Perceptions of secondary school agriculture teachers in the North Central Region of the U.S. regarding sustainable agriculture: implications to curriculum development in agricultural education

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Perceptions of secondary school agriculture teachers in the North Central Region of the U.S. regarding sustainable agriculture: Implications to curriculum development in agricultural education

by

Kehinde Aderemi Ajaiyeoba Agbaje

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

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Major: Agricultural Education

Major Professor: Robert A. Martin

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Ames, Iowa

1998
This is to certify that the doctoral dissertation of

Kehinde Aderemi Ajaiyeoba Agbaje

has met the dissertation requirements of Iowa State University

Signature was redacted for privacy.

Major Professor

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For the Major Program

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For the Graduate College
DEDICATION

I dedicate this study to:

The glory of God the Father Who looked beyond my fault, saw my need, and sent His Son Jesus Christ to sacrifice His sinless life on the Cross of Calvary to pay the penalty for my sins and reconcile me back to Him in a life-long and eternal relationship. There was no other way! The shedding of the blood of Jesus on the Cross was and is still the only way to salvation!

My children, Babatunde Alade, Bankole Amobi, and Ore-Oluwa Yinyinola, who endured and persevered with me through thick and thin during the long arduous years it took me to complete this study.

To my family in Nigeria, especially my father – Papa I. D. Ajaiyeoba, my twin sister – Taiyelolu Sikeade, my other sisters – Feyisara Ajoke and Oluwatoyin Modupe-ore, and my only brother, Dr. Ayotunde Idowu Ajaiyeoba, and their spouses and children, all of who supported me in prayers and filled the empty space created by my absence from home as best as they could.

I would forever be grateful for the wonderful roles these people played in my life, for their support and encouragement during those very difficult times I wanted to call it quits and forget I ever started the graduate studies!

I thank them all from the bottom of my heart.
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ABSTRACT

The major purpose of this study was to determine the perceptions of secondary school agriculture teachers in the North Central Region of the US regarding sustainable agriculture, the extent to which they teach the subject in their curriculum, and the use, credibility, and benefits of selected information sources. A secondary purpose was to develop a model to guide the integration of sustainable agriculture subject matter into the curriculum.

Overall, the teachers had positive perceptions and a basic understanding of sustainable agriculture practices. Teachers in this study expressed the desire to incorporate more of the subject into their curriculum if their needs regarding provision of adequate information, instructional aids and materials, and training were met. The respondents indicated that sustainable agriculture was economically viable. The findings in this study indicated that teachers included sustainable agriculture subject matter in their instructional programs to a moderate extent. Some of the topics that were taught included soil testing, soil erosion, and crop rotations. The following topics were not being taught to any great extent - reduced use of chemicals, reduced use of fertilizers, and herbicide-resistant crops. Teachers perceived that farmers used the following sources to gain information about sustainable agriculture: magazines, neighbors, friends, family members, local chemical and fertilizer dealers. However, university specialists were rated as the most credible sources of information. Other credible sources of information included tours, magazines and friends. The sources given the least ratings on credibility were television and radio programs, commodity promotion boards, newspapers, machinery dealers, and local seed and chemical dealers. Beneficial sources were similar to those observed for credibility.
A curriculum development model was designed to assist educators to integrate sustainable agriculture subject matter into the teaching of agriculture courses. It was concluded that teachers need more training, experience, and instructional materials to enable them to help secondary school students to learn more about sustainable agricultural practices.
CHAPTER I. INTRODUCTION

The rapidly accelerating interest in alternative farming systems over the past several years is mainly a result of agriculture's altered physical, economic, structural, and policy environment. These changes have given rise to a broad range of deepening concerns about the sustainability of current practices. (Francis and Youngberg, 1990, p. 2)

Many of these concerns include a decline in soil productivity from erosion and accompanying loss of organic matter and plant nutrients, hazards to human and animal health from pesticides and feed additives, and increased resistance of weeds and insects to herbicides and insecticides. Others include pollution of surface waters with agricultural chemicals and sediments, detrimental effects of agricultural chemicals on food quality, decrease in number of farms, particularly family farms, and disappearance of localized and direct marketing systems (Francis and Youngberg, 1990, p. 2). Unchecked soil erosion and disappearing forests, wetlands and prairies, have been identified as some of the environmental consequences of conventional agriculture (Keeney, 1991, p. 1).

