds of the missions and goals of the institutions would help both researchers and educators to base their judgements and decisions on facts, and maintain their professional integrity. Where we get funding for research and educational opportunities could be a blinding factor that could inject bias to the equation.

Educational opportunities would help us achieve our goals if they incorporate appropriate curriculum and delivery methods. Thus, we should continuously evaluate our teaching/learning processes in order to maximize learning.

Finally, we need to evaluate our achievements and the process. Evaluation helps us to learn from both successes and failures. It is important that we evaluate our evaluation processes occasionally. Our evaluation should not end at outcome or process evaluation, it should rather go all the way to impact evaluation. Unless we have a chance to see and measure the impacts of our investment in time and resources, we are laboring in vain. Using
the model and the steps presented in the model may give a clearer picture of what we would like to achieve and how we may get there. Then, we may be able to see sustainable agriculture bear fruit now and for generations to come.

The findings of this study show that participants held varied perceptions regarding sustainable agriculture. Sustainable agriculture is a complex concept and process. It involves many disciplines and diverse stakeholders. It requires systems thinking, planning, research, educational opportunities and evaluation. The educational processes are essential for the full integration of sustainable agriculture concepts and practices. This model is designed to help bring together the philosophical, economical, environmental, social and educational dimensions of sustainable agriculture to educators and researchers to look at multiple sustainable agriculture issues in a systematic way to come up with an appropriate research agenda and educational opportunities for learners/farmers to advance the principles of sustainable agriculture. The educational processes dominate the model and are the key to the success of a systematic approach to a sustainable agriculture. This processes are learning, teaching, delivery systems, needs analysis, program development, curriculum design, and evaluation. Without an emphasis on these components of the system, sustainable agriculture principles and practices will not be fully adopted.
APPENDIX A. HUMAN SUBJECTS REVIEW COMMITTEE APPROVAL FORM

PI Name: Awoke D. Dollisso
Title of Project: Perceptions Regarding Sustainable Practices and Educational Processes

Checklist for Attachments
The following are attached (please check):

13. ☑️ A letter or written statement to subjects indicating clearly:
   a) the purpose of the research
   b) the use of any identifier codes (names, numbers), how they will be used, and when they will be removed (see item 18)
   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, whom and how you will contact subjects later
   g) that participation is voluntary; nonparticipation will not affect evaluations of the subject

14. ☑️ A copy of the consent form (if applicable)

15. ☑️ Letter of approval for research from cooperating organizations or institutions (if applicable)

16. ☑️ Data-gathering instruments

17. Anticipated dates for contact with subjects:
   First contact: Nov. 30, 2000
   Last contact: April 30, 2001

18. If applicable: anticipated date that identifiers will be removed from completed survey instruments and or audio or visual tapes will be erased:
   No identifiers will be used
   Month/Day/Year

19. Signature of Departmental Executive Officer:
   Date
   Department or Administrative Unit

20. Initial action by the Institutional Review Board (IRB):
   ☑️ Project approved________ Date
   ☑️ Pending Further Review Date
   ☑️ Project not approved Date
   ☑️ No action required Date

21. Follow-up action by the IRB:
   ☑️ Project approved Date
   ☑️ Project not approved Date
   ☑️ Project not resubmitted Date

Patricia M. Keith
Name of IRB Chairperson
   Date
   Signature of IRB Chairperson
APPENDIX B. COVER LETTER AND DATA COLLECTION INSTRUMENT

Department of Agricultural Education and Studies
201 Curtiss Hall
Ames, Iowa 50011 - 1050

Dear Student,

There is a great debate currently going on in agriculture. That debate focuses on sustainable agriculture. Sustainable agriculture is defined as a farming system that is "economically profitable, environmentally sound and socially responsible" (USDA, 1998).

We need your help! The purpose of this study is to identify perceptions held by future farmers and agriculturists studying agriculture at Iowa State University.

It will take approximately 15 minutes to complete this questionnaire. The results from this study will be helpful in making future decisions about educational practices. We assure you that your responses will be confidential. There will not be an identification code on the questionnaire. Only summary data will be reported. All instruments will be destroyed after analysis of the data. The data will be used to complete a Ph.D. dissertation.

While your participation is strictly voluntary, you are a member of a chosen population to participate in the study. Therefore, it is very important that you complete your survey to assure that the study is representative of agriculture students' views.

Thank you for taking the time from your busy schedule to complete this questionnaire. Without your assistance, it would be impossible to get this much-needed information.

Sincerely,

Awolke D. Dollissu
Graduate Student

Robert Martin
Professor and Department Head
Sustainable agriculture is defined as farming systems that are "economically sound, socially acceptable and environmentally benign" (Cooperative Extension Joint Committee on Sustainable Agriculture, 1991).

