Perceptions of Iowa high school agricultural education teachers and students regarding sustainable agriculture

by

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CHAPTER I: INTRODUCTION

A 1987 survey of Iowa high school agricultural education students indicated that student attitudes toward conservation of natural resources were less than desirable. Since then several conservation education initiatives related to agriculture's impact on the environment have been conducted. During this time, attention has been given to introducing sustainable agriculture systems in Iowa (Whent, Weber, Andrews and Williams, 1988) .

The need for a conservation program in the United States was evident during the Dust Bowl in the 1930s. In response to the Dust Bowl in the 1930's when much of the great plains soil was eroded by wind, the Soil Conservation Act was enacted in 1935 to help farmers control soil erosion. Since the establishment of the Soil Conservation Service in 1936, only limited progress has been made in controlling soil erosion. Leopold (1948, p. 109) identified one of the basic defects in the soil conservation movement:

> We have not asked the citizens to assume any responsibility. We have told farmers that if they will vote right, obey the law, join conservation organizations, use the appropriate conservation practices that are profitable on their land, everything will be fine; the government will do the rest.

Leopold believed that through education and action we could conserve natural resources. His concept remained dormant for many years, but the focus on protecting the environment, including conserving our soil, has received special attention.

One hundred years ago, Iowa had 14 to 16 inches of topsoil. In 1986 half of the original topsoil (6 to 8 inches) has disappeared from Iowa's farmland. In the next one hundred years, if erosion continues at the present rate, Iowa will have only subsoil left. To regenerate the lost soil would take 2,500 to 10,000 years using the general formula of 250 to 1,000 years = 1 inch topsoil (Soil Conservation Service, 1986).

The loss of soil is only one of the problems with agricultural systems. Another problem is the overuse of a variety of chemicals that contaminate our surface and groundwater.

From 1964 to 1983 the use of herbicides rose from 220 to 550 million pounds yearly (Farm Facts, 1991). Research has shown that farm chemicals, such as nitrate fertilizers, contaminate water resources.

Future generations of land users will need to develop a holistic view of agriculture. As Leopold (1990, p. 240) suggested:

> In short, a land ethic [holistic farming] changes the role of Homosapiens [farmer] from the conqueror of the land-community to plain members and citizens of it. It implies respect for the fellow-members of the land community.

Savory (1988) suggested that all aspects of the ecosystem should be considered in planning farming systems. A holistic approach is the only way to heal land that is being lost or damaged by current agricultural practices.

Securing usable farmland for the future will result in the need to change present paradigms about agricultural systems. Giltmier (1990, pp. 625) suggests that:

> Those people who have chosen to live their own version of a decent life by dedicating themselves to the stewardship of the land can do one of two things. They can sit in a dark corner, inappreciable and defensive, wondering when their attempts to accomplish good were only met with public abuse and indifference; they hang around waiting for the public to declare their problems irrelevant at hand because of their past failures or they can get off their butts and share what they know with the public. They can share their idea of what is wrong with the globe is not just a scientific or ethical problem, it is a problem of the community.

Many farmers and agricultural professionals feel that major steps need to be taken to protect our natural resources. Several steps have been taken to conserve the soil and reduce the use of pesticides in recent years, but additional action is needed.

Since 1983, the United States use of herbicides has decreased from 550 million pounds to 375 million pounds yearly. In 1977, the use of insecticides reached 160 million pounds. That figure had decreased to 80 million pounds yearly by 1987 (National Research Council 1989). The Soil and Water Conservation Service stated in an article in Time Magazine that 80 percent of the farmers will be on a residue management program by the year 2000 (Sideny, 1992). With the introduction of the Conservation Reserve Program (CRP), the United States

Department of Agriculture estimates that 30 to 40 million acres of highly erodible land in the CRP program will reduce soil sediment delivery through controlling surface waters as much as 200 million tons per year (Sideny, 1992).

The 1990 farm bill is evidence that conservation of our natural resources is a priority for our society. Public policy is being used to force farmers to preserve the nation's natural resources. The 1990 farm bill requires every farmer with highly erodible land to develop a conservation plan by January of 1992 which complies with government regulations, and to implement the plan by 1995 (United States Farm Bill, 1990). A Leopold Center for Sustainable Agriculture publication (Keeney, 1990, p. 101) reported that:

> Passage of the 1990 farm bill with strong environmental protection provisions and rapidly advancing public environmental concerns have combined to bring **sustainable agriculture** to the forefront of national concern.

Sustainable agriculture is a relative term that has many definitions. Lack of a clear explanation of sustainable agriculture leads to confusion. With a topic as confusing as sustainable agriculture, a major problem is the acceptance of its broad agenda. Change is not easy for most people; it is hard for farmers to adopt new ways of farming.

For many farmers and agricultural business professionals, one of the major reasons for resisting change is economics. Farmers feel that the new way of farming may not provide the income needed to keep their farms profitable. Leopold (1990, p. 110) stated that "Land use ethics are still governed wholly by economic self-interest . . . "

Even if the literature shows that conservation tillage and other sustainable practices reduce operating costs by 25 to 30 percent while yields remain about the same, many farmers are skeptical about the new system of farming. Conflict is obvious between farmers using conventional farming systems and those using sustainable (alternative) systems. Beus and Dunlap (1983, p. 597) suggested that:

> . . . All indications are that the contemporary debate in agriculture seems to have the makings of a true paradigmatic conflict. Proponents of the dominant, conventional agricultural paradigm appear determined to defend their position against the yet relatively unorganized alternative agriculture movement, which in turn appears determined to establish its perspective as a new foundation for agriculture.

Change is evident and sustainable agriculture is on the forefront in agriculture in the 1990s. Change will come slowly through education and active participation of people involved in agriculture.

Purpose of the Study

In order to provide Iowa agricultural education teachers with relevant instructional materials on sustainable agriculture, an understanding of teacher and student perceptions of selected sustainable agriculture concepts is needed. The purpose of the study was to assess the perceptions of Iowa high school agricultural education teachers and their students regarding sustainable agriculture. Such a data base will be useful in developing curriculum and instructional materials on sustainable agriculture for agricultural education programs in Iowa secondary schools.

Objectives

The specific objectives of the study were:

1. To determine the perceptions of Iowa high school agricultural education teachers and students about sustainable agriculture,

2. To test for differences between teacher and student perceptions of sustainable agriculture, and

3. To test for differences among teachers and among students with regard to perceptions of sustainable agriculture when grouped by selected demographic variables.

Limitations of the Study

The limitations of the study were as follows:

1. The study was limited to Iowa.

2. The study was limited to Iowa high school agricultural education teachers and students.

Operational Definitions

•Agricultural Education:

The teaching of agriculture in Iowa secondary schools.

•Sustainable Agriculture:

Agriculture systems that are environmentally sound, profitable and productive and maintain the social fabric of the rural community (Keeney, 1989).

•Sustainable Agricultural Education:

The teaching of sustainable agriculture concepts and practices.

•Perceptions:

The act of perceiving or the ability to perceive by means of senses, audiences, and comprehension.

Summary

This research was designed to investigate the perceptions of Iowa high school agricultural education instructors and students regarding sustainable agriculture. The goal of this research is to provide data that educators can use in guiding the development of sustainable agriculture instructional materials for use in high school agricultural education programs.

CHAPTER II: REVIEW OF LITERATURE

This chapter will provide a summary of related literature with sections on (1) sustainable agriculture, (2) sustainable agriculture practices, (3) natural resources education (environmental), (4) student perceptions about sustainable agriculture, (5) teacher perceptions about sustainable agriculture, (6) farmer perceptions about sustainable agriculture, and (7) sustainable agriculture educational materials.

Sustainable Agriculture

Sustainable agriculture is a confusing term and there is no one definition. The following are some of the many definitions of sustainable agriculture. Fisher (1982) believes there are seven basic components required for the achievement of a sustainable agriculture system: (1) dynamism in biological systems; that which is static is rarely sustainable, (2) a sustainable system of agriculture must be one that achieves the production of crops and livestock and the management of the farm's resources in a way that harmonizes rather than conflicts with nature, (3) the system must be diverse in order to achieve optimum production, (4) it relies primarily on renewable resources for the achievement and maintenance of basic soil fertility, (5) the system in which the input of thought, ingenuity, care, and personal involvement can be judged to be more significant than the inputs of technology, (6) a system of sustainable agriculture should be one which recognizes the contribution of good nutrition to the health of populations and accepts that the producer has a special responsibly to ensure he or she eliminates the hazards of toxicity, and (7) sustainability must embrace more than crops, livestock, and the soil which support their production. It must also include the people who work or live on the land, and the relationship of the land to the rest of the rural community in which it is situated. Reves (1990), an economist, believes that "true sustainable agriculture recognizes the reality of ecological limits to the material growth and the need to live on the interest of our remaining ecological capital." Keeney (1989) defined sustainable agriculture as agriculture systems that are environmentally sound, profitable and productive and maintain the social fabric of the rural community. The definition of sustainable agriculture rests in what an operator can do to conserve resources working in harmony with the environment and yet enjoy long-term profitability (Cooper and Gamon, 1988).

These are only a few of many definitions of sustainable agriculture. With the increasing need to protect the environment, many more definitions will probably emerge. This leads to some confusion about the definition of sustainable agriculture. With many confusing aspects of sustainable agriculture, farmers find themselves skeptical of changing their farming practices.

One of the problems sustainable agriculture is facing is how to change the present paradigms from a conventional to a sustainable (alternative) agriculture. Presented below are the elements of the two competing agricultural paradigms.

Conventional	*Alternative*
<u>Centralization</u>	<u>Decentralization</u>
• National/ international production processing, and marketing	• More local/regional production, processing, and marketing
• Concentrated populations; fewer farmers	• Dispersed control of land; more farmers
• Concentrated land control of land, resources and capital	• Dispersed control of land, resources and capital
<u>Dependence</u>	<u>Independence</u>
• Large, capital-intensive production units and technology	• Smaller, low-capital production and technology
• Heavy reliance on external sources of energy, inputs, and credit	• Reduced reliance on external source of energy, inputs, and credit

• Consumers and dependence on the market	• More personal and community self-sufficiency
• Primary emphasis on science, specialists and experts	• Primary emphasis on personal knowledge, skills, and local wisdoms
<u>Competition</u>	<u>Community</u>
• Lack of cooperation; self interest	• Increased cooperation
• Farm traditions and rural culture outdated	• Preservation of farm traditions rural culture
• Small rural communities not necessary to agriculture	• Small rural community essential to agriculture
• Farm work a drudger; labor an input to be minimized	• Farm work rewarding; labor essential to be made meaningful
• Farming is a business only	• Farming is a way of life as well as a business
• Primary emphases on speed, quantity permanence, and profit	• Primary emphases on quality and beauty
<u>Domination of Nature</u>	<u>Harmony with Nature</u>
• Humans are separate and superior to nature	• Humans are part of and subject to nature
• Nature consists primarily of resources to be used	• Nature is valued primarily of own sake
• Life-cycle incomplete; decay (recycling and wastes) neglected	• Life-cycle complete; growth and decay balanced
• Human-made systems imposed on nature	• Natural ecosystems are imitated
• Production maintained by agricultural chemicals	• Production maintained by development of healthy soil
• Highly processed, nutrient-fortified food	• Minimally processed, naturally nutritious food

Specialization	Diversity
• Narrow genetic base	• Broad genetic base
• Most plants grown in monoculture	• More plant grown in polyculture
• Single-cropping in succession	• Multiple plants grown in complementary rotations
• Separation of crop and livestock	• Integration of crops and livestock
•Standardized production systems	• Locally adapted production systems
• Highly specialized, reductionistic science and technology	• Interdisciplinary, systems-oriented science and technology
Exploitation	**Restraint**
• External costs often ignored	• All external cost must be considered
• Short term benefits outweigh long term outcomes	• Short term and long term outcomes equally important
• Based on heavy use of non-renewable resources	• Based on renewable resources; non-renewable resources conserved
• Great confidence in science and technology	• Limited confidence in science and technology
• High consumption to maintain economic benefit growth	• Consumption restrained to future generations
• Financial success: busy lifestyles; materialism	• Self-discovery; simpler lifestyles; nonmaterialism

(Beus and Dunlap, 1983, p. 597)

Paradigms are not easy to change. Agriculture's view of controlling nature for man's use has existed for many years. The new sustainable agriculture paradigm will require changes in attitude in the farming community.

Sustainable Agriculture Practices

On-Farm Research

This is a useful tool in the development and dissemination of sustainable agriculture practices. In the past, dissemination of technology has been a top-down system. Recently a change has occurred in the fact that researchers and educators view the farmer as a useful resource. Flora (1991) suggests that a partnership needs to be made between university research and extension and the farmer to conduct on-farm research. Working cooperatively will increase the adoption rates of sustainable agriculture practices and will weed out the practices that are not useful. Junke (1990) indicated that on-farm research needs to compare methods of sustainable agriculture to see if they are profitable while improving environmental conditions. Farmers, as researchers, will greatly improve the dissemination of new sustainable agriculture technology.

Filterstrips/ Riparian Bufferstrips

This sustainable agriculture practice uses trees, shrubs and grass planted sequentially in strips along a stream next to agriculture fields to reduce bank erosion and sediment runoff into the stream. A study of such a system reduced sediment runoff into a stream by 95 percent (Schultz, 1991). An added benefit of such a system is that subsurface water moves toward a stream carrying chemicals such as herbicides and fertilizers. The trees and shrubs along the stream will take up much on these chemicals before they reach the stream, thus reducing water contamination (Colletti, Hall, Schultz, Rule, and Mize, 1991). Most farmers do not plant crops all the way to a stream, so it is logical to provide some sort of vegetative strip to control the bank and reduce sediment loading. Comparing the cost of the traditional method (riprap, tires, concrete, etc.) of controlling stream bank erosion and a bufferstrip, it is more expensive to use the older method. Costs of the traditional methods are $50 to $200 per foot, whereas the bufferstrip only costs $7 to $15 a foot (Illinois state water survey, 1991). Economically it is more cost effective to use a bufferstrip than traditional stream bank erosion control.

Narrow Strip Intercropping

This practice's purpose is to add diversity to a farming system. This practice plants many different crops 15 feet wide in rows of six. An example might be one row of walnut trees, a strip of corn, and a strip of oats, then a strip of beans. These are rotated each year (Huber, 1992).

Ridge Tillage

This is a process of establishing rows of soil ridges in which to plant your crop. Ridge tillage is a combination of no-till and minimum tillage. The ridges are not taken out from year to year, but cultivation occurs between ridges. The purpose is to reduce weeds without the use of many chemicals (Iowa State Extension, 1992). Having a cover on the surface increases the number of earthworms in the soil. Worms process much soil, provide fertility, porosity, airation and improve soil structure. In a field with 20 worms per square foot they will process 104.54 tons of soil each year and there is 871,000 worms per acre (Scofield, 1992). This increases infiltration of water. In combination with surface residue, most of the surface runoff is eliminated.

Rotational Grazing

This is a controlled grazing system in which a number of subpastures (paddocks) are grazed in sequence. This system can be 2 to 40 paddocks. The advantages of such a system are reduced costs, increased profits, reduced energy inputs, improved environmental conditions, improved animal health and less labor (Gerrish, 1991). Rotational grazing has shown to be more economical than corn or soybeans on certain soil types and topography (Stohbehn, 1991). Savory (1988) suggests that proper grazing increases energy flow (productivity) above and below ground. Rotational grazing comes closest to what a natural ecosystem might have been like when bison roamed the plains. Improper (over) grazing breaks the natural secession patterns of the grasses. The roots of the grasses lose vigor--many weeds invade the ecosystem and much of the soil becomes exposed, thus causing soil erosion and breakdown of structure. Rotational grazing is a needed sustainable agriculture practice in keeping agriculture close to natural ecosystems.

Late Spring Nitrate Testing

Nitrate sampling is done as late in the spring as possible but still able to sidedress nitrogen if needed. Such a test enables farmers to adjust rates of N fertilizer in response to spring weather conditions and the nitrogen carried over from the previous year (Morris and Blackmer, 1993). A sustainable agriculture practice like this helps reduce the needless application of nitrogen to the soil. It helps reduce costs and protects many water resources from being contaminated.

Row Banding of Herbicides

This is a process where herbicides are placed in a band along a crop to control weeds. This practice reduces the amount of chemicals applied to the fields to control weeds. This practice can reduce the use of chemical fertilizers.

Integrated Pest Management (IPM)

Integrated pest management is a term that encompasses a wide range of pest management practices. The common end for most of them is the reduced use of chemical pesticides. One practice often used in IPM is monitoring insect population within a field. Monitoring populations can determine the level of pests and beneficial insects in a given area. At this point, an IPM manager can calculate the economic threshold to determine if a spray is needed (Pfadt, 1978). A study with the use of IPM saved approximately three fungicide and two insecticide applications to a field of apples in controlling scab and codling moth (Gleason, 1993). With the use of management much of the chemical application regarding pests can be greatly reduced.

Allelopathy / Fall Seeded Cover Crops

Some farmers in Iowa plant oats, rye or hairy vetch as cover crops to control erosion, immobilize nitrogen, increase organic matter, and suppress weeds (allelopathy). These two concepts go hand-in-hand. Allelopathy is defined as both beneficial and detrimental chemical interaction among organisms. In other words, plants produce chemicals that can control weeds. For example, a cover crop is planted in the fall, such as rye. The residue in the spring inhabits the growth of weeds allowing the crop to grow through it (Huber and Guendel, 1992).

Low Input Livestock Facilities

This system of raising livestock is not all that new. A farmer may use smaller shelters in a field to provide living areas. For example, in the summer months with the proper management practices, hogs can farrow in small shelters in the field. This has less stress on the hogs. It also reduces much of the capital investment needed to keep sows in a farrowing crate year around. It is less labor intensive because much of the food they receive is forage in the field (Wissink, 1992).