According to Fretz (1991), conventional agriculture as we presently know and recognize it, involves highly specialized systems in which the emphasis is on high yields achieved with a combination of inputs including fertilizers, pesticides, and other off-farm purchases. These inputs are considered high-input and resource-depleting practices although this approach has been remarkably effective in making the United States agriculture the most productive in the world (p. 15). Fretz (1991) argued that the nation's remarkable productivity is offset by agriculture's heavy dependency on pesticides and synthetic fertilizers which represent health, safety, and environmental hazards. As a result, the public's perception of modern agriculture is deteriorating due to the belief that short-term benefits are being taken
at the expense of long-term considerations (p. 15). He concluded that these perceptions are part of what is driving the sustainable agriculture movement today, and it is the compelling reason for studying alternatives to the conventional agriculture systems we know today (Fretz, 1991, pp. 16-17).

Stauber et al. (1987), focusing on the social and economic challenges of conventional mode of farming, stated that as farmland and farming opportunities become concentrated into fewer and larger operations, many farm communities have stagnated or declined. This situation mirrors a decline in family farm opportunities and number of farming counties, and an increase in poverty rates (pp. 8-9).

Advances in technology have resulted in bigger and faster machines and greater reliance on chemical fertilizers and pesticides. Economically, more energy input have increased capital requirements for farming, increased farm size, and often replaced farmer's skills, labor, and management. Importantly, the chemical and energy inputs are purchased from off the farm, becoming larger expenses that divert dollars away from the farm and create farmer dependency on agribusiness (Stauber et al., p. 9).

Perhaps the best known crusader of what is fast emerging as sustainable agriculture today, is the world renowned environmental philosopher, conservationist, ecologist, and educator, Aldo Leopold (1887-1948), who, "as a trained scientist studied the impacts of trends that were shattering the age-old relationships between Earth's inhabitants and their environment" (cited in Udall, 1987, p. 23). According to Flader (1987), Leopold exhibited a passion for the development of sustainable and environmentally humane land ethic and forest conservation practices to guide the judicious use and management of crop land, wildlife and
forest resources. He devoted his life to understanding the functioning of land as a dynamic system, a community of which we all are members (p. 31).

Leopold also shared his philosophy of land stewardship or the responsibility and accountability that man owes towards the land. He attributed man’s abuse of land to many factors including ignorance and sense of irresponsibility. He stated “We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect” (The Leopold Center for Sustainable Agriculture, 1989, p. 4). He argued that agriculture and other human activities should not seriously interfere with the land’s capability to restore itself.

Given these health, safety, and environmental concerns, Fretz (1991) recommended several approaches for combating the problems including the development and delivery of research-based educational programs that address and demonstrate the linkage between the economics of production and environmental issues associated with individual practices as well as the total system of sustainable agriculture (pp. 18-19).

Aldo Leopold (1949) believed in education as an effective tool to build a well-informed society, which is able to make intelligent decisions concerning good management of the environment. He said to his students at the University of Wisconsin:

I am trying to teach you that this alphabet of ‘natural objects’ (soils and rivers, birds and beasts) spells out a story, which he who runs may read if he knows how. Once you learn to read the land, I have no fear of what you will do to it, or with it. And I know many pleasant things it will do to you. (p. 217)

Leopold (1949) also believed in the quality and credibility of the content of instruction on conservation education as evident in one of his most powerful statements quoted on the back cover of the same publication:
We speak glibly of conservation education, but what do we mean by it? If we
mean indoctrination, then let us be reminded that it is just as easy to
indoctrinate with fallacies as with facts. If we mean to teach the capacity for
independent judgement, then I am appalled by the magnitude of the task. The
task is large mainly because of this refusal of adults to learn anything new. (Leopold, p. 211)

Williams (1997) stated that the new vision for the agricultural industry which encompasses
sustainable agriculture, provides futuristic direction for the secondary school agricultural
education curriculum. Also, new areas of science and technology that address contemporary
issues in agriculture can provide vitality to the curriculum and serve new students not
otherwise enrolled in agricultural education classes (p. 10).

Goodall (1994) affirmed that environmental education challenges other cross-
curricular issues and if it (environmental education) was to be effective in raising awareness
on the issues, those issues must be identified. He identified the major issues as global food
security, the growth of human activities, global warming and its energy implications, the
information society, and the population backlash (p. 1). Sutton (1994) proffered that
educational planning in the secondary curriculum must be advised by these curricular issues
to ensure a balanced treatment of environmental problems (p. 13).