### Part I. Perceptions Regarding Sustainable Agriculture

<table>
<thead>
<tr>
<th>Statement</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainable agriculture promotes productivity.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Sustainable agriculture promotes profitability.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Sustainable agriculture promotes efficiency.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Sustainable agriculture promotes ecological harmony.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Sustainable agriculture preserves natural resources.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Sustainable agriculture promotes diversified farming practices.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Sustainable agriculture promotes continuity of agriculture for future generations.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Sustainable agriculture enhances food safety.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Sustainable agriculture enhances water and air quality.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

### Part II. Interest/Motivation to Learn Sustainable Agriculture Concepts and Practices

<table>
<thead>
<tr>
<th>Statement</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>I don't have the necessary knowledge or experience to practice sustainable agriculture.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Sustainable agriculture concepts are not clear to me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>I would like to learn more about sustainable agriculture concepts.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>I would like to practice sustainable agriculture.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Sustainable agriculture has a bright future.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>I would like to participate in sustainable agriculture educational programs.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>
### Part III. Perceived Level of Concern Regarding Agricultural Issues

Please indicate your level of concern about each of the following agricultural issues by circling the appropriate number on a 4-point scale (1 = Not Concerned to 4 = Very Concerned):

<table>
<thead>
<tr>
<th>Issue</th>
<th>Very Concerned</th>
<th>Concerned</th>
<th>Initially Concerned</th>
<th>Not Concerned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food safety</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water quality</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air quality</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil erosion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deforestation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Destruction of the ecosystems</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dependence on chemical and seed companies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expansion of large farms at the expense of small farms</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expansion of cities on farmland</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Part IV. Extent of Experiences with Farming Practices

Please indicate the extent to which you have had experiences in each of the following farming practices by circling the appropriate number on a 4-point scale (1 = Never to 4 = Always):

<table>
<thead>
<tr>
<th>Practice</th>
<th>Never</th>
<th>Sometimes</th>
<th>Frequently</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop rotation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cultivation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cover crops</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leguminous crops</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integrated pest management</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low intensity livestock production</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No tillage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pasture rotation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Part V. Perceptions Regarding Teaching/Learning Methods

<table>
<thead>
<tr>
<th>Teaching/Learning Methods</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Frequently</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Hands-on activities</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Demonstrations</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Field visits</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Group discussion</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Face to face consultation with experts</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Variety of methods</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Please indicate the extent to which you think each of the following teaching/learning methods is effective at providing sustainable agriculture education by circling the appropriate number on a 5-point scale (1 = Not effective to 5 = Very effective).

### Part VI. Perceptions Regarding Sources of Agricultural Information

<table>
<thead>
<tr>
<th>Sources of Agricultural Information</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Frequently</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet/web</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Magazines</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Course materials</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Video tapes</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Colleagues</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Extension services</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Seed and chemical dealers</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Radio</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>DTN (Data Transmission Network)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Family members/relatives</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Television</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Please indicate the extent to which you use each of the following information sources for agricultural information relevant to farming operations by circling the appropriate number on a 5-point scale (1 = Never to 5 = Always).
Please complete the blanks/ or circle the options that are appropriate to your situation.

1) Your age in years ________.

2) Your gender: a) female b) male

3) Did you grow up on farm? a) Yes b) No. If yes, the type of operation was:
   a) crops only b) animals only and c) both animals and crops. If no, go to the next question.

4) Your career goal is to become a _______. a) full-time farmer b) part-time farmer
c) work for agriculture companies d) Other _______ specify below.
   1) __________
   2) __________
   3) __________

5) Do you have any comments about sustainable agriculture in general?
   _______________________________________________________________________
   _______________________________________________________________________
   _______________________________________________________________________

6) In your view, where is the agricultural industry headed?
   _______________________________________________________________________
   _______________________________________________________________________
   _______________________________________________________________________
APPENDIX C. AN INTERVIEW SCHEDULE

1. What does sustainable agriculture mean to you?

2. Do farmers use sustainable farming practices?

3. What agricultural issues concern you most?

4. What specific farming practices do you consider sustainable?

5. Do you think you need to learn more to really understand and practice sustainable agriculture?

6. What methods are best to learn sustainable agriculture practices? Why?

7. Do farmers use Extension services?

8. What potential strategies and solutions do you recommend to deal with the problems that are related to conventional farming practices?

9. What role do you believe Agricultural Extension should play in promoting sustainable agriculture practices?

10. What role do you believe individual farmer should play in promoting sustainable farming practices?
REFERENCES


Experiment Station Committee on Organization and Policy (ESCOP). (1992). Research agenda for the 1990s. College Station, TX: Subcommittee of ESCOP.