Agroforestry

Agroforestry is the combination of the use of trees within an agriculture system. There are many of these systems. One system proposed for use of trees in a cropping system is strip cropping with trees and other row crops. This can be done successfully on highly erodible land. One may use a tree such as walnuts as a long term crop of nut and harvest in 100 to 150 years as a lumber source. The use of black alder is also a promising tree, because it fixes nitrogen at a rate equal to that of chemically applying it (Countryman, Krambeer, 1992).

Riparian bufferstrips are also included in an agroforestry system. Bufferstrips can be used to control streambank and provide a low-cost fuel source. The production of biomass with popular trees in combination with bufferstrip is very economical. When a popular tree is cut, it grows back quickly, thus still maintaining the stream bank and providing a low-cost energy source. Iowa imports 98 percent of its energy sources. This low-cost energy source is a good alternative to other fuel sources. These alternative fuel sources can be used in a wide variety of cropping systems (Countryman, Hall, Schultz, Wray, 1992). One such system utilizes the waist sulge of a city to increase the productivity of a biomass source. Popular trees are planted in rows and the sulge is placed between the rows. This works as a fertilizer source. The biomass is harvested and burned converting biomass energy into electricity that can be utilized (Schultz, Hall, Mize, Colletti, 1992).

Natural Resources Education

Changing from conventional to sustainable agriculture can be facilitated by high schools through secondary school agricultural education programs. A National Academy of Science report suggested that sciences related to natural resources should be incorporated into new components of agricultural education in secondary schools (National Academy Press, 1988). A study (Whent, Weber, Andrews and Williams, 1988) of Iowa high school agricultural education students, found that students were "undecided" or only "sightly agreed" with the following statements:

1. Nature replaces soil slowly
2. The majority of soil conservation practices are costly
3. Soil erosion pollutes water
4. Soil erosion harms wildlife
5. Laws are necessary to reduce soil erosion
6. Highly erodible land should be retired from crop production

7. Helping plan a conservation system is expensive to farmers

8. Most farmers manage the application of agriculture chemicals to prevent water pollution

This study indicated the need to change the way high school students view agriculture. Agricultural education can help change the way people look at agriculture's impact on the environment. Educational initiatives should provide opportunities for students to be actively involved in learning about the relationship between agriculture and the environment. Hungerford and Volk (1990, p. 17) suggested that:

> If environmental issues are to become an integral part of instruction designed to change behavior, instruction must go beyond an "awareness" or "knowledge" of issues. Students must be given the opportunity to develop the sense of "ownership" and "empowerment" so that they are fully invested in an environmental sense and prompt to become responsible, active citizens. The research is very clear on this matter. Citizenship behavior can be developed through environmental education.

Leopold (1948) also suggested we increased conservation education, but he felt that increasing the volume of conservation education is not the only answer, but to ask people to actively participate in conservation was equally important.

Education in sustainable agriculture should be a combination of classroom instruction and active participation in solving problems related to agricultural systems. Problem solving within the community will give students an active role in the development of a better society. Williams and Weber (1990, p. 14) stated that:

> Instruction in natural resources needs to be expanded and focused to help youth and adults understand the relationship between agriculture systems and conservation of natural resources.

Instruction in sustainable agriculture by high school agricultural education programs must be done in a way that allows students to make decisions. Critical thinking skills will help students solve natural resources and agricultural problems in the future. The teacher needs to be more of a mentor leading his/her students to making wise decisions about sustainable agricultural systems. Simmons (1987-88) suggested that teachers must play an integral role in any natural resource education program; without a teacher's enthusiastic participation, an ongoing natural resource educational program is severely handicapped. Teachers must provide the leadership to introduce students to new agricultural systems. New practices can be transferred from the high school agricultural education classroom to the farm through students' supervised agricultural experience programs.

Student Perceptions about Sustainable Agriculture

Whent, Andrews, Williams and Weber (1991, p. 21) advanced that an understanding of student perceptions provides a benchmark for developing educational programs, meaning that when perceptions are known, then a strategy can be developed to meet the need. Forming positive attitudes toward sustainable agriculture needs to start as early in the educational process as possible. Jaus (1984, p. 63) stated that "the research is clear in that attitudes are more easily changed at an early age and that the smallest amount of education in environmental science changes children's opinions about nature." In his study on the development and retention of environmental attitudes in elementary school children, the results are as follows:

1. Minimal instruction in environmental education is effective in producing highly positive attitudes toward the environment in elementary children.
2. These positive attitudes are retained over time.
3. Elementary school children posses slightly positive attitudes toward the environment without the intervention of formal instruction (Jaus 1984, p. 63).

Moore (1977) found that children ages 8-12 have their deepest relationship with the environment, nature and the outdoors. This is because that at this age children are starting to discover themselves and the world around them. Thus, they enjoy actively discovering nature.

Values start to become set as the ages of students increase. Values of young students are affected by their parents' and teachers' values at early ages. Adults may be a positive or a negative role model for youth with regard to attitudes toward the environment. A study of college-level students found students' attitudes toward the environment changed only minimally. Kinsely and Wheatley (1984) suggested that, it is difficult to change the attitudes of college-aged students. Thus, as students increase in age they become more closed-minded. Blackburn (1984 p. 74) stated that: "Resistance to change is normal and should be expected. People tend to resist change because of their fear of new conditions which will exist after change has accrued."

The literature suggests that younger students accept change easier than older students. Thus, educational initiatives related to sustainable agriculture should focus on upper elementary and middle school students when possible.

Teacher Perceptions about Sustainable Agriculture

Secondary school agricultural education programs can help sustainable agriculture become the new paradigm for agriculture. De La Cruz (1981) stated that he felt every elementary and secondary teacher should make environmental education a part of all school activities. He goes on to say that environmental education is a philosophy of education that will reflect a way of life with concern for the quality of the environment and an idealism based on the fundamental concepts of ecology. Thus, we can infer that high school agricultural education integrate sustainable agriculture into its curriculum. Curriculum changes need to reflect an active participation in sustaining the land for future generations. Simmons' (1987-88, p. 35) study of high school teachers from several disciplines in relation to environmental science indicated:

> For the most part, teachers seem to feel that the goals of environmental education are worthwhile topics of discussion, and they are convinced that environmental education should be incorporated into the school's curriculum.

This study found that teachers:

- Felt that environmental education was an important part of education
- Felt that it was their responsibility to teach about the environment
- Felt personal growth and enjoyment from the program
- Felt that the social aspect was important
- Felt that their students would benefit
- Saw it as a challenge

Fears that teachers had:

- •Spent more time planning which kept them away from their families
- •Gotten lost outdoors/could not physically keep up with the students
- •Lost privacy and gotten too close to students
- •Worried about losing control outside classes
- •Not filled the time allotted
- •Done something embarrassing
- •Looked foolish

Teachers suggested needs:

- •Full lesson plan support
- •Training in how to teach outdoors
- •Inservice training needed as update
- •Learn how to use the school site for environmental education
- •Learn to integrate environmental education into the classroom

Farmer Perceptions about Sustainable Agriculture

Andrews (1989) indicated that farmers felt that conservation of soil resources was an important concern. The following concepts presented in his research show a positive response to soil conservation. A ten-point scale was used to determine the following perceptions: (1) soil erosion is a problem in Iowa (X=7.08), (2) soil erosion pollutes water (X=7.72), (3) people want to conserve soil (X=7.36), (4) most soil erosion is beyond the farmer's control (X=4.48), (5) more education is needed on natural resources and conservation (X=7.26). This indicates that farmers see the problems with soil erosion in Iowa and the desire to conserve soil. Farmers also indicated that they want more education on natural resources and conservation practices so they can use it on their farms.

Bruening (1989) indicated that farmers viewed water quality issues as a great concern. Farmers wanted to know how they could protect the groundwater from contamination. Research also reveals that farmers felt that soil erosion was a societal (urban, rural, industrial) not just a rural agriculture problem. Thus, society demands a perfect product, and in a natural system products grown are not perfect. Farmers want to conserve soil but some feel frustrated because of the quality and economical demand placed on them. This study also indicated the need for education in natural resources and conservation practices. Thus, farmers are willing to change their practices if they are trained in conservation practices that are economical.

In the 1990 Iowa rural farm poll, farmers were asked how they perceived sustainable agriculture. The majority of the farmers indicated that sustainable agriculture would result in improved family health, healthier livestock, lower production costs, improved soil conditions, and improved environmental conditions. This indicates a positive perception of many sustainable agriculture outcomes. They did not see profits increase with the decrease of production costs and they would not have higher yields under adverse conditions. Over 75 percent of the farmers indicated that it would increase labor. Farmers may see the increase in management of the whole farm system (Lasley and Kettner, 1990).

Sustainable Agriculture Educational Materials

Recognizing that agricultural education has an opportunity to help change agricultural systems to sustainable agriculture, the Agricultural Education and Studies Department at Iowa State University has developed educational materials on sustainable agriculture. Teacher inservice activities have been conducted to strengthen teacher understanding of sustainable agriculture and to disseminate the materials to the teachers. The materials developed are reviewed in this section.

Groundwater Flow Model

The Groundwater Flow Model is an educational tool made of plexiglass used to visualize the movement and contamination of groundwater. This tool is currently being marketed by the Student Chapter of Soil and Water Conservation Society at Iowa State University in cooperation with Agricultural Education and Studies at Iowa State University. A descriptive study (Guendel, 1992) found that the groundwater flow model was a positive and useful educational tool. Some of the comments made were "overwhelming positive comments, requests from local banks, county fair coverage helped spread the word", "very effective in making youth and adults aware of water quality problems" and "the groundwater flow model has made my classes exciting and demonstrated with ease how water moves through the soil and where it is stored---students and adults alike enjoyed the learning experiences with the groundwater flow model." Quantitative measures of the effectiveness of the model were positive. A ten-point scale was used and the results were as follows: (1) illustrating groundwater concepts (X=8.10), (2) supporting other forms of information about groundwater (X=7.47) , (3) explaining potential groundwater contamination problems (X=8.01), and (4) creating awareness of groundwater contamination problems (X=8.02). All of these responses indicate that the groundwater flow model is an effective tool in educating people about groundwater and potential contamination problems.

Sustainable Agriculture Manager (SAM) Computer Program

SAM is a computer program for learning about sustainable agriculture. It was developed by the Department of Agricultural Education and Studies at Iowa State University. The program focused on two different lessons. The first focuses on defining sustainable agriculture and designing a management system to practice sustainable agriculture. Lesson two focuses on describing practices that may be used as part of a sustainable agriculture system and choosing practices for a sustainable agriculture system. Scofield (1991, p. 95) indicated in a study on the computer assisted program that the "instructional unit was effective in increasing knowledge of sustainable agriculture concepts."

Groundwater Protection through Prevention

This is a curriculum developed by Agricultural Education and Studies at Iowa State University. It has been provided to the teachers of Iowa to instruct students on problems related to groundwater contamination and the management practices that can be used to prevent groundwater contamination (Williams, 1989). These educational materials were used by agricultural education instructors in providing instruction to 3,500 students in 140 Iowa schools in 1989-90.

Introduction to Natural Resources and Conservation Technology Unit

This is a set of teaching materials that gives an overview of natural resources concepts Whent (1989). The materials included lessons on recognizing natural resources, including soil, water, forest and wildlife.

Leopold Center For Sustainable Agriculture Educational Initiatives

The Leopold Center for Sustainable Agriculture is dedicated to developing sustainable agriculture practices, completing sound reliable research and then educating the public about that research. The Center provides instruction through conferences, meetings, workshops, demonstrations, field days, inservice training, and publications (Pirog, 1992).

Practical Farmers of Iowa (PFI) Educational Initiative

PFI is a farmer organization dedicated to the development of practical, sustainable agriculture technology. On-farm research is done to determine the usefulness of selected practices. One of the goals of PFI is to keep families on the land and farming (PFI, 1990). PFI conducts innovative educational projects to inform youth and adults about the results of on-farm research. In one project, the Agricultural Education and Studies Department worked in cooperation with PFI in providing training for agricultural education teachers in sustainable agriculture practices in a hands-on field training program. This initiative reached about 100 different teachers throughout Iowa. PFI also has a mentor program where high school agriculture students are paired with PFI farmers to provide education in sustainable agriculture. PFI educational programs also feature field days, farmer-to-farmer training, and development and distribution of publications.

CHAPTER III: METHODS AND PROCEDURES

This chapter explains the methods and procedures used in this study. The following will be discussed: population and sample, instrumentation, collection of data, analyses of data, and research questions.

The purpose of the study was to assess the perceptions of Iowa high school agricultural education teachers and students regarding sustainable agriculture. Such a data base will be useful in developing curriculum and instructional materials on sustainable agriculture for agricultural education programs in Iowa secondary schools. The research was under a project that was approved by the Human Subjects in Research Iowa State University. The study was approved by the Human Subjects in Research at Iowa State University.

Population and Sample

The population for the study was all of the secondary school agricultural education teachers and students in Iowa. Stratified random sampling was used to get representation from the six FFA regions in Iowa. Ten teachers (schools) were randomly selected from each of the six FFA districts in Iowa to participate in the study. Thus, the sample included the 60 agricultural education teachers in these schools and their students enrolled in agricultural education classes. The study targeted eleventh and twelfth grade students; however, some teachers administered the instrument to all of their students. Seventy-two percent (43) of the teachers responded by completing a teacher instrument and involving their students in completing student instruments.

Instrumentation

Two instruments were developed, one for Iowa agricultural education teachers and one for agricultural education students. Both instruments consisted of two parts: (1) a section on perceptions regarding sustainable agriculture, and (2) a section to gather demographic information.

The teacher survey included seven related parts to sustainable agriculture:

1. Eleven items to measure perceptions about conservation of Iowa natural resources.
2. One item to measure knowledge of sustainable agriculture.
3. Eight items to measure understanding of sustainable agriculture.
4. Five items to measure acceptance of sustainable agriculture.
5. Twelve items to measure knowledge of sustainable agriculture practices.
6. Nine items to measure expectations of sustainable agriculture.
7. Sixteen items to measure impact of sustainable agriculture.

The second part of the teacher instrument gathered demographic information about respondents: age, gender, years of teaching, level of education, size of school, size of agricultural education program, use of the term "sustainable agriculture", use of sustainable instructional materials and tools, past training in sustainable agriculture, and use of Soil and Water Conservation District Commissioners in educational programs.

The student instrument included six sections related to sustainable agriculture:

1. Eleven items to measure perceptions about conservation of Iowa natural resources.
2. Eight items to measure understanding of sustainable agriculture.
3. Five items to measure acceptance of sustainable agriculture.
4. Twelve items to measure knowledge of sustainable agriculture practices.
5. Nine items to measure expectations of sustainable agriculture.
6. Sixteen items to measure impact of sustainable agriculture.

The second part of the student instrument gathered demographic information about the following: gender, grade in school, place of residence, topography of land where they lived, plans after high school graduation, and use of selected sustainable agriculture education materials.

Collection of Data

One teacher instrument and 15 student instruments were mailed to each teacher included in the sample. Accompanying the instruments was a cover letter explaining the purpose of the study, that the surveys were coded for grouping data, and that the information provided would be considered confidential. The teachers were to complete the teacher instrument and to administer the student instrument to their eleventh and twelfth grade agricultural education students. A lesson plan was provided to make completion of the instrument a learning experience (see appendix). Data were collected March through April of 1992.

Analyses of Data

Responses provided by teachers and students were coded and analyzed using the computer facilities at the Iowa State University Computation Center. The Statistical Package of the Social Sciences (SPSS) was used in analyzing the data. Parts of the instruments were analyzed for reliability using Chrom Box Alpha. Means and standard deviation were calculated to describe perceptions of teachers and students. T-tests and one way analysis of variance (ANOVA) were used to test for differences when teachers and students were grouped by demographic variables.

Research Questions

1. What are the characteristics of the teachers participating in the study?
2. What are the characteristics of the students participating in the study?
3. What are the perceptions of teachers and students regarding sustainable agriculture?
4. Do high school agricultural education teachers and their students differ in their perceptions of sustainable agriculture?

5. Do high school agricultural education students' perceptions of sustainable agriculture differ when they are grouped by selected demographic variables?

6. Do high school agricultural education teachers' perceptions of sustainable agriculture differ when they are grouped by selected demographic variables?

Summary

This research is a descriptive study designed to investigate the perceptions of Iowa high school agricultural education teachers and students regarding sustainable agriculture. The goal of this research is to provide data to educators to guide the development of sustainable agriculture instructional materials.

CHAPTER IV: FINDINGS

The purpose of the study was to assess the perceptions of Iowa secondary school agricultural education teachers and their students regarding sustainable agriculture. Such a data base will be useful in developing curriculum and instructional materials in sustainable agriculture for agricultural education programs in Iowa secondary schools.

A stratified random sampling technique was used to identify participants for the study. Ten schools in each of the six Iowa FFA districts were randomly selected from all Iowa secondary schools offering agricultural education. Instruments were developed to measure teacher and student perceptions of sustainable agriculture. Likert-type scales were used to measure perceptions of sustainable agriculture. The data were analyzed using selected statistical packages.

The findings will be presented and discussed in five sections: (1) profile of teachers, (2) profile of students, (3) comparison of teacher and student perceptions regarding sustainable agriculture, (4) analysis of teacher perceptions, and (5) analysis of student perceptions.

Profile of Teachers

There were 43 teacher responses but only 41 were usable. Figure 1 reveals that 17.1 percent (N=7) of the teachers came from the northwest FFA district, 14.6 percent (N=6) from the northcentral FFA district, 9.8 percent (N=4) from the northeast FFA district, 24.3 percent (N=10) from the southwest FFA district, 17.1 percent (N=7) from the southcentral FFA district, and 17.1 percent (N=7) from the southeast FFA district.

The gender of the teacher respondents (Figure 2) were 95.1 percent (N=39) male and 4.9 percent (N=2) female.