The fore-going exposition firmly established the fact that education on sustainable
agriculture plays a crucial role in moving us forward on our journey towards agricultural
sustainability. It is also critical that teachers who teach and play a major role in developing
the agricultural education curriculum in secondary schools perceive the importance of
sustainable agriculture and the effective teaching of the subject in their curriculum.
Statement of the Problem

A relevant agricultural education curriculum in secondary schools is one that reflects and is responsive to the conventional agricultural problems in the society and successfully integrates the teaching and learning of sustainable agriculture as a means of adequately preparing the future farmers of the nation to adopt agricultural practices that fulfill environmental health, safety, and sustainability requirements. The content and quality of the education that students receive on sustainable agriculture depends very much on the perceptions and knowledge of the teachers who hold the responsibility of guiding, teaching, and facilitating the students' learning process. This, in turn, may have an impact on the students' career decisions and practices in college and in later life. Sustainable agriculture is a relatively new field and was developed as an overarching, interconnected framework of technologies, practices and systems in response to the problems currently facing agriculture (Fretz, 1991, p. 15). Although many studies have been conducted in other areas of sustainable agriculture, there is a lack of adequate information specifically on the perceptions of secondary school agriculture teachers regarding sustainable agriculture and the extent to which they teach the subject in their curriculum. Since the perceptions of teachers have an impact on the curriculum content and the extent to which they teach any subject, this situation does not augur well for the formative evaluation and development of a responsive and well-balanced agricultural education curriculum and instructional strategies for secondary schools. Curriculum developers and teachers in secondary schools need good information as a basis for decision making regarding their work.
Purpose and Objectives of the Study

The major purpose of this study was to generate useful research-based information on the perceptions of secondary agriculture teachers regarding the teaching of sustainable agriculture in the twelve states comprising the North Central Region of the United States namely: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. The objectives of this study were:

1. To identify the perceptions of secondary agricultural education teachers regarding sustainable agriculture.

2. To assess the extent to which teachers teach sustainable agriculture in their secondary school agricultural education curriculum.

3. To identify the teachers' perceptions regarding use, credibility, and benefits of information sources on sustainable agriculture and related topics.

4. To determine the relationships, if any, between the selected demographic variables of the teachers and their perceptions regarding sustainable agriculture, the extent to which they teach it; and the use, credibility, and benefits of information sources.

5. To articulate the implications of the findings to secondary school agricultural education curriculum.

6. To develop a model to assist the infusion and integration of sustainable agricultural practices into the curriculum.

Need for the Study

Wallace (1994) stated that a major constraint to the adoption of sustainable agricultural practices was the ignorance of the general public about sustainable issues. He
alleged that an average American consumer has little or no understanding about Integrated Pest Management for example, despite the appreciable role it has played in reducing pesticide risks (p. 6). In the same vein, Barr (1994) implied that despite the fact that agriculture is the basic human enterprise, fewer people have a full appreciation for its reality each decade. The further this country moves from the farm, the less the average consumer understands about any aspect of agriculture (p. 20).

Hamilton (1994) posited that an essential part of the effort to attain sustainability would be to educate consumers about how food is produced. According to him, "Only if the nation's consumers realize they have a stake in the future of farming will it be possible to actively shape agriculture rather than passively watch it change" (p. 11). Weber (1996) believed that appreciation for agriculture is a quality we would have to work to instill in our future leaders as well as promotion of interaction between rural and urban dwellers so that they could work together for a strong and environmentally sound agriculture. He advised that a good place to start is the classroom where there is much opportunity for additional effort in this area (p. 3). Therefore, there is the need to conduct this study to find out the extent to which teachers in secondary schools teach sustainable agriculture in their curriculum. The results of Schiro’s (1992) study implied that the type of ideology and beliefs system espoused by teachers determine what they teach (pp. 250-286). Therefore, we need to study teachers' perceptions regarding sustainable agriculture. Data from a study like this may yield useful information to improve the agricultural education curriculum so that sustainable agriculture teaching would be accorded comparable status with other agricultural subjects in secondary schools.
Implications and Educational Significance

If we are to hasten the pace of the paradigm shift towards agricultural and environmental sustainability, it is necessary that future farmers of America and others be equipped with knowledge on sustainable agriculture and taught the art of making environmentally-safe and wise decisions regarding their future farming practices. The process of education in secondary schools offers a viable opportunity to achieve this goal and also provides a good foundation to build upon for college and eventual farming careers. An understanding of the perceptions of the teachers or facilitators of the learning process regarding sustainable agriculture will help educators in the development of an improved curriculum and teacher preparation programs.

Operational Definitions

The following list of terms and their definitions guided this study:

*Perception*: The professional and personal judgments or views of respondents regarding an event, issue, concept, or condition based on their knowledge and experience or that of others.

*Source*: A person or place from which information may be obtained or gotten.

*Extent*: The degree, amount, or scope of something.

*Use of Source*: The frequency at which a source is accessed, sought, or consulted by farmers.

*Credibility of Source*: The extent to which the source is trusted by farmers.

*Benefit of Source*: The extent to which the source fills a need for farmers.
Agricultural Education: Various forms of instructional and practical learning activities designed to meet a need to learn; can be formal or non-formal, within or outside the classroom environment, short-term or long-term, continuous or non-continuous. Examples: classroom instruction, laboratory practical demonstrations, field experiments or demonstrations, organized tours, special programs or news media etc. etc.

Agricultural Education Teacher: A person who provides planned subject matter and learning activities and facilitates the educational process of students learning about agriculture to develop professional knowledge and skills.

Agricultural Teacher Preparation: A set of standards and processes through which an individual prepares for a teaching career in agriculture.

Teaching Method: Procedures, styles, or ways that a teacher selects to facilitate the teaching/learning process (Weeks, 1988).

Teaching Technique: A teaching method, skill, style, or procedure which a teacher selects to facilitate the teaching/learning process.

Teaching Strategy: A complex educational behavior of a teacher in using methods, techniques, tools, discipline, and communication in order to achieve learning goals and/or objectives.

Teaching/Learning Process: The planning, organizing, and implementing of the delivery and acquisition of knowledge and skills that lead to a desired change in behavior, attitudes, and practices of students.

Effectiveness: The act of producing the desired results of teaching and learning through the use of selected procedures, tools, and techniques.
Secondary Agricultural Education Program: Planned and documented agriculture subject matter teaching and learning activities for teaching seventh to twelfth grade students.

Vocational Agricultural Education: Agricultural education program designed to prepare individuals for gainful employment as semi-skilled or skilled workers or professionals in the agricultural industry (Shinn, 1997)

Sustainable Agriculture: Approaches and practices of agricultural systems that are ecologically sound, environmentally humane, economically viable, and socially responsible. (Ikerd, 1996).

Ecosystems: Conceptual systems within which communities exchange energy, materials, and information with one another and with their physical environment. Roberts (1978).

Curriculum: An organized set of formal educational and/or training plans. It is a blueprint for educational activities such as what learning students are to develop, the means of evaluation, the materials and equipment to be used, and the qualities required of teachers (Pratt, 1980, p. 4). The detailed plan for making desirable changes in pupil behavior (Christine and Christine, 1971, p. 18)

Instruction: The activation of the curriculum plan to cause changes in pupil behavior.

Environment: The whole of the planet Earth consisting of the geosphere, the atmosphere or space region, the hydrosphere, and the biosphere comprising all living organisms including plants, animals, micro-organisms, and human beings occupying the planet.

Environmental Sustainability: The ability of life support systems in the environment to maintain their quality and continued productivity indefinitely.

Agroecosystems: Ecological systems modified by human beings to produce food, fiber, and other agricultural products (Conway, 1987).
Conservation: The improvement and or wise use of resources according to the principles that assure their highest economic or social benefits.

Chemicals: Inorganic elements or substances that are produced off-farm to inhibit or enhance a plant's ability to function in the environment.

Pesticides: Any chemical used to destroy, prevent, or inhibit pests.

Herbicides: Chemicals used to control unwanted plants.
CHAPTER II. REVIEW OF THE LITERATURE

The purpose of this study was to identify the perceptions held by agricultural educators in secondary schools regarding sustainable agriculture, the extent to which they teach sustainable agriculture, and their perceptions about the use, credibility and benefits of information sources on the subject. This review of relevant literature was organized around the following subheadings in order to provide an appropriate theoretical framework for the study: 1) What is Sustainable Agriculture; and 2) Curriculum Change and Development?

What is Sustainable Agriculture?

The National Research Council (1991) stated, "The definition of agricultural sustainability, it is frequently noted, varies by individuals, discipline, profession, and area of concern. The literature offers hundreds of definitions of sustainable agriculture" (p. 13). There is no "consensus" definition for sustainable agriculture. The legislation establishing the Leopold Center for Sustainable Agriculture defined it as "the appropriate use of crop and livestock systems and agricultural inputs supporting those activities which maintain economic and social viability while preserving the high productivity and quality of Iowa's land" (Keeney, 1989, p. 2). As Flora (1991) puts it, "Sustainable agriculture is as much a goal and a process as a definable set of techniques. Definitions abound, controversy is high, and the very term has almost become so all-inclusive as to be meaningless" (p. 5). McIsaac (1996) defined sustainable agriculture as "one that, over the long term, enhances the environmental quality and the resource base on which agriculture depends; provides for basic human food and fiber needs; is economically viable; and enhances the quality of life for
farmers and society as a whole" (p. 5). He observed that while most people agree with these goals, there is still much disagreement about how to achieve them (p. 5).