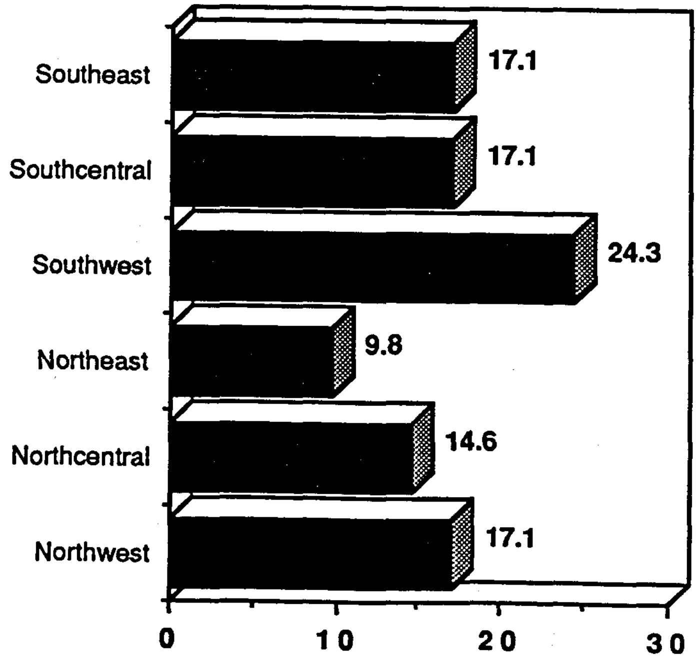

Figure 1. Distribution of teachers by FFA district

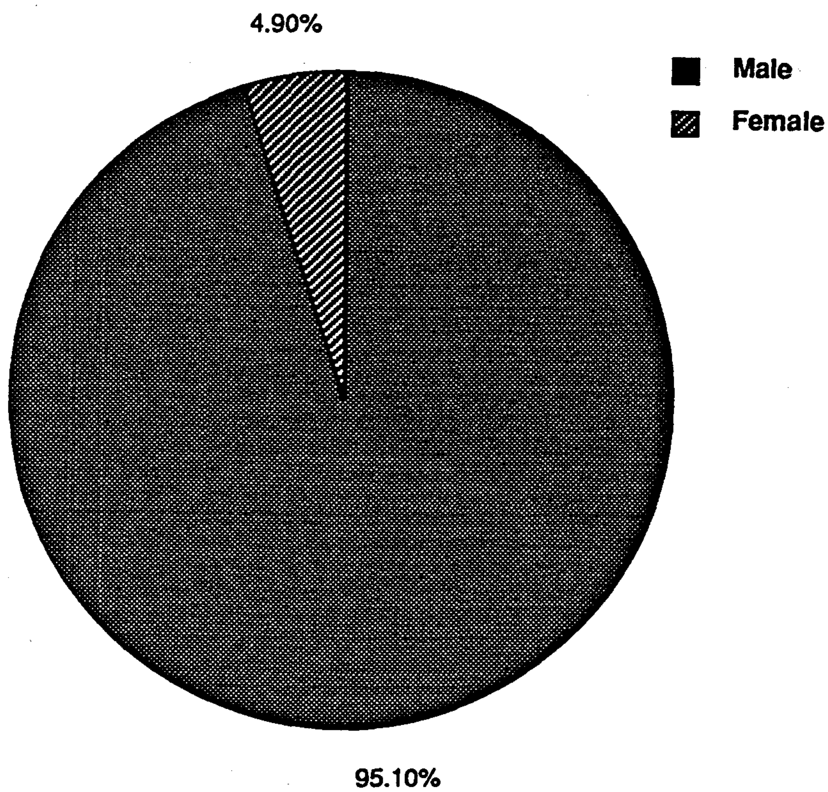

Figure 2. Distribution of teachers by gender

Figure 3 reveals that 26.8 percent (N=11) of the teachers were 20 to 30 years old, 36.6 percent (N=15) were 30 to 40 years old, and 36.6 percent (N=15) were 40 years of age or older.

Figure 4 shows that almost all, 95.1 percent (N=39) of the teachers grew up on a farm. Only 4.9 percent (N=2) were not from a farm.

The distribution of teachers by highest level of formal education is presented in Figure 5. Over half of the teachers had completed education beyond the B.S. (more than 16 years education) level, compared to 46.4 percent with only a B.S. degree.

Figure 6 reveals that most teacher respondents were experienced teachers, 17.5 percent (N=7) had taught 1 to 5 years, 20 percent (N=8) had taught 6 to 10 years, 35 percent (N=14) had taught 11 to 15 years, and 27.5 percent (N=11) had 16 or more years of teaching experience.

Figure 7 reveals that two-thirds of the schools had 400 or less students in grades 9-12; 31.8 percent (N=13) had 150 or less students, 37.0 percent (N=15), had 151 to 400 students, and 31.5 percent (N=13) had 401 or more students enrolled.

Over two-thirds of the Iowa agricultural education programs enrolled 50 or less students as indicated in Figure 8. Eight (19.5 percent) of the programs had 25 students or less students, 50.8 percent (N=21) had 26 to 50 students, and 29.6 percent (N=12) had 51 or more students enrolled in the program.

Figure 9 shows the number of middle school students (seventh and eighth graders) enrolled in agricultural education programs. Five schools (38.4 percent) had 35 or less middle school students enrolled in agricultural education, 30.8 percent (N=4) had 36 to 50 students, and 30.8 percent (N=4) had 51 or more students enrolled. Twenty-eight teachers indicated that they did not have a middle school agricultural education program in their school district.

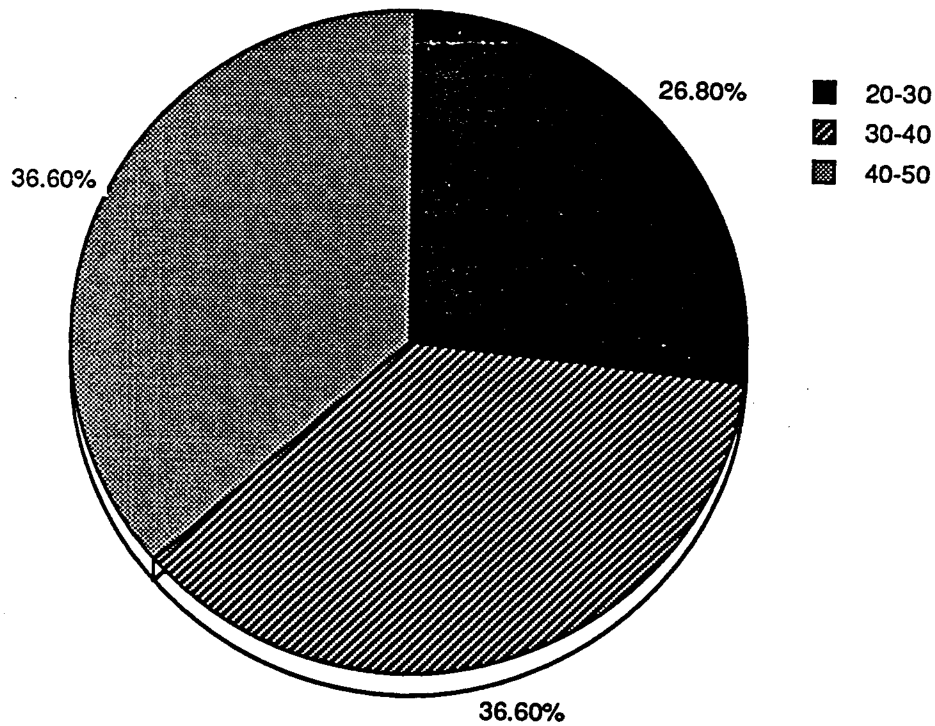

Figure 3. Distribution of teachers by age

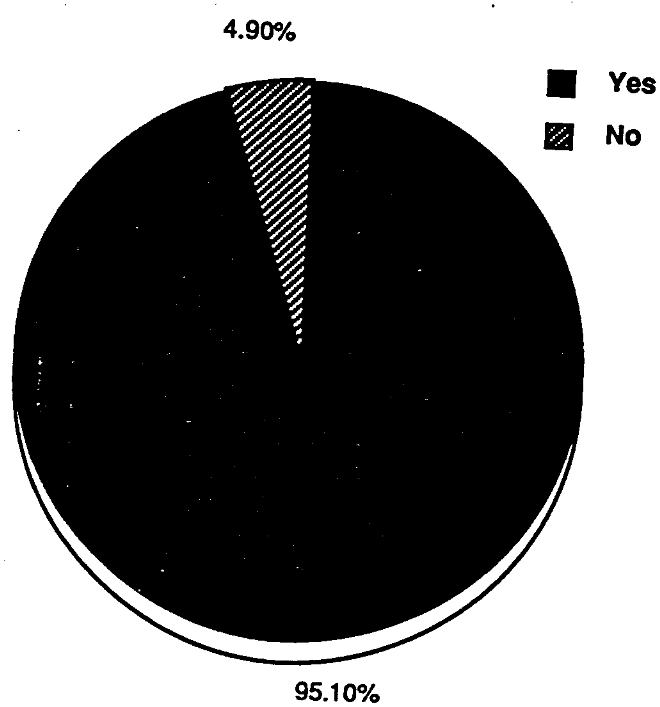

Figure 4. Distribution of teachers by farm experience

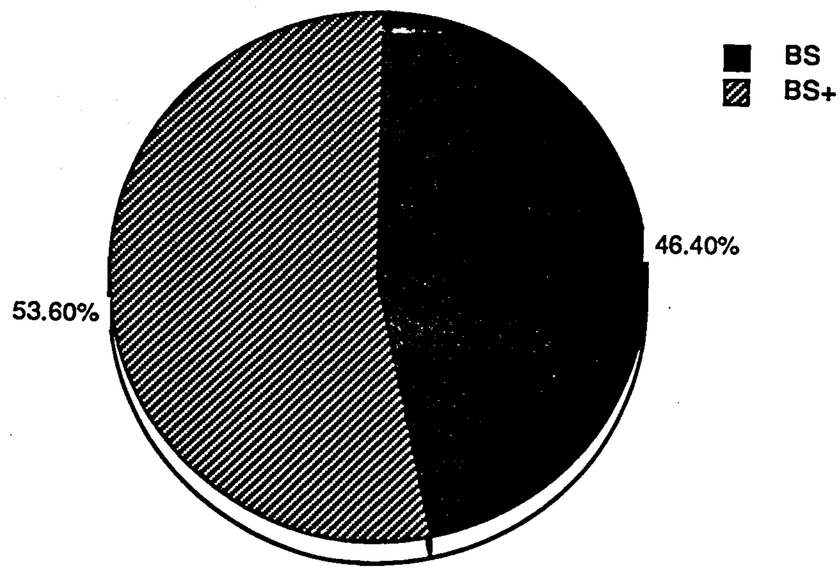

Figure 5. Distribution of teachers by years of formal education

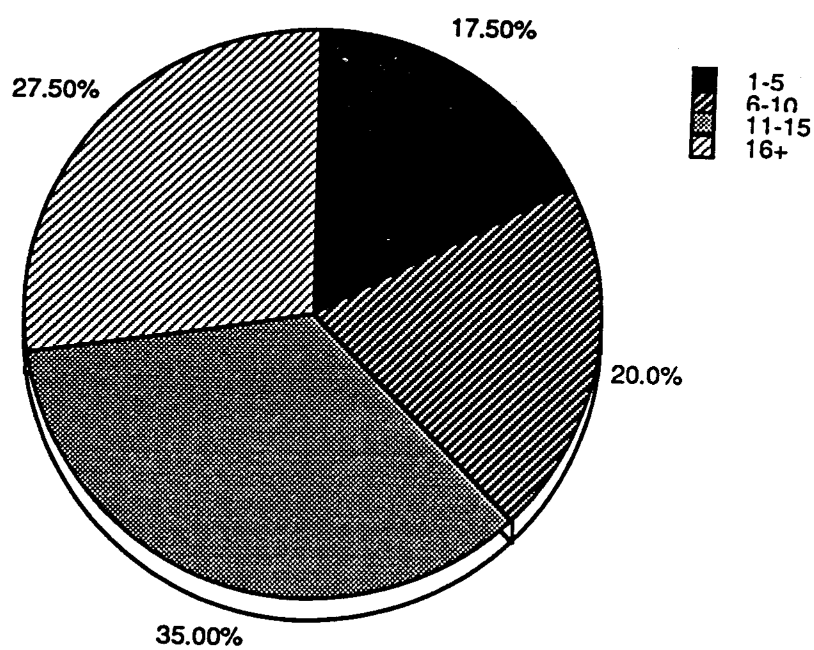

Figure 6. Distribution of teachers by years of teaching

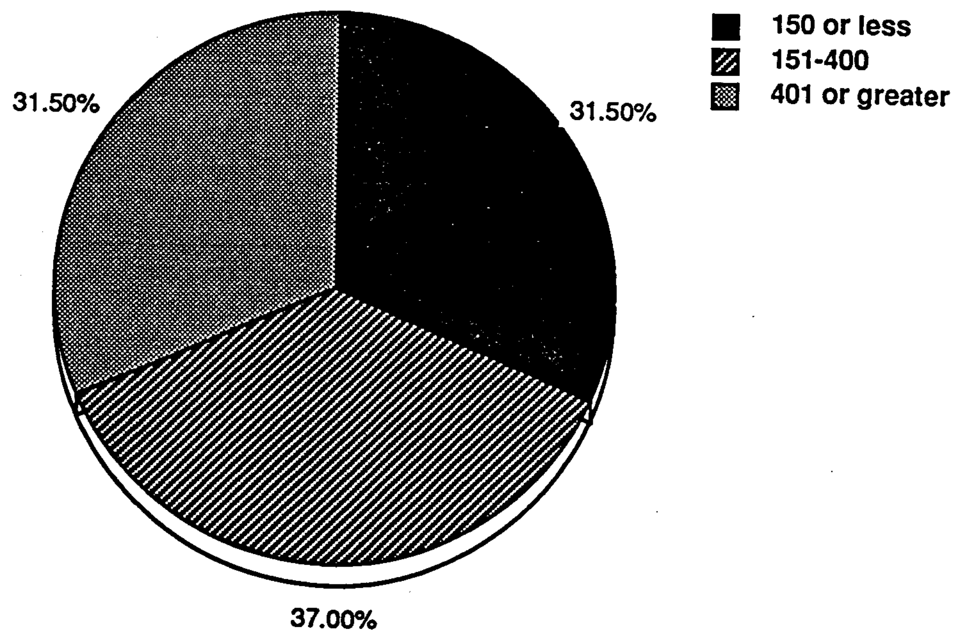

Figure 7. Distribution by size of high schools

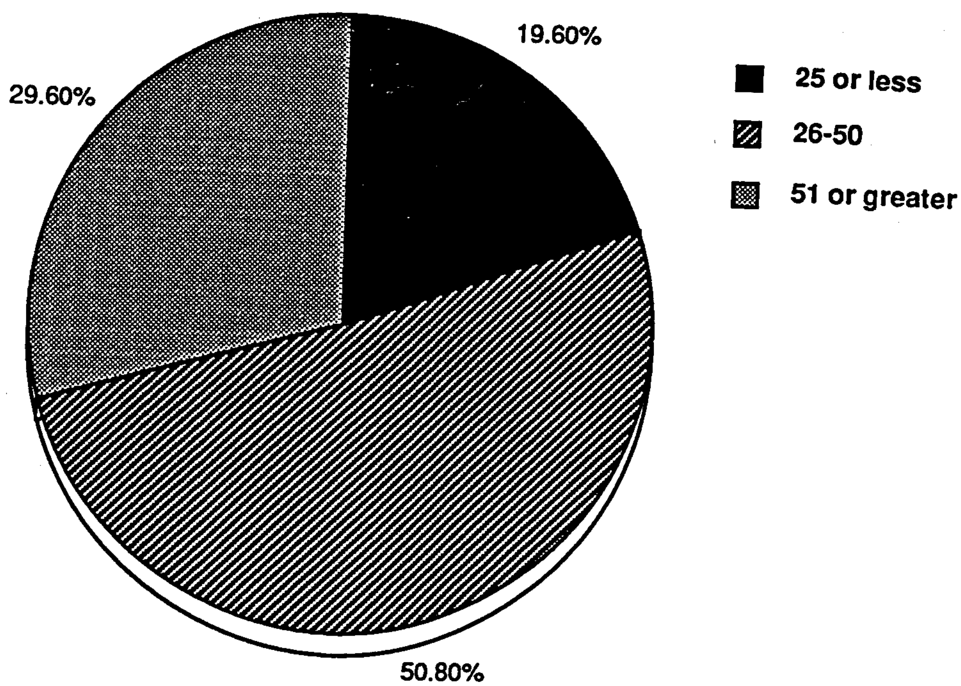

Figure 8. Distribution of teachers by size of high school agricultural education program

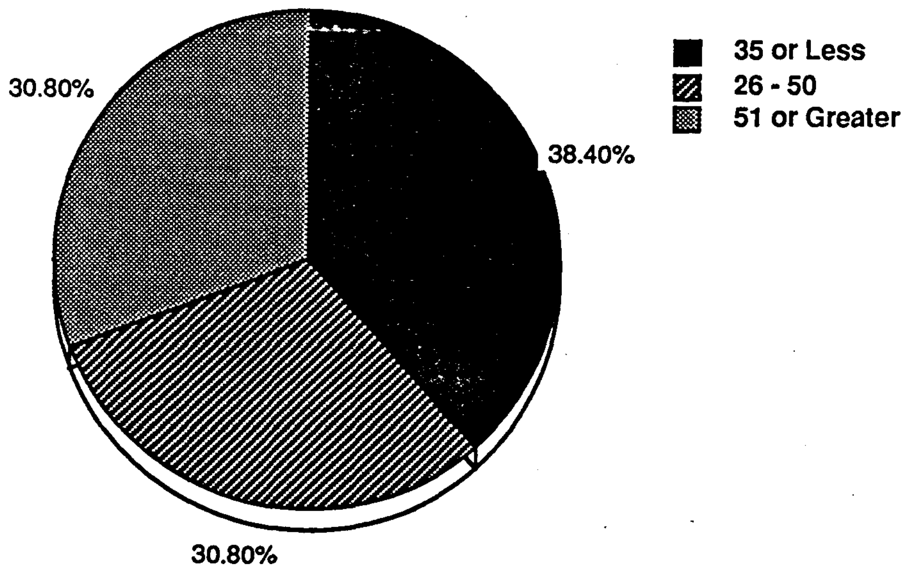

Figure 9. Distribution of teachers by size of middle school agricultural education program

Figure 10 shows that 92.2 percent (N=37) of the teachers reported teaching sustainable agriculture as part of their agricultural education program, and 9.8 percent (N=4) stated they did not.