Ikard (1992) referred to sustainable agriculture as a term used to identify farming systems that attempt to address economic and environmental trade-offs within the context of whole-farm systems (p. 42). According to Ikard (1992), sustainable agriculture represents a balance between conventional and alternative agricultural systems and recognizes the necessity for both environmental soundness and economic viability rather than one at the expense of the other. Also, sustainable agriculture treats environmental protection, resource conservation, efficient food and fiber production, financial viability of farmers, and quality of life in rural communities as multiple objectives in achieving the goal of long-run sustainability (p. 43).

The Northwest Area Foundation (1994) viewed sustainable agriculture as a goal to produce food in ways that can be continued indefinitely, rather than as a rigidly defined set of practices. However, the practices required to farm sustainably vary by climate, soil type, region, locale, as well as over time, as the conditions within which each farm operates changes (p. 2). Contained in the 1987 Iowa Groundwater Protection Act that created the Leopold Center for Sustainable Agriculture is yet another definition of sustainable agriculture:

The appropriate use of crop and livestock systems and agricultural inputs supporting those activities which maintain economic and social viability while preserving the high productivity and quality of Iowa's land. (Ensign, 1988, p. 3)

As rightly observed by the National Research Council (NRC) (1991), virtually all of the hundreds of definitions of sustainable agriculture incorporated the following characteristics:
a) long-term maintenance of natural resources and agricultural productivity
b) minimal adverse environmental impacts
c) adequate economic returns to farmers
d) optimal crop production
e) satisfaction of human needs for food and income, and
f) provision for the social needs of farm families and communities. (p. 2)

In the final analysis, all definitions explicitly promote environmental, economic, and social goals in their efforts to clarify and interpret the meaning of sustainability, and suggest the need to ensure flexibility within agro-ecosystems in order to respond effectively to stress (NRC, 1990). The report concluded that “these characteristics of sustainable agriculture provide a framework and suggest an agenda for the evolution of agriculture and natural resource management to meet the needs of changing societies and environments” (p. 2).

The legacy of Aldo Leopold

During the period marking the tenth anniversary of the establishment of the Aldo Leopold Center for Sustainable Agriculture (1987-1997), it is appropriate to begin this literature review by casting a look back at what can be called the foundation-laying work for sustainable agriculture in the United States. This approach will offer an insight into the originating work and progressive advance of the sustainable agriculture movement. A review of the “Land Ethic” section of the renowned scientist’s work titled “A Sand County Almanac and Sketches Here and There” (Leopold, 1949, pp. 1-226), fulfilled this objective.

In the early stages of his career, Aldo Leopold observed that the hunting and livestock grazing patterns of the Southwest lands produced a progressive and mutual deterioration of the plants, soils and the animal community subsisting on them (Leopold, 1949, p. 206). Also, the massive degradation and devastation of natural habitats and biological cycles caused by the selfish exploitation of the environment by man in the name of agriculture, and for
economic purposes only, did not escape the scrutinizing eyes of the great scientist. Tanner (1987) recorded that on two of Leopold’s hunting trips to the Rio Gavilan in the Sierra Madre of northern Chihuahua in the mid-1930’s, Leopold observed that the area of land which was protected from overgrazing by the Apache Indians, bandits, economic depression, and unstable administration, still retained the virgin stability of its soils and the integrity of its flora and fauna. “It was here,” Leopold reflected years later, “that I first clearly realized that land is an organism, that all my life I had seen only sick land, whereas here was a biota still in perfect aboriginal health” (p.16).

Huffaker (1997) noted that Leopold persisted in his personal intellectual struggle to better understand the land community and his own participation in it (p. 24). His observations and experiences provided sufficient motivation and passion to spend the rest of his life studying the environment and the interconnectedness and interdependent nature of all elements within the boundaries of the Earth. Leopold’s studies gave birth to the development of The Land Ethic, and the concept of the biotic health of the land (Tanner, 1987, pp. 3-25). Leopold concluded "That land is a community is the basic concept of ecology, but that land is to be loved and respected is an extension of ethics" (Huffaker, 1997, p. 24).