Using a four-point scale (1=never, 2=sometimes, 3=often, and 4=always) teachers were asked, "How often do you explicitly use the term sustainable agriculture when teaching?" The mean response was 2.10, indicating that they used the term "sometimes".

Teachers were asked, " How do you feel about teaching sustainable agriculture as part of your curriculum?" A five-point scale (1=not important, 2=somewhat important, 3=unsure, 4=very important, and 5=utmost importance) was used to measure responses. The mean response was 3.22, indicating that teachers were "unsure" about teaching sustainable agriculture as part of the agricultural education curriculum.

Figure 11 reveals that teachers are devoting a portion of the agricultural education curriculum to sustainable agriculture. Over half of the teachers are devoting six percent or more to the agricultural education curriculum to sustainable agriculture.

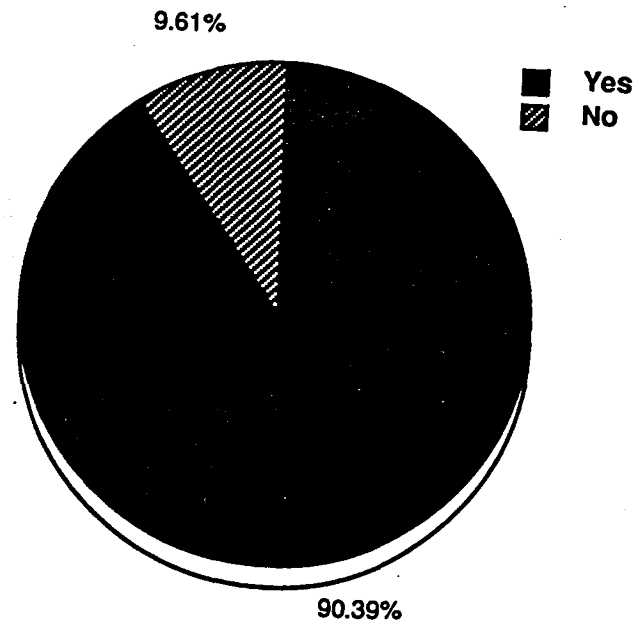

Figure 10. Distribution of teachers teaching sustainable agriculture

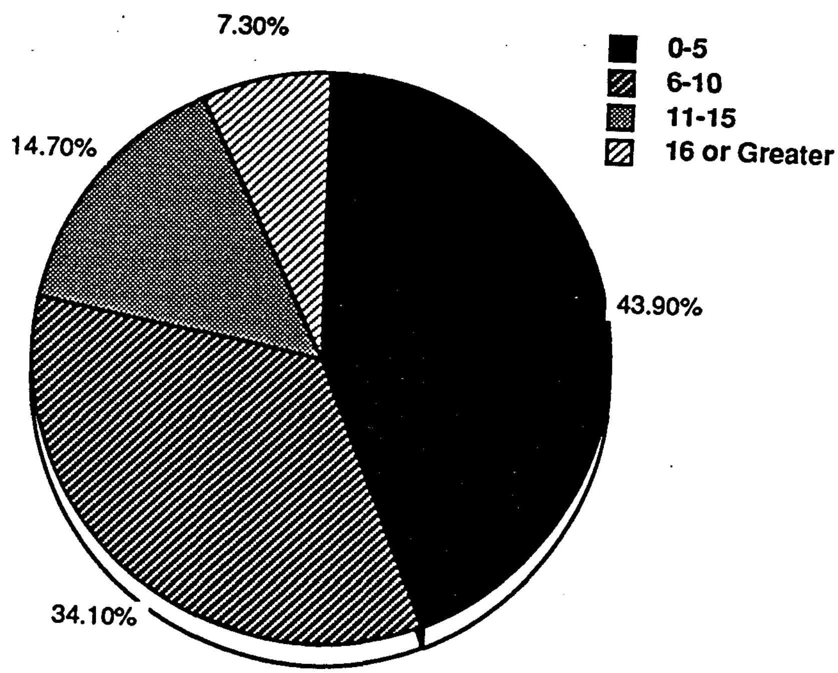

Figure 11. Distribution of teachers by percentage of curriculum devoted to sustainable agriculture

Teachers reported that 25 percent of their students had supervised agricultural experience (SAE) programs related to sustainable agriculture as revealed in Figure 12. SAE is a required component of the agricultural education program that provided students practical experiences in some area of agriculture.

The Department of Agricultural Education and Studies at Iowa State University has developed instructional materials and tools, and conducted teacher inservice programs on sustainable agriculture. The teachers were asked if they had obtained the sustainable agriculture materials and how useful they were. Figure 13 indicates that 75.7 percent (N=28) of the teachers had Natural Resources Educational Packet, 91.9 percent (N=24) of the teachers had Groundwater Protection Through Prevention, 64.9 percent (N=24) of the teachers had Introduction to Natural Resources and Conservation Technology, 52.2 percent of the teachers had Teaching Sustainable Agriculture Manager (computer program), and 35.1 percent (N=13) of the teachers had a Groundwater Flow Model.

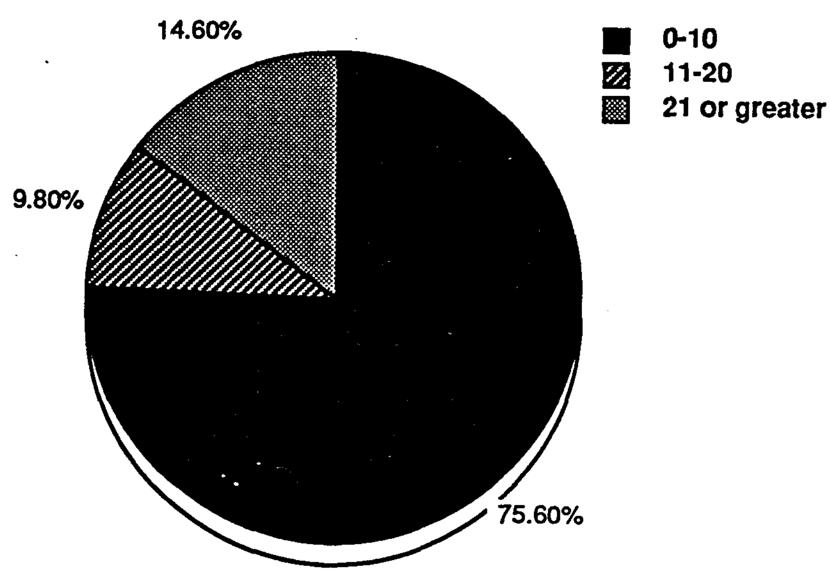

Figure 12. Distribution of teachers by percentage of students with SAEs related to sustainable agriculture

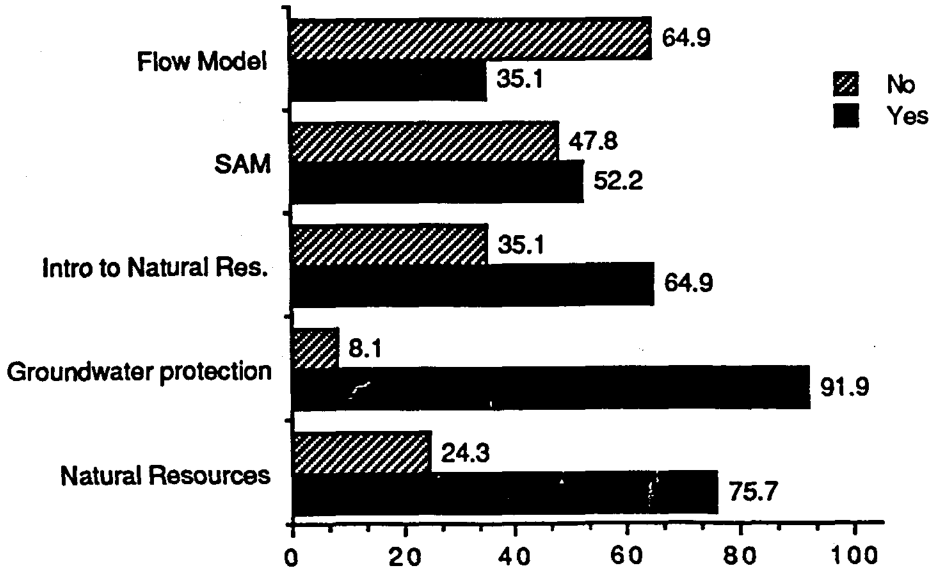

Figure 13. Distribution of teachers by access to sustainable agriculture instructional materials and tools

Teachers were asked to indicate how useful the sustainable agriculture instructional materials and tools were using a three-point scale (1=not useful, 2=somewhat useful, 3=very useful). The mean usefulness scores ranged from 2.18 to 2.56, indicating that teachers perceived the materials to be between "somewhat" and "very useful" in teaching. The groundwater flow model had the highest mean, 2.56 (Table 1).

Profile of Students

This study included 464 student respondents. Figure 14 shows the distribution of students by Iowa FFA district; 15.8 percent (N=74) from the northwest FFA district, 17.1 percent (N=80) from the northcentral FFA district, 12.6 percent (N=59) from the northeast FFA district, 22.7 percent (N=106) from the southwest FFA district, 16.3 percent (N=76) from the southcentral FFA district, and 15.4 percent (N=72) from the southeast FFA district.

Figure 15 indicates that 82.7 percent (N=384) of the students were male and 16.7 percent (N=2) were female (three people did not respond).

Table 1. Usefulness of the Iowa State University sustainable agriculture instructional materials

Instructional Materials		Mean	Standard Deviation
Natural Resources Educational Packet	(N=32)	2.18	.47
Groundwater Protection Through Prevention	(N=38)	2.32	.47
Introduction to Natural Resources and Conservation Technology	(N=29)	2.21	.56
Sustainable Agriculture Manager (computer program)	(N=23)	2.49	.51
Groundwater Flow Model	(N=18)	2.56	.51

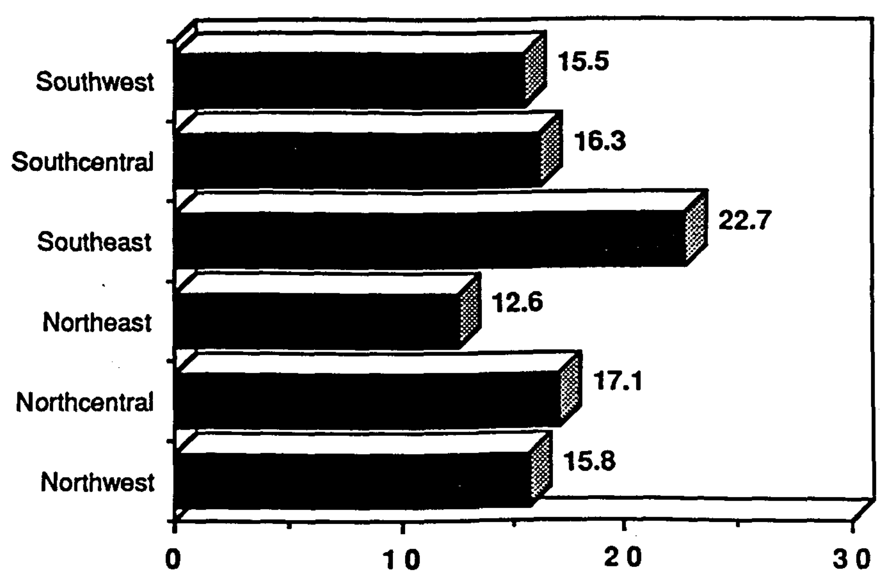

Figure 14. Distribution of students by Iowa FFA district

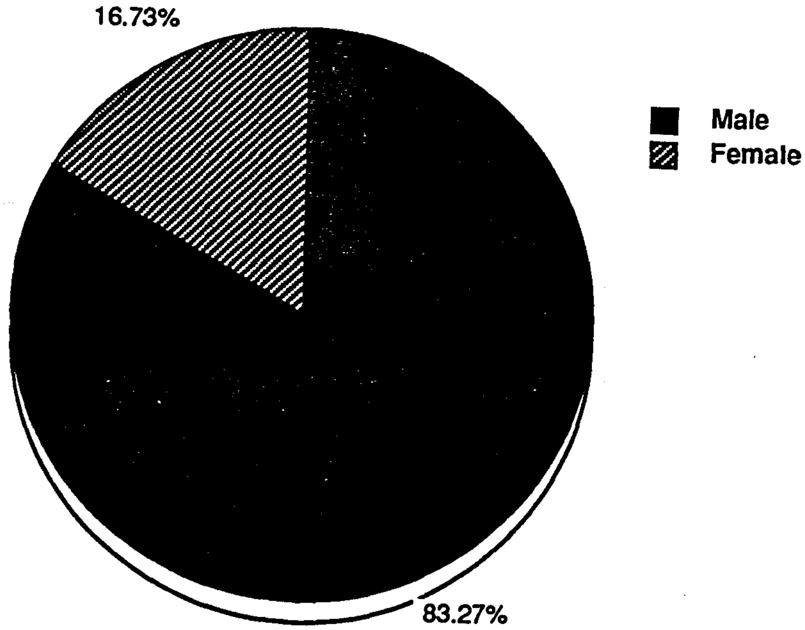

Figure 15. Distribution of students by gender

Figure 16 reveals that 5.2 percent (N=24) of the students were in the ninth grade, 18.5 percent (N=86) were in the tenth grade, 41.1 percent (N=191) were in the eleventh grade, and 35.3 percent (N=164) were twelfth graders, (two responses were missing).

Figure 17 reports that 63.2 percent (N=295) of the students lived on a farm, 24.1 percent (N=112) lived in a town or city, and 12.4 percent (N=58) lived in a rural area but not a farm. (Two responses were missing).

Figure 18 summarizes responses when students were asked to describe the surrounding land where they lived. About one-fourth, 26.4 percent (N=123), indicated the land was flat, 60.4 percent (N=282) lived where the land was slightly hilly, and 13.1 percent (N=61) lived on very hilly land (one missing case).

Figure 19 indicates that upon graduation 37 percent (N=168) of the students planned to attend a vocational school or community college, and 30 percent (N=136) planned to enter a four-year university. Only 8.8 percent (N=40) stated that they planned to enter farming after high school, 4.2 percent (N=19) planned to enter a occupation other than farming, 6.4 percent

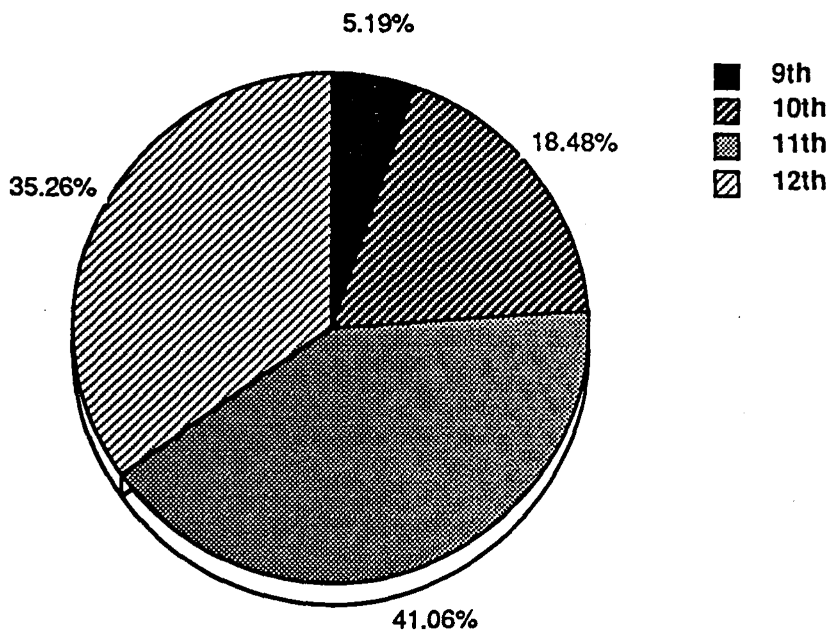

Figure 16. Distribution of students by grade level

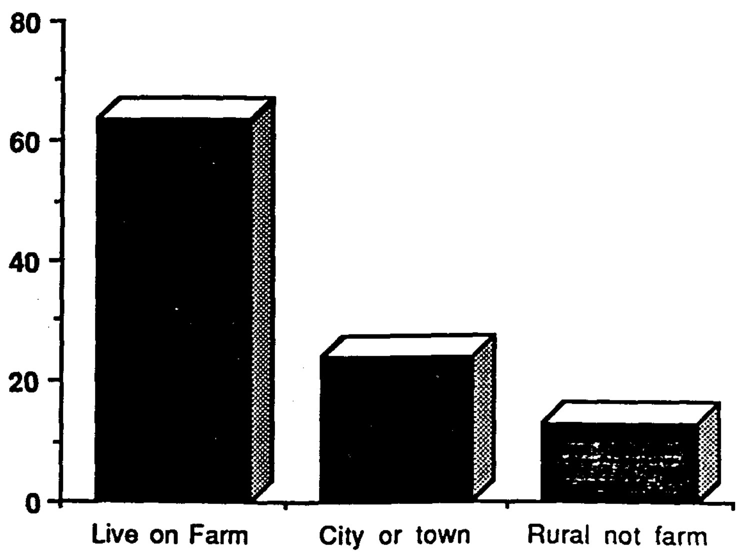

Figure 17. Distribution of students by place of residence

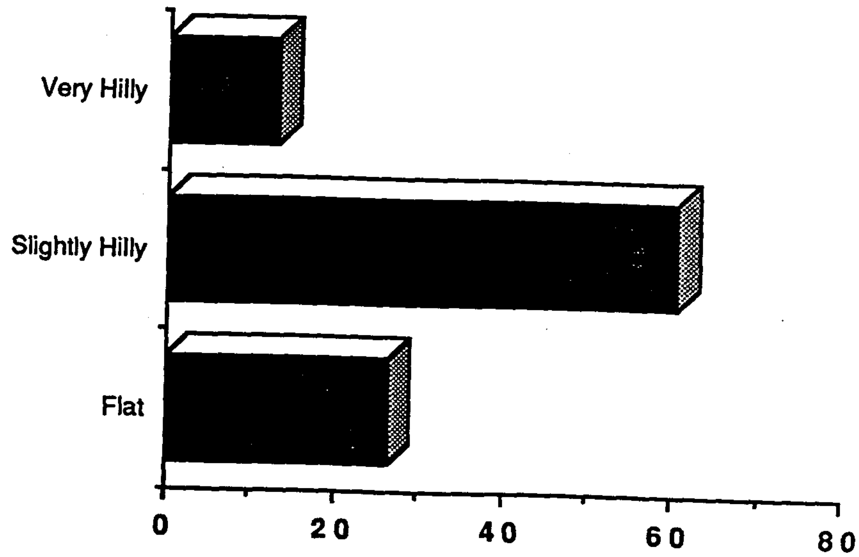

Figure 18. Distribution of students by the topography of the land where they lived

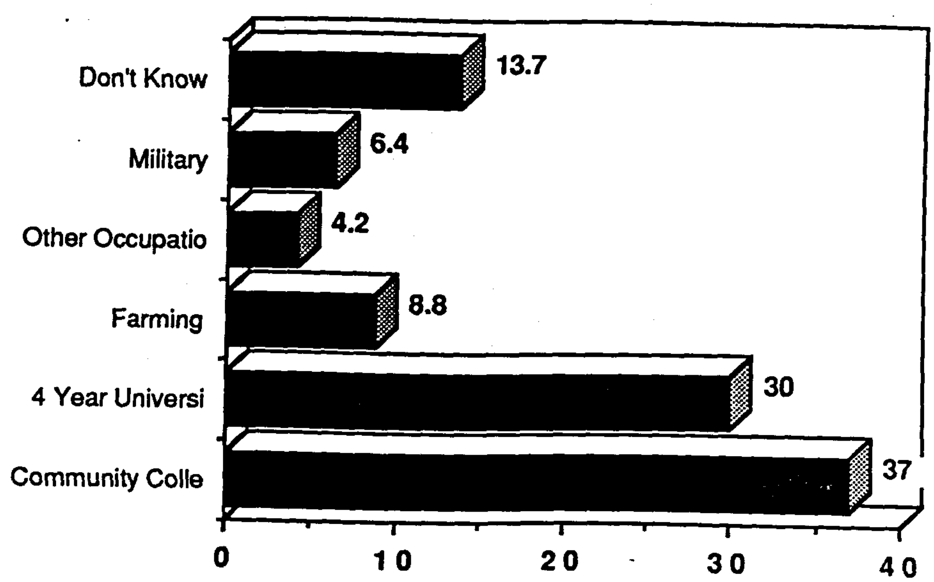

Figure 19. Distribution of students by plans upon graduation

(N=29) indicated that they would enter the military, and 13.7 percent (N=13) indicated they did not know. Thirteen students did not respond to the question.

As revealed in Figure 20, half (N=158) of the students planning to attend college indicated they would study in some field of agriculture and 49.7 percent (N=156) stated they would study areas outside of agriculture. There were 153 missing cases, suggesting that a number of students were not sure about their area of study in college.

Students were asked if they had used sustainable agriculture teaching materials and tools developed by the Agricultural Education Department at Iowa State University (Figure 21). If they had used them, they were asked how useful they were in learning sustainable agriculture concepts. Over one-fourth of the students had used Groundwater Protection Through Prevention, one-fifth had used Teaching Sustainable Agriculture Manager, and one-fifth had used the Groundwater Flow Model.

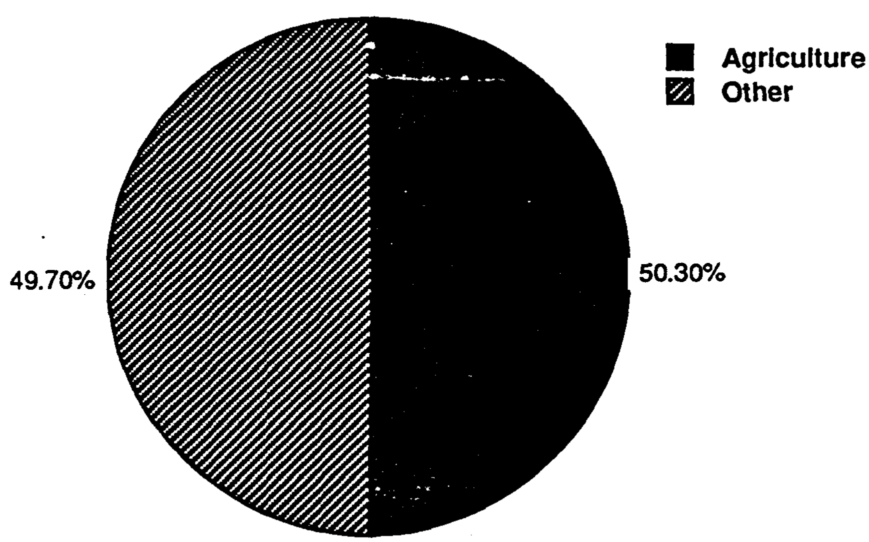

Figure 20. Distribution of students by field of study in college

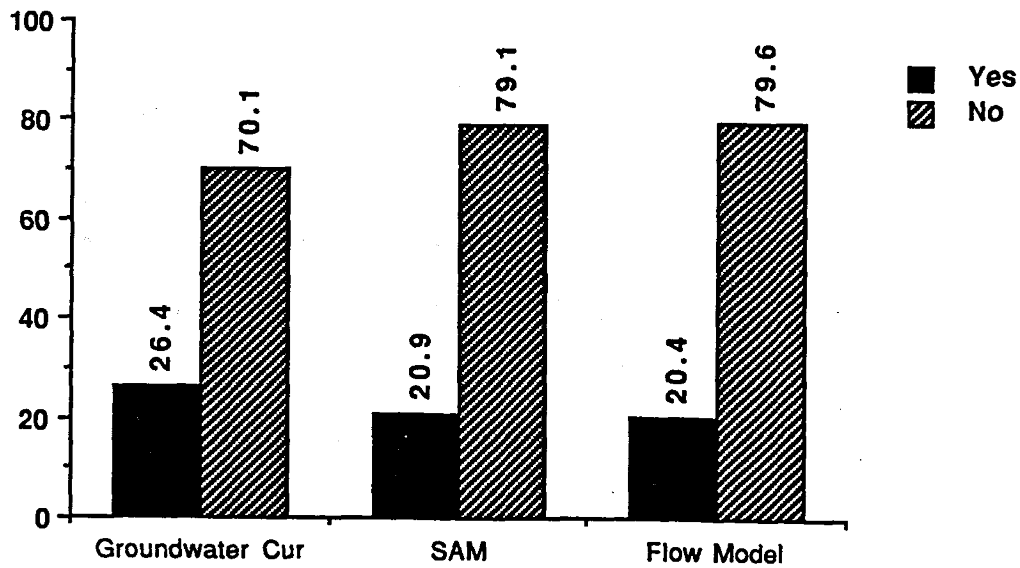

Figure 21. Student use of sustainable agriculture materials and tools

Students who said they had used the sustainable agriculture materials and tools were asked to indicate how helpful they were. A three-point scale (1=Not at all Helpful, 2=Somewhat Helpful and 3=Very Helpful) was used to obtain this measure. Mean student responses ranged from 2.15 to 2.29, indicating that students perceived the materials and tools as "somewhat helpful". The computer program had the highest mean, 2.29 (Table 2).

Table 2. Helpfulness of sustainable agriculture materials and tools as perceived by students

Materials and Tools		Mean	Standard Deviation
Groundwater Protection Through Prevention	(N=96)	2.15	.60
Sustainable Agriculture Manager (computer program)	(N=76)	2.36	.56
Groundwater Flow Model	(N=79)	2.29	.58

Comparison of Teacher and Student Perceptions Regarding Sustainable Agriculture

There were seven sections in the teacher survey and six sections in the student survey to assess perceptions related to sustainable agriculture.

Perceptions about Conservation of Iowa Natural Resources

Teachers and students were asked to respond to eleven statements related to conservation of Iowa natural resources using a five-point scale (1=strongly disagree, 2=disagree, 3=unsure, 4=agree, 5=strongly agree). The reliability for this section of the instrument was .66 for students and .87 for teachers.

Table 3 reports the means and standard deviations for teachers and students by statement. Also reported are the results of t-tests comparing teacher and student means. Composite data are also reported.

In general both teachers and students had a favorable perception about conservation of Iowa natural resources. Student means ranged from 3.42 to 4.29 and teacher ranged from 3.05 to 4.78. Student means of 4.0 (agree) or above were observed for the following statements: (1) soil erosion affects the water quality of lakes, ponds and streams in Iowa, (2) protecting wildlife is a concern in Iowa, (3) worms are beneficial to soil formation, (4) conservation is good for the community in which you live, and (5) soil conservation maintains farmland for future generations.

Teacher means of 4.0 (agree) or above were observed for the following statements: (1) soil erosion affects the water quality of lakes, ponds and streams in Iowa, (2) worms are beneficial to soil formation, (3) soil conservation maintains farmland for future generations (4) soil erosion is a problem in Iowa, (5) conservation is good for the community in which you live, (6) topsoil is produced naturally, (7) protecting wildlife is a concern in Iowa, and (8) conservation is a state of harmony between people and nature.

Table 3. Perceptions of teachers and students about conservation of Iowa natural resources (Teachers N=41, Students N=464)

Conservation Statement	Mean	SD	t-value	prob.
Soil Erosion is a problem in Iowa.	3.96	.703 Students		
	4.59	.741 Teachers		
			-5.48	.0001
Soil erosion affects the water quality of lakes ponds and streams in Iowa.	4.12	.710		
	4.78	.698		
			-5.72	.0001
Topsoil is produced naturally.	3.83	.931		
	4.42	.921		
			-3.88	.0001
Protecting wildlife is a concern in Iowa.	4.10	.769		
	4.34	.617		
			-1.97	.050
Worms are beneficial to soil formation.	4.10	.821		
	4.71	.750		
			-4.89	.0001
Conservation is good for the community you live in.	4.29	.664		
	4.56	.838		
			-2.48	.014
Conservation is a state of harmony between people and nature.	3.92	.799		
	4.32	.756		
			-3.18	.003
Farmers should be paid to protect wildlife.	3.42	1.166		
	3.05	.973		
			2.30	.026
Laws are needed to reduce loss of natural resources.	3.80	.901		
	3.66	.911		
			.94	.352
Soil conservation maintains farmland for future generations.	4.26	.702		
	4.68	.610		
			-4.21	.0001

Table 3. (Continued)

Conservation Statement	Mean	SD	t-value	prob.
Protecting woodland is a concern in Iowa.	3.50	.876		
	4.17	.704		
			-2.28	.023
Composite	3.98	.540	Students	
	4.30	.403	Teachers	
			-5.66	.0001
Reliability:	.66			
	.87			

Student means were lowest for the following: (1) farmers should be paid to protect wildlife (X=3.43), (2) laws are needed to reduce loss of natural resources (X=3.80), and (3) topsoil is produced naturally (X=3.83). Teacher means were lowest for the following: (1) farmers should be paid to protect wildlife (X=3.05), and (2) laws are needed to reduce loss of natural resources (X=3.66).

Significant differences were observed between student and teacher means for 10 of the 11 statements and for the composite means. The only statement with means that were not significantly different was "laws are needed to reduce loss of natural resources". In all cases but two, (1) "laws are needed to reduce loss of natural resources" and (2) "farmers should be paid to protect wildlife" the teachers were significatly different than the students. The teacher means were significantly higher than the student means. The positive perception of teachers about conservation of Iowa natural resources provides a base for strengthening the sustainable agriculture education curriculum at the high school level. The perceptions exhibited by students and teachers present a commonality for building a dynamic educational environment that focuses on sustainable agriculture.

Teacher Knowledge of Sustainable Agriculture

The section pertaining to knowledge about sustainable agriculture related only to teachers. Teachers indicated they felt "somewhat informed" (mean=2.49 on a 4.0 scale) about sustainable agriculture.

Understanding of Sustainable Agriculture

Teachers and students were asked to indicate on a five-point scale to what extent sustainable agriculture is a clear and meaningful term to themselves and others (1=very confusing and 5=very clear). The results are reported in Table 4.

Teachers indicated that they perceived themselves as being fairly clear (X=4.05) "regarding the meaning of sustainable agriculture". They suggested that other agricultural

Table 4. Understanding of sustainable agriculture as perceived by teachers and students (Teachers N=41, Students N=464)

Person(s)	Mean	SD	
To yourself	3.28 4.05	1.04 .77	Students Teacher
To your ag. education teacher	4.29	.98	Students
To other ag. education students	3.17	.93	Students
To other ag. education teachers	3.73	.59	Teacher
To your ag. education students	2.66	.69	Teacher
To farmers	2.93	.72	Teacher
To people in your community	2.98 2.20	.98 .68	Student Teacher
To your parents	3.54	1.09	Students

education teachers were less clear (X=3.73) in their understanding of the concept. Teachers perceived that their students were "unsure" (X=3.17) of the meaning of sustainable agriculture, and that people in the community (X=2.20) and farmers (X=2.93) did not fully understand the meaning of sustainable agriculture.

Students perceived that they did not fully understand (X=3.28) the meaning of sustainable agriculture. Students felt their agricultural education teacher understood the term sustainable agriculture (X=4.29). Students also perceived that their parents had a fairly clear understanding of sustainable agriculture (X=3.54). Students felt other students (X=3.17) and community people (X=2.98) did not have a clear understanding of sustainable agriculture.

Acceptance of Sustainable Agriculture

Teachers and students were asked on a five-point scale (1=complete rejection, 2=somewhat reject, 3=neutral, 4=somewhat accept, and 5=complete acceptance) to indicate the degree of acceptance of sustainable agriculture by themselves and others. The results are summarized in Table 5.

Table 5. Acceptance of sustainable agriculture as perceived by teachers and students (Teachers N=41, Students N=464)

Person(s)	Mean	SD	
Yourself	3.70	.81	Student
	4.05	.74	Teacher
Other ag. education teachers	3.73	.59	Teacher
Other ag. education students	3.50	.77	Student
Your students	3.27	.74	Teacher
People in your community	3.33	.81	Student
	3.07	.72	Teacher

Teachers indicated they have "somewhat accepted" (X=4.05) sustainable agriculture as a new approach to farming. However, they perceived a lower level of acceptance by other teachers (X=3.73), their students (X=3.27), and people in the community (X=3.07).

Students were somewhat less accepting (X=3.70) of sustainable agriculture than their teachers and perceived community people to be "neutral" in accepting sustainable agriculture.

Knowledge of Sustainable Agriculture Practices

Teachers and students were asked to indicate their level of knowledge of sustainable agriculture practices using a four-point scale: 1=know little, 2=know a little, 3=know some, 4=know a lot. The results are summarized in Table 6.

The reliability for both students and teachers were very high for this measure, .90 for each. The teachers' composite mean for their perceived knowledge of sustainable agriculture practices was 2.87 on the four-point scale, suggesting that teachers feel they have additional things to learn about sustainable agriculture practices. The students indicated that they "know a little" (X=2.16) about the practices. It should be noted that both teachers and students had the least knowledge of "allelopathy" and "agroforestry". These means were below 2.0 on a four-point scale. The following are the top three practices the teachers perceived they knew the most about: (1) rotational grazing (X=3.51), (2) row banding of herbicides (X=3.37), and (3) filterstrips (X=3.15). The three teachers knew least about (1) allelopathy (X=1.85), (2) agroforestry (X=1.90), and (3) late spring nitrate testing (X=2.85).

The following are the top three practices students perceived they knew the most about (1) rotational grazing (X=2.80), (2) low input livestock facilities (X=2.52), and (3) narrowstrip intercropping (X=2.34). Students knew the least about (1) allelopathy (X=1.31), (2) agroforestry (X=1.63), and (3) filterstrips (X=2.01).

Table 6. Knowledge of sustainable agriculture practices as perceived by teachers and students
(Students N=464, Teachers N=41)

Practice	Mean	SD	t-value	prob.
Filterstrips	2.01	.91	Students	
	3.15	.79	Teachers	
			-8.67	.0001
Rotational grazing	2.80	.87		
	3.51	.60		
			-5.15	.0001
Narrow strip intercropping	2.34	1.00		
	3.10	.66		
			-4.99	.0001
Fall seeded cover crops	2.33	.98		
	3.05	.71		
			-4.60	.0001
Allelopathy	1.31	.59		
	1.85	.88		
			-5.07	.0001
Low input livestock facilities	2.52	.94		
	2.90	.68		
			-2.76	.008
Row banding of herbicides	2.22	1.00		
	3.37	.62		
			-7.25	.0001
On-farm research	2.32	.90		
	2.90	.80		
			-4.42	.0001
Integrated pest management	2.14	.90		
	3.02	.72		
			-7.35	.0001
Late spring soil nitrate test	2.14	1.00		
	2.85	.85		
			-5.07	.0001

Table 6. (Continued)

Practice		Mean	SD	t-value	prob.
Agroforestry		1.63	.83		
		1.90	.86		
				-1.98	.053
	Composite	2.16	.892	Students	
		2.87	.744	Teachers	
				-8.29	.0001
	Reliability:	.90			
		.90			

The t-test was used to test for significant differences between teacher and student means with regard to their perceived knowledge of sustainable agriculture practices. Teacher knowledge was significantly higher than student knowledge for all 11 practices and the composite.