Conservation and the land ethic

Leopold (1949, pp. 1-226) articulated his views on what a land ethic should be in one of his major works titled “A Sand County Almanac and Sketches Here and There.” He gave an ecological definition of an ethic which can be regarded as a mode of guidance for meeting ecological situations, as a “limitation on freedom of action in the struggle for existence,” and philosophically as “a differentiation of social from anti-social conduct” (Leopold, 1949, p.
The unique thing implied by both definitions is "symbiosis" or the tendency of interdependent individuals or groups to evolve modes of cooperation. A land ethic, therefore, recognizes that the individual is a member of a community of interdependent parts, with the community boundaries enlarged to include soils, waters, plants, and animals, or collectively, the land (p. 204). "A land ethic changes the role of Homo sapiens from conqueror of the land-community to plain member and citizen of it. It implies respect for its fellow-members, and also respect for the community as such" (p. 204).

Conservation, on the other hand, is seen by Leopold (1949) as a state of harmony between men and land and basing it solely on economic self-interest is hopelessly lopsided because this approach "tends to ignore, and thus eventually to eliminate many elements in the land community that lack commercial value, but that are (as far as we know) essential to its healthy functioning" (p. 207). This logically brings up the issue of the health of the land which Leopold (1949) explained as the "capacity of the land for self-renewal. Conservation is our effort to understand and preserve this capacity" (p. 221).

**The Leopold Center for Sustainable Agriculture**

The Leopold Center for Sustainable Agriculture constitutes yet another resource for education on sustainable agriculture. Keeney (1992) stated that the critical mission with which the Iowa Legislature has entrusted the Center included the examination of problems in the environmental, economic, and social structure of Iowa agriculture, nurturing and encouraging the development of farming systems that will lead to a more sustainable agriculture, and communicating the findings to those who can use this information on a broader scale (p. 4). The education programs conducted by the Center are structured to help
many audiences manage change in their farm fields, research laboratories, and public education activities, utilizing a simple philosophy that says, "the most effective tactic for getting information to those who can use it is to bring those groups together to educate each other" (Leopold Center for Sustainable Agriculture, 1995-1996, p. 4). The goal of the Center's educational programs is to get working information on sustainable agriculture to people who need them and work with groups and agencies that teach sustainable farming (Leopold Center for Sustainable Agriculture, 1990, p. 12).

The Center conducts educational programs based on its research findings. With help from the Iowa Cooperative Extension Service and other agencies and organizations, educational programs reach farmers, extension personnel, conservationists, non-profit groups, agricultural chemical dealers and applicators, community college and students, and agricultural leaders (Leopold Center for Sustainable Agriculture, Annual Report, pp. 4-5). Professionals managing the Center hoped to add audience evaluations of its educational programs and step up work with teachers of sustainable farming.

The Center supports educational programs, conferences, and workshops that offer research-based information to farmers, conservationists, educators, agricultural suppliers, and others who have an interest in conserving the environment. The Center recognizes the importance of sound information and management alternatives to increase farmers' returns while using fewer inputs (Leopold Center for Sustainable Agriculture, 1995-1996, p. 4). The Center also wants to instill the quality of appreciation for agriculture in future leaders because more Iowans now grow up in urban rather than rural surroundings (Weber, 1997, p. 3). "A good place to start is the classroom where there is much opportunity for additional effort in this area. High school agriculture and science teachers are important agents of
change in shaping the attitudes of our future farmers and rural/urban citizens. If teachers are to be effective, they must use innovative educational tools and involve their students in real life hands-on experiences" (Weber, 1997, p. 3). The Center achieves this goal by adapting teaching materials to best fit the science classrooms, develop guides for team and student teaching, introduce the revised materials to a minimum of fifty teachers via the Iowa Communications Network (ICN), and carry out project evaluation and publicize the results on time.

**Current views about sustainable agriculture**

Despite the existence today of a wide diversity of definitions, perceptions, perspectives, and opinions about sustainable agriculture, some views and definitions agreed with and validated Leopold’s (1949, pp. 201-226) views. Francis (1990) saw sustainable agriculture as a philosophy based on human goals and on understanding the long-term impact of man’s activities on the environment and on other species. He stated:

> Use of this philosophy guides our application of prior experience and the latest scientific advances to create integrated, resource conserving, equitable farming systems. These systems reduce environmental degradation, maintain agricultural productivity, promote economic viability in both the short and long term, and maintain stable rural communities and quality of life. (p. 8)

According to the National Research Council (1991), as more individuals and organizations recognize the need for adjustments to conventional agriculture that are environmentally, socially, and economically compatible, sustainable agriculture has come to connote approaches to agriculture. These approaches provide for the needs of current and future generations while conserving natural resources. Within the context of the emerging
recognition on the part of agricultural production and environmental management groups, common, rather than competing goals of sustainable agriculture, are shared (p. 2).

Keeney (1988), the Director of the Leopold Center for Sustainable Agriculture at Iowa State University, argued that the combination of economic and environmental issues has made for a problem that "you couldn't produce your way out of" (p. 2). He foresaw a transition in American agriculture from a system predicated on increasing crop production to one focusing on "the appropriate use of crop and livestock systems and agricultural inputs supporting those activities which maintain economic and social viability while preserving the high productivity and quality of land" (p. 2).

Fretz (1991) stated that sustainable agriculture emerged as an overarching, and interconnected framework of technologies, practices, and systems developed in response to the problems facing agriculture (p. 15). He stated:

The components of this framework are found in the concepts that underlie integrated pest management, low-input sustainable agriculture, rotational grazing, ecological agriculture, waste management, organic farming, and alternative agriculture. By taking and adapting something from these technologies, we are defining sustainable agriculture. The underlying principle of each of these components' parts is that of management by thinking rather than by doing. (p. 17)

Granatstein (1988) laid emphasis on three important concepts that must be included in the discussion of long-term sustainable agriculture. They are: 1) A reduction in the use of and reliance on non-renewable resources such as oil-based products or mined phosphates, 2) The use of low-input or low external input systems on the farm implying a change in the resources needed for farming, and a shift from those resources purchased off the farm to those already on the farm, and 3) The critical nature of the important relationship between the farmer and the land, and the size and scale of the farming operation (p. 2). The author
explained that although in an ideal sense, the off-farm purchases will decrease as farmers move to a sustainable system, actual farm management skills and an understanding of the intricate biological and economic workings of the farm will increase. It was his hope that sustainable agriculture will never be fully defined, for according to him, "that would only limit the possibilities of what it can be. Ultimately, sustainable agriculture is an ongoing process within which farmers work to refine and improve their relationship with the land, leaving both better off from the exchange" (p. 3).

Flora (1990) chose to explore the benefits of sustainable agriculture within the context of rural communities. According to her, the distinguishing characteristics of sustainable communities include diversified farming systems, better links to consumers and to markets, more participation and responsibility in community affairs, and legitimization of sustainable agricultural innovation generated by local farmers. Another major feature of sustainable rural communities is an effective mechanism to make capital available for non-agriculture development instead of the current situation of over-investment in agriculture. Such capital saving measures include diversification by using more complex rotations and adding animal enterprises, reduced pesticide inputs to zero levels or economic thresholds, adaptation of soil and money-saving tillage practices without herbicides, and the use of nitrogen-fixing legumes as cover crops and in rotation to help decrease the need for nitrogen fertilizer (p. 350).

Ikerd (1996) agreed with other authors that the basic goal of sustainable agriculture is agricultural sustainability, arguing that agriculture, by its very nature, is an effort by mankind to shift the ecological balance so as to favor humans relative to other species in production of food and physical protection. Thus, sustaining agriculture means we are sustaining it for the
benefit and wellbeing of the present and future generations of humankind on a “forever” basis (p. 71). Three logical prerequisites for agricultural sustainability were elucidated: (1) ecological soundness, (2) economic viability, and (3) social responsibility, all of which, he argued, are essential, equally critical, inseparable, and mutually inclusive (p. 73).

Furthermore, the author explained that the first element, ecological soundness, is demonstrated in the fact that humanity is interconnected with the other biophysical elements of the natural environment and certain agricultural practices do tip the ecological balance of nature. Attempting to tip this ecological balance too far or too fast may lead to the destruction of the integrity of the natural ecosystem, poisoning of the natural environment, degradation of natural resources, and if necessary steps are not taken to reverse the trend, ultimate destruction of human life on earth may occur (p. 73).

Ikerd (1996) continued that economic viability of sustainable agriculture is important in that the basic nature of human beings demands that they act in their own economic self-interest and pursue activities that will enhance this motive. In many cases, profits need not be maximized, but people cannot persist in activities that are inconsistent with economic survival, regardless of any personal desire to do so. Hence, enterprises that lack economic viability will lose control over the use of ecological resources to economically-viable competitors. He concluded that farmers who cannot survive financially will ultimately lose their farms to the economically-viable “neighbors” (p. 74). The bad news is that sustainability cannot be attained if the only economically-viable “neighbors” are those who degrade the agro-ecosystem in pursuit of short-run profits. Finally, a socially responsible agricultural system is one that equitably meets the basic human food and fiber needs,
provides economic opportunities, supports self-determination, and ensures social equity for both current and future generations of mankind (p. 74).