Expectations from Use of Non-Chemical Practices

Teachers and students were asked to indicate their expectations from the use of non-chemical agricultural practices (Table 7). A five-point scale (1=very unlikely, 2=somewhat unlikely, 3=unsure, 4=somewhat likely, 5=very likely) was used in gathering the responses.

Composite means for teachers (X=3.36) and students (X=3.39) were slightly on the positive end of the scale, suggesting that teachers and students are positive about their expectations from the use of non-chemical agricultural practices. The top three expectations by teachers were (1) less groundwater contamination (X=4.42), (2) improved health of families (X=4.29), and (3) improved soil conditions (X=3.98). The bottom three expectations by teachers were (1) fewer weeds (X=2.32), (2) fewer insects (X=2.34), and (3) higher yields under adverse conditions (X=2.68).

Table 7. Expectations from use of non-chemical practices as perceived by teachers and students
(Teachers N=41 Students N=464)

Expectation	Mean	SD	t-value	prob.
Improved soil conditions	3.58	.91	Student	
	3.98	.82	Teacher	
			-2.92	.005
Improved health for farm families	3.94	.90		
	4.29	.81		
			-2.62	.012
Less groundwater contamination	4.11	.98		
	4.41	.59		
			-1.99	.047
Better quality products	3.42	1.01		
	3.22	.88		
			1.35	.184
Higher yields under adverse conditions	3.09	1.00		
	2.68	.69		
			2.53	.005
Lower overall production cost	3.56	.96		
	3.90	.83		
			-2.47	.017
Higher profits for farmers	3.27	.96		
	3.07	.72		
			1.27	.205
Fewer weeds	2.78	1.14		
	2.32	.65		
			2.55	.011
Fewer insects	2.75	1.12		
	2.34	.69		
			2.31	.021
Composite	3.39	.57	Students	
	3.36	.45	Teachers	
			.38	.705
Reliability	.75			
	.78			

Students' top three expectations were (1) less groundwater contamination (X=4.12), (2) improved health for farm families (X=3.94), and (3) improved soil conditions (X=3.58). It should be noted that student expectations are the same as teacher expectations. Students' bottom three expectations were (1) fewer insects (X=2.75), (2) fewer weeds (X= 2.79) ,and (3) higher yields under adverse conditions (X=3.09). These bottom three student expectations were the same as teacher expectations.

Results from t-test analyses are also reported in Table 7. No significant difference was observed in the composite means for teachers and students. Thus, composite expectations by teachers and students from use of non-chemical agricultural practices were similar. Further analyses revealed that teachers had significantly higher (.05 level) means regarding four expectations: (1) improved health of families, (2) less groundwater contamination, (3) lower overall production cost, and (4) improved soil conditions.

Student expectations were significantly greater (.05 level or greater) than teacher expectations from use of non-chemical agricultural practices for the following: (1) higher yields under adverse conditions, (2) fewer weeds, and (3) fewer insects.

Impact of Sustainable Agriculture

Teachers and students were asked to indicate their perceptions of the impact that sustainable agriculture will have on selected areas of Iowa agriculture. A five-point scale was used (1=very unlikely, 2=somewhat unlikely, 3=unsure, 4=somewhat likely, 5=very likely) to measure responses. The results are reported in Table 8.

The reliability for the impact measure was .82 and .81, respectively for students and teachers. The top three impacts teachers perceive from sustainable agriculture are (1) conservation of soil (X=4.48), (2) greater management practices (X=4.45), and (3) reduced use of chemicals (X=4.18). The three bottom perceived impacts were:

Table 8. Impact of sustainable agriculture as perceived by teachers and students (Students N=464, Teachers N=41)

Impact	Mean	SD	t-value	prob.
Protection of groundwater	3.89	.88	Students	
	4.15	.69	Teachers	
			-2.26	.028
Lower profits for farmers	3.13	.82		
	3.00	.67		
			1.14	.258
Benefits for citizens of Iowa	3.47	.84		
	3.95	.67		
			-4.31	.0001
Benefits for society	3.56	.81		
	4.07	.72		
			-4.36	.0001
Conservation of soil	3.97	.97		
	4.49	.51		
			-4.14	.0001
Reduced use of chemicals	3.71	.97		
	4.18	.98		
			-2.87	.006
More small farms	3.10	.96		
	2.70	1.04		
			2.34	.024
Better rural communities	3.40	.85		
	3.35	.89		
			.32	.752
More expensive food	3.22	.95		
	3.35	.77		
			-.98	.334
Safer food	3.81	.87		
	3.70	1.02		
			.65	.516
Increased labor requirements	3.41	.94		
	4.00	.45		
			-3.92	.0001
Changes in equipment	3.90	.83		
	4.03	.70		
			-1.09	.282
More livestock	3.55	.82		
	3.60	.90		
			-.36	.720

Table 8. (Continued)

Impact	Mean	SD	t-value prob.
Greater management requirements	3.78	.84	Students
	4.45	.67	Teachers
			-5.87 .0001
Protection of wildlife	3.81	.89	
	4.05	.64	
			-1.19 .234
Protection of woodlands	3.81	.89	
	4.00	.68	
			-1.32 .188
Composite	3.60	.45	Students
	3.82	.39	Teachers
			-2.95 .003
Reliability	.82		
	.81		

(1) more small farms (X=2.70), (2) lower profits for farmers (X=3.00), and (3) better rural community and more expensive food (X=3.35).

The top three impacts students perceived from sustainable agriculture were (1) conservation of soil (X=3.97), (2) protection of groundwater (X=3.89), and (3) protection of wildlife (X=3.88). The bottom three perceived outcomes for students were (1) more small farms (X=3.10), (2) lower profits for farmers (X=3.13), and (3) more expensive food (X=3.22).

Results from t-tests analysis, comparing students and teachers perceived impact from sustainable agriculture are reported in Table 8. The composite mean for teachers was significantly higher than the composite mean for students (.01 level). Individual items where teacher means were significantly greater (.05 level or greater) than student means are (1) benefits to society, (2) conservation of soil, (3) benefits to citizens of Iowa,

(4) reduces chemical use, (5) decreased use of chemical, (6) greater management requirements, and (7) protection of groundwater. It was interesting to note that the student mean was significantly greater than the teacher mean for "more small farms".

Analyses of Teacher Perceptions

This section provides an analyses of teacher perceptions about sustainable agriculture when teachers were grouped by selected demographics. The t-test was used to determine differences between two groups and the one-way analyses of variance was used when three or more groups were analyzed. The Duncan test was used to isolate means that were significantly different when significant F-values were observed.

Analyses of Teachers' Composite Perceptions about Conservation of Iowa Natural Resources

Table 9 summarizes the results of tests for significant differences in composite means for teachers' perceptions about conservation of Iowa's natural resources when teachers were grouped by selected variables.

No significant difference (.05 level) was observed in the teachers' perceptions about conservation of Iowa natural resources composite means when teachers were grouped by independent variables. These findings indicate that Iowa secondary high school agricultural education teachers are homogeneous in their perceptions about conservation of natural resources.

Analyses of Teachers' Composite Perceptions about Knowledge of Sustainable Agriculture

Table 10 reveals the results of tests for significant differences in composite means for teachers' perceptions about their knowledge of sustainable agricultural when teachers were grouped by selected teacher demographic variables.

Table 9. Tests for differences among teachers' composite perceptions about conservation of Iowa natural resources

Teacher Demographic Variable		Composite Mean	Composite SD	F/t-value	prob.
Age (F-test)					
20-30	N=11	4.39	.42		
31-40	N=15	4.16	.73		
>40	N=15	4.39	.294	.877	.424
Level of Education (t-test)					
B.S. (16 years)	N=19	4.20	.69		
>B.S.	N=22	4.41	.26	-1.34	.189
Years of Teaching (F-test)					
1-5	N=7	4.29	.42		
6-10	N=8	4.55	.34		
11-15	N=14	4.17	.73		
>15	N=10	4.31	.26	.894	.454
Size of School (F-test)					
150 or Less	N=13	4.28	.35		
151 to 400	N=14	4.27	.78		
>400	N=11	4.41	.28	.239	.789
Number of Students in Agricultural Education Program (F-test)					
≤25	N=8	4.44	.38		
26-50	N=20	4.25	.65		
>50	N=12	4.33	.29	.421	.659
FFA District (F-test)					
Northwest	N=7	4.35	.28		
Northcentral	N=6	4.41	.49		
Northeast	N=4	4.32	.23		
Southwest	N=10	4.04	.85		
Southcentral	N=7	4.43	.29		
Southeast	N=7	4.46	.29	.786	.567
ISU Inservice Training (t-test)					
Yes	N=13	4.24	.81		
No	N=26	4.34	.30	-.555	.181
Use of Natural Resources Educational Packet (t-test)					
Yes	N=28	4.27	.58		
No	N=9	4.37	.27	-.500	.203

Table 9. (Continued)

Teacher Demographic Variable		Composite Mean	Composite SD	F/t-value	prob.
Use of Groundwater Protection Through Prevention (t-test)					
Yes	N=34	4.29	.55		
No	N=3	4.30	.14	-.020	.320
Use of Introduction to Natural Resources and Conservation Technology Unit (t-test)					
Yes	N=24	4.27	.61		
No	N=13	4.34	.33	-.38	.182
Use of Teaching Sustainable Agriculture Manager (t-test)					
Yes	N=20	4.25	.66		
No	N=17	4.35	.31	-.53	.174
Use of Groundwater Flow Model (t-test)					
Yes	N=13	4.34	.31		
No	N=24	4.27	.61	.32	.183

Table 10. Tests for significant differences among teachers' composite perceptions about knowledge of sustainable agriculture

Teacher Demographic Variable		Composite Mean	Composite SD	F/t-value	prob.
Age (F-test)					
20-30	N=11	2.59	.57		
31-40	N=15	2.98	.39		
>40	N=15	3.07	.52	3.26 (3>1)	.049
Level of Education (t-test)					
B.S .	N=19	2.79	.49		
>B.S.	N=22	3.01	.54	-1.33	.193
Years of Teaching (F-test)					
1-5	N=7	2.33	.50		
6-10	N=8	3.01	.52		
11-15	N=14	3.06	.46		
>16	N=10	3.02	.45	4.34 (2,3,4>1)	.0104

Table 10. (Continued)

Teacher Demographic Variable		Composite Mean	Composite SD	F/t-value	prob.
Size of School (F-test)					
150 or Less	N=13	2.68	.61		
151 to 400	N=15	2.92	.50		
>400	N=11	3.09	.35	2.02	.147
Number of Students in Agricultural Education Program (F-test)					
25<	N=8	2.77	.46		
26-50	N=21	3.00	.52		
>50	N=12	2.85	.57	.650	.528
FFA District (F-test)					
Northwest	N=7	2.92	.40		
Northcentral	N=6	2.96	.59		
Northeast	N=4	3.08	.40		
Southwest	N=10	2.81	.70		
Southcentral	N=7	3.13	.40		
Southeast	N=7	2.68	.47	.678	.643
ISU Inservice Training (t-test)					
Yes	N=13	3.07	.70		
No	N=26	2.79	.38	1.32	.119
Use of Natural Resources Educational Packet (t-test)					
Yes	N=28	2.95	.58		
No	N=9	2.73	.30	1.09	.284
Use of Groundwater Protection Through Prevention (t-test)					
Yes	N=34	2.95	.48		
No	N=3	2.33	.80	2.00	.053
Use of Intro. to Natural Resources and Conservation Technology Unit (t-test)					
Yes	N=24	3.01	.60		
No	N=13	2.69	.29	1.79	.082
Use of Teaching Sustainable Agriculture Manager (t-test)					
Yes	N=20	3.03	.48		
No	N=17	2.74	.56	1.72	.095
Use of Groundwater Flow Model (t-test)					
Yes	N=13	2.96	.48		
No	N=24	2.86	.56	.52	.603

Only two significant differences were observed in the composite means for teacher perceived level of knowledge about sustainable agriculture practices, when teachers were grouped by selected teacher demographic variables. Teachers over 40 years old age had significantly higher means than teachers that were 20 to 30 years of age. This suggests that older teachers have more knowledge about sustainable agriculture than teachers 30 years of age or under. Teachers with six or more years of experience in teaching had significantly higher means than teachers with one to five years of experience.

Analyses of Teachers' Composite Perceptions about Their Expectations from Use of Non-Chemical Agricultural Practices

Table 11 reveals results of the tests for significant differences in composite means for teachers' perceptions about expectations of non-chemical agricultural practices when teachers were grouped by selected teacher demographic variables.

Three significant differences were found in teacher expectations from use of non-chemical practices. Teachers who had used the Natural Resources Educational Packet, Groundwater Protection Through Prevention, and Introduction to Natural Resources and Conservation Technology Unit had significantly higher means (.05 level or greater) than teachers who had not used these materials.

Analyses of Teachers Composite Perceptions about the Impacts of Sustainable Agriculture

Table 12 reveals the results of tests for significant differences in composite means for teachers' perceptions about the impact of sustainable agriculture when teachers were grouped by selected teacher demographic variables.

No significant difference was observed, suggesting that teachers were in agreement on perceived impact of sustainable agriculture.

Table 11. Tests for differences among teachers' composite expectations from use of chemical agricultural practices

Teacher Demographic Variable		Composite Mean	Composite SD	F/t-value	prob.
Age (F-test)					
20-30	N=11	3.45	.51		
31-40	N=15	3.11	.48		
>40	N=15	3.33	.40	.342	.713
Level of Education (t-test)					
B.S.	N=19	3.48	.42		
>B.S.	N=22	3.25	.46	1.64	.110
Years of Teaching (F-test)					
1-5	N=7	3.37	.43		
6-10	N=8	3.63	.45		
11-15	N=14	3.34	.43		
>16	N=10	3.22	.47	1.29	.29
Size of School (F-test)					
150 or Less	N=13	3.28	.45		
151 to 400	N=14	3.28	.44		
>400	N=11	3.49	.46	.872	.426
Number of Students in Agricultural Education Program (F-test)					
25<	N=8	3.21	.51		
26 to 50	N=20	3.39	.42		
>50	N=12	3.41	.47	.538	.589
FFA District (F-test)					
Northwest	N=7	3.14	.39		
North Central	N=6	3.50	.55		
Northeast	N=4	3.19	.46		
Southwest	N=10	3.28	.46		
South Central	N=7	3.43	.51		
Southeast	N=7	3.59	.33	.996	.435
ISU Inservice Training (t-test)					
Yes	N=13	3.41	.38		
No	N=26	3.29	.48	.79	.437

Table 11. (Continued)

Teacher Demographic Variable		Composite Mean	Composite SD	F/t-value	prob.
Use of Natural Resources Educational Packet (t-test)					
Yes	N=28	3.48	.37		
No	N=9	3.02	.49	3.00	.005
Use of Groundwater Protection Through Prevention (t-test)					
Yes	N=34	3.42	.42		
No	N=3	2.85	.39	2.25	.031
Use of Intro. to Natural Resources and Conservation Technology Unit (t-test)					
Yes	N=24	3.54	.35		
No	N=13	3.06	.43	3.68	.001
Use of Teaching Sustainable Agriculture Manager (t-test)					
Yes	N=20	3.48	.40		
No	N=17	3.25	.47	1.61	.116
Use of Groundwater Flow Model (t-test)					
Yes	N=13	3.38	.36		
No	N=24	3.37	.49	.04	.971

Table 12. Tests for significant differences among teachers' perceptions about the impact of sustainable agriculture

Teacher Demographic Variable		Composite Mean	Composite SD	F/t-value	prob.
Age (F-test)					
20-30	N=11	3.80	.41		
31-40	N=15	3.83	.29		
>40	N=15	3.81	.47	.017	.983
Level of Education (t-test)					
B.S.	N=19	3.72	.26		
>B.S.	N=22	3.90	.46	-1.53	.135
Years of Teaching (F-test)					
1-5	N=7	3.73	.32		
6-10	N=8	3.89	.39		
11-15	N=14	3.92	.36		
16 >	N=10	3.70	.49	.776	.516

Table 12. (Continued)

Teacher Demographic Variable		Composite Mean	Composite SD	F/t-value	prob.
Size of School (F-test)					
150 or Less	N=13	3.75	.37		
151 to 400	N=14	3.75	.48		
>400	N=11	3.93	.28	.728	.485
Number of Students in Agricultural Education Program (F-test)					
25 <	N=8	3.78	.43		
26-50	N=20	3.84	.44		
>50	N=12	3.80	.27	.082	.921
FFA District (F-test)					
Northwest	N=7	3.89	.62		
Northcentral	N=6	3.86	.42		
Northeast	N=4	3.61	.23		
Southwest	N=10	3.68	.32		
Southcentral	N=7	4.00	.29		
Southeast	N=7	3.85	.32	.794	.562
ISU Inservice Training (t-test)					
Yes	N=13	3.83	.38		
No	N=26	3.79	.40	.31	.757
Use of Natural Resources Educational Packet (t-test)					
Yes	N=28	3.89	.29		
No	N=9	3.54	.56	1.70	.127
Use of Groundwater Protection Through Prevention (t-test)					
Yes	N=34	3.83	.32		
No	N=3	3.56	.92	.50	.664
Use of Intro. to Natural Resources and Conservation Technology Unit (t-test)					
Yes	N=24	3.86	.30		
No	N=13	3.71	.52	.93	.365
Use of Teaching Sustainable Agriculture Manager (t-test)					
Yes	N=20	3.85	.31		
No	N=16	3.75	.47	.77	.449
Use of Groundwater Flow Model (t-test)					
Yes	N=13	3.81	.41		
No	N=24	3.81	.38	-.02	.988

Analyses of Student Perceptions

This section provides an analyses of student perceptions about sustainable agriculture when students were grouped by selected student demographic variables. The t-test was used to test for differences when two groups were analyzed and one-way analysis of variance was used when three or more groups were analyzed.

Analysis of Students' Composite Perceptions about Conservation of Iowa Natural Resources

Table 13 reveals the differences between students' perceptions toward the conservation of Iowa natural resources when grouped by selected demographics.

Significant differences (.05 level or greater) were observed in students' composite perceptions about conservation of Iowa natural resources for two demographic variables: grades in school and place of residence. Juniors (eleventh grade) were significantly higher than sophomores. This suggests that instruction in conservation of natural resources may be emphasized in the sophomore year of the agricultural education curriculum (data were collected early in the school year, thus instruction for juniors had to be in earlier years).

Students from farms had significantly higher means than students from urban areas. Regardless of residence, students received the same classroom instruction, but students from the farm are in constant contact with agriculture. Farm students can more clearly see the need to conserve natural resources for a profitable agriculture. Students from urban areas are not in contact with agriculture as a way of life; thus, indicating they perceive it is important to conserve natural resources, but not as much as students growing up on a farm.

Analyses of Students' Composite Perceptions about Knowledge of Sustainable Agriculture

Table 14 reveals the results of tests for significant differences in students' composite means for perceptions about their knowledge of sustainable agricultural practices when students were grouped by selected student demographic variables.

Table 13. Tests for differences among students' composite perceptions about conservation of Iowa natural resources

Student Demographic Variable		Composite Mean	Composite SD	F/t-value	prob.
<u>Gender</u>					
Male	N=382	3.97	.40		
Female	N=76	3.92	.35	1.27	.205
<u>Grade in School</u>					
9th	N=24	3.84	.33		
10th	N=82	3.88	.43		
11th	N=190	4.02	.37		
12th	N=163	3.97	.37	3.11 (3>2)	.026
<u>Place of Residence</u>					
Farm	N=293	4.01	.39		
Town or City	N=111	3.87	.41		
Rural not farm	N=55	3.95	.36	4.79 (1>2)	.009
<u>Topography of Residence</u>					
Flat	N=121	3.98	.41		
Slightly hilly	N=278	3.95	.40		
Very hilly	N=61	4.05	.37	1.59	.204
<u>Immediate Plans After High School</u>					
Post Secondary Ed.	N=30	3.99	.41		
Enter Farming	N=40	4.00	.39		
Enter Other Occupations	N=107	3.94	.38	.478	.620

Table 14. Tests for significant differences among students' composite perceptions about knowledge about sustainable agriculture practices

Student Demographic Variable		Composite Mean	Composite SD	F/t-value	prob.
<u>Gender</u>					
Male	N=382	2.24	.61		
Female	N=78	1.94	.65	3.89	.0001
<u>Grade in School</u>					
9th	N=24	2.06	.67		
10th	N=83	2.09	.60		
11th	N=187	2.26	.62		
12th	N=163	2.16	.64	2.00	.113
<u>Place of Residence</u>					
Farm	N=288	2.35	.58		
Town or City	N=112	1.92	.64		
Rural not farm	N=57	1.90	.58	29.06	.0001
				(1>2,3)	
<u>Topography of Residence</u>					
Flat	N=123	2.19	.68		
Slightly hilly	N=277	2.20	.62		
Very hilly	N=58	2.10	.54	.564	.570
<u>Immediate Plans After High School</u>					
Post Secondary Ed.	N=301	2.22	.62		
Enter Farming	N=40	2.52	.54		
Enter Other Occupations	N=107	2.00	.61	11.44	.0001
				(1>3,2>1,3)	

Significant differences were observed in students' perceived knowledge about sustainable agriculture for three of the demographic variables: gender, place of residence, and plans after high school. The mean for males was greater than the mean for females. Male students may be more actively involved in the everyday practices of agriculture than females, providing a greater opportunities to learn about new farming practices.

The mean for students from the farm were significantly higher (.01 level) than the mean for non-farm students. Thus, students' perceived level of knowledge of sustainable agriculture practices may be influenced by living on a farm.

Students planning to gain a post-secondary education had significantly higher mean than students planning to enter occupations other than farming immediately after high school. (Of the students planning to enter post-secondary education, about 50 percent planned to study agriculture.) Students planning to enter farming immediately after high school had a significantly higher mean than students planning to seek non-farm occupations and those planning to pursue a post-secondary education.

Analyses of Students' Composite Perceptions about Their Expectations from Use of Non-Chemical Agricultural Practices

Table 15 reveals the results of tests for significant differences in students' composite means for students about expectations from the use of non-chemical agricultural practices when students were grouped by selected demographic variables.

No significant differences were observed in students' perceptions of their expectations from the use of non-chemical agricultural practices when grouped by selected demographic variables.

Table 15. Tests for significant differences among students' expectations from use of non-chemical agricultural practices

Student Demographic Variable		Composite Mean	Composite SD	F/t-value	prob.
Gender					
Male	N=382	3.37	.58		
Female	N=76	3.50	.53	-1.71	.087
Grade in School					
9th	N=24	3.33	.60		
10th	N=83	3.28	.60		
11th	N=188	3.44	.53		
12th	N=164	3.40	.59	1.71	.165
Place of Residence					
Farm	N=292	3.38	.60		
Town or City	N=109	3.40	.52		
Rural not farm	N=58	3.48	.53	.763	.467
Topography of Residence					
Flat	N=123	3.43	.52		
Slightly hilly	N=276	3.38	.56		
Very hilly	N=61	3.40	.73	.32	.727
Immediate Plans after High School					
Post Secondary Ed.	N=299	3.36	.59		
Enter Farming	N=40	3.48	.55		
Enter Other Occupations	N=109	3.48	.52	2.07	.127

Analyses of Students' Composite Perceptions about the Impact of Sustainable Agriculture

Table 16 reveals the results of tests for significant differences in composite means for students' perceptions about the impact of sustainable agriculture when students were grouped by selected demographic variables.

Students' plans after high school were the only demographic variables where significant differences in means for expectations of sustainable agriculture were observed. Students who planned to enter farming after high school had significantly higher means than students with other plans.

Students planning to obtain a post-secondary education had significantly higher means than students planning to enter non-farm occupations. Of the students planning to pursue a post-secondary education, 50 percent of them planned to study agriculture.

Table 16. Tests for significant differences among students' perceptions about the impact of sustainable agriculture

Student Demographic Variable		Composite Mean	Composite SD	F/t-value	prob.
Gender					
Male	N=372	3.60	.46		
Female	N=74	3.63	.40	-.65	.519
Grade in School					
9th	N=24	3.63	.33		
10th	N=83	3.54	.51		
11th	N=187	3.60	.43		
12th	N=163	3.61	.45	.820	.483
Place of Residence					
Farm	N=284	3.62	.44		
Town or City	N=112	3.53	.48		
Rural not farm	N=57	3.63	.40	1.49	.227
Topography of Residence					
Flat	N=123	3.60	.47		
Slightly hilly	N=277	3.61	.44		
Very hilly	N=58	3.60	.45	.072	.931
Future plans after high school					
Post Secondary Ed.	N=301	3.63	.44		
Enter Farming	N=40	3.81	.44		
Enter Other Occupations	N=107	3.44	.42	11.54 (1>3, 2>1,3)	.0001

CHAPTER V: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The purpose of the study was to identify the perceptions of Iowa high school agricultural education teachers and students regarding sustainable agriculture. More specifically, the objectives were to (1) determine the perceptions of Iowa high school agricultural education teachers and students about sustainable agriculture, (2) to test the differences between teacher and student perceptions of sustainable agriculture, and (3) to test the differences among teachers and among students with regard to perceptions of sustainable agriculture when grouped by selected demographic variables.

Stratified random sampling procedure was used in selecting 41 teachers and 464 students to participate in the study. Instruments were developed to measure student and teacher perceptions regarding sustainable agriculture and to gather demographic data.

Conclusions and Recommendations

(1) A profile of participating Iowa high school agricultural education teachers are as follows:

- 95 percent are male and 5 percent are female
- 63 percent are 40 years of age and younger
- 95 percent have a farming background
- About half have education beyond a B.S.
- About 38 percent have taught 1 to 10 years and 62 percent have taught longer than 10 years
- About a one-third were from schools of 150, one-third from 151 to 400 and a one-third over 400 students
- About half of the agricultural education programs had less than 50 students

•Over half of the teachers indicated they did not have a junior high agricultural education program

•Over 90 percent of the teachers taught subjects related to sustainable agriculture

•About 75 percent indicated 1 to 10 percent of their curriculum was devoted to sustainable agriculture

• About 75 percent indicated that 0 to 10 of their students' SAE's were devoted to sustainable agriculture

•Other than the Ground Water Flow Model, well over half of the teachers had the curriculum and instructional materials developed at Iowa State University.

Recommendation:

Newly developed instructional materials should focus on strategies to integrate sustainable agriculture concepts into the agricultural education program, including ideas for student supervised agricultural experiences.

(2) A profile of participating Iowa high school agricultural education students are as follows:

•About 80 percent were male and 20 percent were female

•Over 75 percent were in eleventh and twelfth grade

•Over 60 percent were from a farm the rest were from a rural area or a town

•About 60 percent lived on slightly hilly, 15 percent on very hill and 25 percent on flat land

•Over 65 percent planned to attend a form of education after high school and 50 percent plan to study agriculture

•Only about 9 percent indicated they would farm directly after high school

Recommendation:

Iowa high school agricultural education programs appear to be highly dominated by farm, male students. A shift from subject matter related to traditional agriculture to sustainable agriculture with a greater focus on natural resources, ecology, etc., may help attract female and non-farm students to the program.

(3) Iowa high school agricultural education teachers and their students have a positive perception regarding conservation of natural resources.

These findings suggest that the perceptions of agricultural education teachers and students embrace some of the elements of Beus and Dunlap's (1983) sustainable agriculture paradigm. Elements related to "community" and "harmony with nature" were especially observed.

Five years ago Whent, Andrews, Williams and Weber (1988) found that attitudes about conserving natural resources were less than desirable among high school agricultural education students. The possible change in perceptions of students toward conservation of natural resources might be contributed to the development and distribution to the teachers of new instructional materials related to conserving natural resources, sustainable agriculture, and groundwater protection by the Department of Agricultural Education and Studies at Iowa State University in the past few years. Other than the groundwater flow model, a majority of the teachers had these instructional materials in their schools. Janus (1984) indicated that small amounts of environmental education can change attitudes of youth about nature.

Recommendation:

Natural resources and environmental education should be growing points of Iowa high school agricultural education programs. Increased emphasis in these areas could increase enrollment and serve an important need in the school curriculum. Such instruction in agricultural education in the public schools can play an important role in implementing the sustainable agriculture paradigm.

(4) Iowa agricultural education teachers perceive they are "somewhat informed" about sustainable agriculture.

(5) Iowa high school agricultural education teachers perceived they posses a fairly clear understanding of sustainable agriculture.

(6) Iowa high school agricultural education students perceived that they did not have a clear understanding of sustainable agriculture

(7) Teachers indicated that they "somewhat accepted" sustainable agriculture; however, students perceived themselves to be "neutral".

The fact that teachers were accepting and felt they understood the meaning of sustainable agriculture, and that students did not fully accept sustainable agriculture creates a highly desirable learning environment (transfer knowledge from teacher to students). Simmons (1987-88) indicated that high school teachers from all disciplines feel that environmental education is an important part of any education curriculum and it was their responsibility to teach students about the environment and the problems we have created. Enthusiasm for the subject by the teacher is an important part of the teaching process.

Recommendation:

Initiatives to infuse sustainable agriculture education into high school agricultural education programs should be continued. Availability of new instructional materials and teacher inservice education can encourage curriculum reform.

(8) Teacher perceptions revealed that they have additional things to learn about sustainable agriculture practices and students measured themselves as only "knowing a little" about them.

Differences between teacher and student knowledge of sustainable agriculture practices were observed.

Many of the sustainable agriculture practices studied in this research are new. Several of these practices have been addressed in educational materials recently developed at Iowa State University (Sustainable Agriculture Field & Laboratory Exercises, 1992). They were disseminated and inserviced during 1992.

Recommendation:

The impact of newly developed sustainable agriculture instructional materials on high school agricultural education programs should be assessed and the findings used in future educational initiatives.

(9) Teacher and student expectations of non-chemical practices were perceived as slightly positive. No significant differences were observed in teacher and student perceptions.

Agriculture has been dependent on the use of agricultural chemical products for a long time, but since 1977 the use of insecticides has dropped 50 percent and the use of herbicides has dropped by 25 percent (Farm Facts, 1992). An explanation for the slightly positive perceptions might be that teachers and students alike expect reduced use of chemical to improve the health of farm families, reduce groundwater contamination and improve soil conditions. These findings suggest that teachers and students perceive benefits from non-chemical practices but may not have sufficient knowledge about alternative practices as revealed in Number 6 above.

Recommendation:

The benefits resulting from sustainable agriculture should be highlighted in instructional materials.

(10) Teachers' perceptions regarding the impact of sustainable agriculture were significantly greater than students' perceptions.

Even though students were positive about the impact of sustainable agriculture, they may not see how all of the elements of sustainable agriculture fit together. In contrast, teachers may see more clearly how the elements interconnect, recognizing that a change in one area will affect other areas in the sustainable agriculture paradigm. Students were more positive when it came to specific concepts like "protection of wildlife and woodlands" and "conservation of soil".

Recommendation:

Sustainable agricultural educational materials should focus on how the "parts" of sustainable agriculture are interconnected. Savory (1988) suggested that all aspects on nature and human kind are connected and agriculture needs to integrate itself to such a system.

(11) Iowa agricultural education teachers are homogeneous in their perceptions of sustainable agriculture.

Recommendation:

Agricultural education teachers should be encouraged to share their positive perceptions regarding sustainable agriculture with their students. These positive teacher perceptions can serve as a foundation for expansion of sustainable agriculture instruction at the high school level.

(12) Iowa agricultural education students are heterogeneous in their perceptions of sustainable agriculture. This is especially true with regard to perceptions about conservation of natural resources and perceived knowledge about sustainable agriculture practices. Gender, place of residence and plans after high school were independent variables where differences were observed in one or more measures of students' perceptions regarding sustainable agriculture.

Male students were significantly higher in knowledge of sustainable agriculture practices than females. Male farm students were significantly higher than farm female students and rural non-farm male students were significantly higher than rural non-farm female students. An effort needs be made to increase female student knowledge of sustainable agriculture practices. Many of these women will be in leadership positions in the future and they will be making important decisions about agriculture policy. If women have positive perceptions about sustainable agriculture then the effort being made to change agriculture will have a better chance of succeeding.

Students from a farm perceived conservation on natural resources more positively than students from a town or city. This suggests that students close to the land (living on a farm) can see benefits of conservation more clearly than students who do not depend on the land for a livelihood. Andrews, (1989) found that Iowa farmers have positive attitudes toward conservation. These findings suggest that farm families value our natural resources. Many of the non-farm students will be in leadership positions in the future and if they have positive perceptions of sustainable agriculture the paradigm shift will occur more quickly.

Students who planned to enter farming immediately after high school had higher perceptions than students with post secondary educational plans and students who planned to enter occupations other than farming with regard to knowledge of sustainable agriculture practices and impact of sustainable agriculture. Thus, it appears that future farmers are ahead of their fellow students in a move toward a sustainable agriculture paradigm.

Recommendation:

Efforts needed to be increased to reach students planning to entering post-secondary education and non-farm occupations after high school. Many of these students will be making decisions and public policy about agriculture in the future. Educational efforts need to focus on the non-traditional (female and non-farm) agriculture students in future sustainable agriculture educational initiatives.

Recommendations for Additional Research

1. The study of teacher and student perceptions regarding sustainable agriculture should be expanded to the central states region.
2. Periodical measures of teacher and students knowledge of sustainable agriculture should be made to guide curriculum development initiatives.
3. A consistent scale should be used throughout future instruments that gather data from teachers and students related to sustainable agriculture.
4. Instructional materials on agroforestry systems (holistic farming systems) should be developed and tested in high school agricultural education programs.

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APPENDIX A: INFORMATION ON THE USE OF HUMAN SUBJECTS IN RESEARCH, IOWA STATE UNIVERSITY

INFORMATION ON THE USE OF HUMAN SUBJECTS IN RESEARCH
IOWA STATE UNIVERSITY
(Please follow the accompanying instructions for completing this form.)

1. Title of project (please type): Natural Resources and Conservation Programs in Agriculture (Experiment Station Project # 2856)

2. I agree to provide the proper surveillance of this project to insure that the rights and welfare of the human subjects are properly protected. Additions to or changes in procedures affecting the subjects after the project has been approved will be submitted to the committee for review.

David L. Williams	8/17/87	
Typed Named of Principal Investigator	Date	Signature of Principal Investigator
201 Curtiss Hall	294-0241	
Campus Address	Campus Telephone	

RECEIVED AUG

3. Signatures of others (if any) Date Relationship to Principal Investigator

4. ATTACH an additional page(s) (A) describing your proposed research and (B) the subjects to be used, (C) indicating any risks or discomforts to the subjects, and (D) covering any topics checked below. CHECK all boxes applicable.

- [ ] Medical clearance necessary before subjects can participate
- [ ] Samples (blood, tissue, etc.) from subjects
- [ ] Administration of substances (foods, drugs, etc.) to subjects
- [ ] Physical exercise or conditioning for subjects
- [ ] Deception of subjects
- [ ] Subjects under 14 years of age and(or) [X] Subjects 14-17 years of age
- [X] Subjects in institutions (Iowa High Schools and Iowa Area Schools)
- [ ] Research must be approved by another institution or agency

(Draft Copy of opinionnaires, cover letter and instruction are attached)

5. ATTACH an example of the material to be used to obtain informed consent and CHECK which type will be used. (see attached)

- [ ] Signed informed consent will be obtained.
- [X] Modified informed consent will be obtained.

6. Anticipated date on which subjects will be first contacted: Month 9 Day 1 Year 87

Anticipated date for last contact with subjects: 8 30 91

7. If Applicable: Anticipated date on which audio or visual tapes will be erased and(or) identifiers will be removed from completed survey instruments: 8 (Month) 30 (Day) 91 (Year)

8. Signature of Head or Chairperson Date Department or Administrative Unit

8-17-87 Agricultural Education Dept.

9. Decision of the University Committee on the Use of Human Subjects in Research:

[X] Project Approved [ ] Project not approved [ ] No action required

George G. Karas	9/10/87	
Name of Committee Chairperson	Date	Signature of Committee Chairperson

APPENDIX B: COVER LETTER

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Department of Agricultural Education and Studies
201 Curtiss Hall
Ames, Iowa 50011-1050
Administration and Graduate Programs 515 294-5904
Research and Extension Programs 515 294-5872
Undergraduate Programs 515 294-6924

Feb. 24, 1992

Dear Iowa Agricultural Education Teacher:

We are working with high school agricultural education departments in Iowa to expand instruction in sustainable agriculture. Your school has been randomly selected to participate in a study of the knowledge and opinions of agricultural education teachers and students regarding sustainable agriculture. We hope you will elect to participate. Please clear this with your school administration if you deem necessary.

We need your help in administering the enclosed Student Survey on Sustainable Agriculture (gold copies) to students in your highest level agricultural education class (11th- 12th grade). We want this activity to be part of the regular agriculture curriculum in your school. While students are completing their surveys, we would like for you to complete the teacher survey (cardinal copy).

Enclosed is a teaching outline you could use the day you administer the survey. Also enclosed are directions for you to share with the class. Fifteen copies of the (gold) student survey are enclosed. If additional copies are needed, you may duplicate them.

Please return all completed surveys by March 9th, 1992, using the enclosed envelope. The information provided will be held in confidence. Only group data will be reported. The forms have been coded to aid in processing.

Thanks to you and your students for helping in this activity. We will be using the results to guide development of instructional materials on sustainable agriculture.

Sincerely,

Kenneth L. Wise Graduate Assistant Iowa State University	Eldon Weber Consevation Education Coordinator Iowa State University	David Williams Professor and Head Agriculture Education and Studies, Iowa State University

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Department of Agricultural Education and Studies
201 Curtiss Hall
Ames, Iowa 50011-1050
Administration and Graduate Programs 515 294-5904
Research and Extension Programs 515 294-5872
Undergraduate Programs 515 294-6924

Dear Agriculture Teacher:

Recently Iowa State University Agriculture Education and Studies Department had chosen your school to be part of a study on sustainable agriculture. We have not received the surveys that were sent to you yet. Please have you and your students fill out the surveys and sent them back.

Thank you for your cooperation.

Kenneth L Wise	Eldon Weber	
Graduate Student	Conservation Educator	Head of Department

Teaching Outline
on
Sustainable Agriculture Opinions

I. **Introduction:** Explain that Iowa State University is working with selected Iowa high schools to gather inputs from student and teacher about sustainable agriculture. Teachers and students are asked to voluntarily provide the information requested. The information provided will be used to guide development of educational materials on sustainable agriculture.

II. Distribute copies of the Student Survey on Sustainable Agriculture and have each student complete it. Review the directions.

III. The teacher is asked to complete a copy of the Teacher Survey on Sustainable Agriculture while students complete their surveys.

IV. Collect the completed surveys. (Please mail in enclosed self-addressed envelope By March 9th, 1992.)

V. Define sustainable agriculture for the students. **Definition:** "The appropiate use of crop and agricultural systems supporting those activities which maintain economic and social viablity while preserving the high productivity and quality of Iowa's land. Using an extra copy of the survey, ask students to share their thinking on selected items on the survey.

VI. Suggested classroom activities.
- •Identify sustainable agriculture practices in the community. Discuss advantages and disadvantages of each practice compared to conventional methods.

- •Conclude by challenging sustainable agriculture practices that could be used in the community. Tell the students when sustainable agriculture units will be taught in the agriculture curriculum.

APPENDIX C: TEACHER AND STUDENT COMMENTS

TEACHER COMMENTS

•What do I eliminate from curricula in order to teach all you have suggested in the survey?

•Redoing curriculum and I am going to add many sustainable agriculture areas.

•Sometimes we are overwhelmed with teaching materials.

•With less people on the land, it is difficult to get students interested in sustainable agriculture.

STUDENT COMMENTS

•We need chemicals in order to have a decent crop. If not, we would have so many weeds and pesticides that we could not control it.

•Agriculture is something that needs to be taken seriously and will hopefully be appreciated in the future.

•I really don't know much about farming.

•I believe farmers must switch toward sustainable agriculture in order to stay within the boundaries of the law, and it provides a future for the next generation.

•I think there should be laws that make people plant grass waterways in highly erodible areas. Seeing all the good topsoil being washed away is a pitiful sight. All those thousand acre farmers don't care about the people who will have to farm land after them.

•Sustainable agriculture is already here. We need to expand the knowledge of sustainable agriculture and let people know about its benefits.

•I think we need to limit pesticide and use reusable containers.

•Soil conservation is very important. Wildlife conservation is a necessity. Water contamination is a growing concern.

•I think wildlife and preserving our existing wildlife along with preserving our soil are our most important concerns.

•I believe future farming will become totally sustainable agriculture.

•I think university studies are completely inaccurate. Most of the time because the people who do them are not out there on the farm every day living with what they say is supposed to be the "best" and "most efficient" way to do things.

•I am from a farming family and I plan to farm. In my opinion, farming with less chemicals is the way of the future for the sake of the land.

•My family practices sustainable agriculture and I hope others will learn of the dangers of the ways people farm. Now I think the general welfare of the ecology and the community is in serious danger if it doesn't change quickly.

•I don't even know what the definition is!!

•I think it is a big concern in Iowa to conserve water.

APPENDIX D: INSTRUMENTS

Student Survey on Sustainable Agriculture

____

We are interested in your knowledge and opinions about sustainable agriculture. Please answer the questions in this survey by circling the appropriate number or writing the appropriate response in the blanks.

1. Below are a number of statements concerning Iowa agriculture. Circle the response that most closely fits your opinion of each statement.

	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
a. Soil erosion is a problem in Iowa. . . .	1	2	3	4	5
b. Soil erosion affects the water quality of lakes, ponds, rivers, and streams in Iowa.	1	2	3	4	5
c. Topsoil is produced naturally.	1	2	3	4	5
d. Protecting wildlife is a concern in Iowa.	1	2	3	4	5
e. Worms are beneficial to soil formation.	1	2	3	4	5
f. Conservation is good for the community you live in.	1	2	3	4	5
g. Conservation is a state of harmony between people and nature.	1	2	3	4	5
h. Farmers should be paid to protect wildlife.	1	2	3	4	5
i. Laws are needed to reduce losses of natural resources.	1	2	3	4	5
j. Soil conservation maintains farmland for future generations.	1	2	3	4	5
k. Protecting woodlands is a concern in Iowa.	1	2	3	4	5

2. To what extent is sustainable agriculture a clear and meaningful term?

	Very Confusing				Very Clear
a. To yourself	1	2	3	4	5
b. To your ag education teacher	1	2	3	4	5
c. To other ag education students	1	2	3	4	5
d. To your parents	1	2	3	4	5
d. To people in your community	1	2	3	4	5

3. We are interested in how well sustainable agriculture is accepted by high school agriculture education teachers and students. Below is a scale to rate acceptance, ranging from complete rejection to complete acceptance. Please circle the number that reflects your opinion of how well sustainable agriculture is accepted by:

	Complete Rejection		Neutral		Complete Acceptance
a. Yourself	1	2	3	4	5
b. Other ag education students	1	2	3	4	5
c. People in your community	1	2	3	4	5

4. Below is a list of practices and concepts identified with sustainable agriculture. Indicate how much you know about each by circling the appropriate number.

	Know Nothing	Know A Little	Know Some	Know A Lot
a. Filter strips	1	2	3	4
b. Rotational grazing	1	2	3	4
c. Narrow strip intercropping	1	2	3	4
d. Fall seeded cover crops	1	2	3	4
e. Allelopathy	1	2	3	4
f. Ridge tillage	1	2	3	4
g. Low input livestock facilities	1	2	3	4
h. Row banding of herbicides	1	2	3	4
i. On-farm research	1	2	3	4
j. Integrated Pest Management	1	2	3	4
k. Late spring soil nitrate test	1	2	3	4
l. Agroforestry	1	2	3	4

5. Many sustainable agriculture practices are designed to limit the use of purchased inputs such as pesticides and commercial fertilizers by substituting non-chemical alternatives. Please indicate how likely the substitution of non-chemical alternatives will result in:

	Very Unlikely	Somewhat Unlikely	Unsure	Somewhat Likely	Very Likely
a. Improved soil conditions	1	2	3	4	5
b. Improved health for farm families	1	2	3	4	5
c. Less groundwater contamination	1	2	3	4	5
d. Better quality products	1	2	3	4	5
e. Higher yields under adverse conditions	1	2	3	4	5
f. Lower overall production costs	1	2	3	4	5
g. Higher profits for farmers	1	2	3	4	5
h. Fewer weeds	1	2	3	4	5
i. Fewer insects	1	2	3	4	5

6. Please indicate how likely it is that sustainable agriculture will result in:

	Very Unlikely	Somewhat Unlikely	Unsure	Somewhat Likely	Very Likely
a. Protection of water quality	1	2	3	4	5
b. Lower profits for farmers	1	2	3	4	5
c. Benefits for citizens of Iowa	1	2	3	4	5
d. Benefits for society	1	2	3	4	5
e. Conservation of soil	1	2	3	4	5
f. Reduced use of chemicals	1	2	3	4	5
g. More small farms	1	2	3	4	5
h. Better rural communities	1	2	3	4	5
i. More expensive food	1	2	3	4	5
j. Safer food	1	2	3	4	5

(Question 6 is continued on the next page)

6 (continued). Please indicate how likely it is that sustainable agriculture will result in:

	Very Unlikely	Somewhat Unlikely	Unsure	Somewhat Likely	Very Likely
k. Increased labor requirements	1	2	3	4	5
l. Changes in equipment	1	2	3	4	5
m. More livestock	1	2	3	4	5
n. Greater management requirements	1	2	3	4	5
p. Protection of wildlife	1	2	3	4	5
q. Protection of woodlands	1	2	3	4	5

7. What is your gender? Male_____ Female_____

8. What grade are you in?

9th 1

10th 2

11th 3

12th 4

9. Which county do you live in? ______________

10. Do you live:

On a farm 1

In a city or town 2

In a rural area
but not on a farm 3

11. How would you best describe the land where your home is located?

Flat 1

Slightly hilly . . 2

Very hilly . . 3

12. What are your plans upon completion of high school?

			Agriculture	Other
Attend a vocational school or community college	1	If yes, what field?	1	2
Attend a four year college or university	2	If yes, what field?	1	2
Enter farming	3			
Enter occupation other than farming	4	If yes, what field?	1	2
Enter the military	5			
Don't know	6			

Other____

13. Have you ever used any of the following educational tools in your classroom?

			If yes, how helpful were they?		
	Yes	No	Not at all Helpful	Somewhat Helpful	Very Helpful
a. A computer program called Sustainable Agriculture Manager (SAM)	1	2	1	2	3
b. Groundwater instruction materials	1	2	1	2	3
e. The groundwater flow model	1	2	1	2	3

Other comments?____

____

____

____

Teacher Survey on Sustainable Agriculture

____

We are interested in your knowledge and opinions about sustainable agriculture. Please answer the questions in this survey by circling the appropriate number or writing the appropriate response in the blanks.

1. Below are a number of statements concerning Iowa agriculture. Circle the response that most closely fits your opinion of each statement.

	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
a. Soil erosion is a problem in Iowa. . . .	1	2	3	4	5
b. Soil erosion affects the water quality of lakes, ponds, rivers, and streams in Iowa.	1	2	3	4	5
c. Topsoil is produced naturally.	1	2	3	4	5
d. Protecting wildlife is a concern in Iowa.	1	2	3	4	5
e. Worms are beneficial to soil formation.	1	2	3	4	5
f. Conservation is good for the community you live in.	1	2	3	4	5
g. Conservation is a state of harmony between people and nature.	1	2	3	4	5
h. Farmers should be paid to protect wildlife.	1	2	3	4	5
i. Laws are needed to reduce losses of natural resources.	1	2	3	4	5
j. Soil conservation maintains farmland for future generations.	1	2	3	4	5
k. Protecting woodlands is a concern in Iowa.	1	2	3	4	5

2. How well informed are you about sustainable agriculture? *(please circle only one response)*

Not at all informed 1

Somewhat informed 2

Very well informed 3

Not sure 4

3. To what extent is sustainable agriculture a clear and meaningful term?

	Very Confusing				Very Clear
a. To yourself	1	2	3	4	5
b. To other ag education teachers	1	2	3	4	5
c. To your ag education students	1	2	3	4	5
d. To farmers you work with	1	2	3	4	5
e. To people in your community	1	2	3	4	5

4. We are interested in how well sustainable agriculture is accepted by high school agriculture education teachers and students. Below is a scale to rate acceptance, ranging from complete rejection to complete acceptance. Please circle the number that reflects your opinion of how well sustainable agriculture is accepted by:

	Complete Rejection		Neutral		Complete Acceptance
a. Yourself	1	2	3	4	5
b. Other ag education teachers	1	2	3	4	5
c. Your students	1	2	3	4	5
d. People in your community	1	2	3	4	5

5. Below is a list of practices and concepts identified with sustainable agriculture. Indicate the extent of your knowledge about each by circling the appropriate number.

	Know Nothing	Know A Little	Know Some	Know A Lot
a. Filter strips	1	2	3	4
b. Rotational grazing	1	2	3	4
c. Narrow strip intercropping	1	2	3	4
d. Fall seeded cover crops	1	2	3	4
e. Allelopathy	1	2	3	4
f. Ridge tillage	1	2	3	4
g. Low input livestock facilities	1	2	3	4

(Question 5 is continued on the next page)

5 (continued). Below is a list of practices and concepts identified with sustainable agriculture. Indicate the extent of your knowledge about each by circling the appropriate number.

	Know Nothing	Know A Little	Know Some	Know A Lot
h. Row banding of herbicides	1	2	3	4
i. On-farm research	1	2	3	4
j. Integrated Pest Management	1	2	3	4
k. Late spring soil nitrate test	1	2	3	4
l. Agroforestry	1	2	3	4

6. Many sustainable agriculture practices are designed to limit the use of purchased inputs such as pesticides and commercial fertilizers by substituting non-chemical alternatives. Please indicate how likely the substitution of non-chemical alternatives will result in:

	Very Unlikely	Somewhat Unlikely	Unsure	Somewhat Likely	Very Likely
a. Improved soil conditions	1	2	3	4	5
b. Improved health for farm families	1	2	3	4	5
c. Less groundwater contamination	1	2	3	4	5
d. Better quality products	1	2	3	4	5
e. Higher yields under adverse conditions	1	2	3	4	5
f. Lower overall production costs	1	2	3	4	5
g. Higher profits for farmers	1	2	3	4	5
h. Fewer weeds	1	2	3	4	5
i. Fewer insects	1	2	3	4	5

7. Please indicate how likely it is that sustainable agriculture will result in:

	Very Unlikely	Somewhat Unlikely	Unsure	Somewhat Likely	Very Likely
a. Protection of water quality	1	2	3	4	5
b. Lower profits for farmers	1	2	3	4	5
c. Benefits for citizens of Iowa	1	2	3	4	5
d. Benefits for society	1	2	3	4	5
e. Conservation of soil	1	2	3	4	5

(Question 7 is continued on the next page)

7 (continued). Please indicate how likely it is that sustainable agriculture will result in:

	Very Unlikely	Somewhat Unlikely	Unsure	Somewhat Likely	Very Likely
f. Reduced use of chemicals	1	2	3	4	5
g. More small farms	1	2	3	4	5
h. Better rural communities	1	2	3	4	5
i. More expensive food	1	2	3	4	5
j. Safer food	1	2	3	4	5
k. Increased labor requirements	1	2	3	4	5
l. Changes in equipment	1	2	3	4	5
m. More livestock	1	2	3	4	5
n. Greater management requirements	1	2	3	4	5
p. Protection of wildlife	1	2	3	4	5
q. Protection of woodlands	1	2	3	4	5

8. What is your age? ________

9. What is your gender? Male_____ Female_____

10. Did you grow up on a farm? Yes_____ No______

11. How many years of formal education do you have? ________

12. How many years have you been teaching high school agriculture? ________

13. How many students are in your high school (grades 9-12)? _________

14. How many students are in your ag education classes (grades 9-12)? _________

15. How many students are in your agriculture exploratory classes (grades 7-8)? _______

16. Do you teach any sustainable agriculture topics during your ag education classes?

Yes 1
No 2

17. How often do you explicitly use the term "sustainable agriculture" when teaching?

Never 1
Sometimes . . 2
Often 3
Always . . . 4

18. How do you feel about teaching sustainable agriculture as part of your curriculum?

Not important 1
Somewhat important 2
Unsure 3
Very important 4
Utmost importance 5

19. Approximately what percent of you agriculture curriculum is devoted to sustainable agriculture?

_______%

20. About what percent of the students in your ag education classes have SAE projects related to sustainable agriculture each year?

_______%

21. A number of materials have been developed over the past several years as aids for teaching about natural resources. These materials are listed below. For each indicate whether you use the materials.

			If yes, how useful are these materials?		
	Yes	No	Not Useful	Somewhat Useful	Very Useful
a. Natural resources educational packet	1	2	1	2	3
b. Groundwater protection through prevention	1	2	1	2	3
c. Introduction to natural resources and conservation technology unit .	1	2	1	2	3
d. Teaching sustainable agriculture (Sustainable Agriculture Manager: a computer assisted instructional unit for education in secondary schools)	1	2	1	2	3
e. Groundwater Flow Model	1	2	1	2	3

22. Are you using any other sustainable agriculture/natural resources curriculum/instructional materials?

Yes . . 1

No . . 2

a. If yes, please describe:____

____

23. Have you participated in past in-service trainings on sustainable agriculture and natural resources?

Yes . . 1

No . . 2

23a. If yes, how useful was the training?

Not at all Useful				Very Useful
1	2	3	4	5

24. Have you worked with your Soil & Water Conservation District Commissioners in conservation education programs?

Yes 1

No 2

24a. If no, would you be interested in doing so in the future?

Yes 1

No 2

Other comments?____

____

____