**Sustainable agriculture education**

Leopold (1949) recognized the importance of education as an indispensable tool to gaining an understanding of the land and the environment as a whole. He contended that the educational policy as well as the content, the quality, and the quantity of the education are equally important if we are to be successful in our conservation efforts (p. 207). He said:

> When one asks why no rules have been written, one is told that the community is not yet ready to support them; education must precede rules. But the education in progress makes no mention of obligations to land over and above those dictated by self-interest. The net result is that we have more education but less soil, fewer healthy woods, and as many floods as in 1937. (pp. 208-209)

At the time period in question which was the first one half of this century, Leopold (1949) also noted that the educational and economic system of the day was headed away from, rather than towards an intense consciousness of the land and the real ecological training was scarce. When he observed that the higher educational system of the day seemed deliberately to avoid ecological concepts, he argued that one of the requisites for an ecological comprehension of the land was an understanding of ecology. This understanding is by no means co-extensive with education and does not necessarily originate in courses bearing ecological labels. To him, such courses might as well be labeled geography, botany, agronomy, history or economics, but as long as ecological concepts are prominently featured, this approach was acceptable. He concluded that as the ethical frontier advances from the individual to the community, the intellectual content of conservation education increases (pp. 223-224).
Similarly, Wallace (1993) implied that a major constraint to the adoption of sustainable agriculture practices was the ignorance of the general public about sustainable issues. He cited the case of Integrated Pest Management (IPM) for example in which he alleged that the average American consumer has little or no understanding about IPM, despite the appreciable role IPM plays in greatly reducing or eliminating the risk of pesticide contamination of food, water, and natural resources. He advised that urban education programs be established for educating the public on the value of sustainable approaches and practices in the urban environment as well as in agricultural systems (p. 6).

Power (1994) argued that regardless of changes and technical advancements, key ingredients in the development and acceptance of sustainable production systems in the future would be education and desire. He went further to explain that the general public needs to become informed regarding the ecological principles involved in sustainable agriculture so that there is wide support for ecologically sound alternatives. He concluded that education is particularly important to sustainable agriculture advocacy groups so that causes they promote have dependable ecological and economical basis (p. 212).

A study conducted by Iowa State University Extension indicated that sustainable agriculture educational needs of agricultural educators and extension personnel in Iowa were important, as perceived by the personnel themselves, and by farmers. The purpose of the study was to acquire useful information for preparing educators and the Extension system to render better services in sustainable agriculture to their clientele (DeWitt, 1997, p. 3). The findings revealed that in most categories, there was general agreement among the two groups concerning the most important topics which extension personnel and educators need to be knowledgeable about. The “hot” topics included alternative field crops and rotations, niche
marketing contacts, odor management and rotational grazing in livestock production, economics and profitability of sustainable agriculture, alternative nitrogen sources and management, manure handling, storage, and management, and residue management systems. Others were holistic and integrated resource management, pesticide use reduction, value-added agriculture, stream-bank and habitat protection, windbreaks, and beginning farmer programs, Leopold Center for Sustainable Agriculture, Practical Farmers of Iowa, on-farm research, and health and safety issues in agriculture. In other words, agricultural educators are expected to be familiar with most available knowledge on sustainable agriculture and know where to obtain answers to those issues they are not familiar with (p. 3).

Pence (1997), concerned with hastening the pace of sustainable agriculture education and research, proposed the “Agriculture Partnership Model” between university research scientists, farmers, extension, and educators. This model is based on certain principles that included a structure of local management teams that bring together different members of the agricultural community as equal participants in project leadership. It also involved a process of farmer outreach that emphasizes equal learning relationships and that values farmer knowledge. In the agricultural partnership model, the author explained, both structure and process encourage a leveling of the playing field or as one almond grower in California described it, the “learning field,” where the university scientist is part of the agricultural conversation but no longer the sole source of legitimate knowledge. Here, the palette of valuable knowledge is expanded to include the farmer and his experience (pp. 10-11).

Pence’s (1997, pp. 10-11) partnership model compares favorably with the Liberated Team Approach for an intelligent organization that was envisioned by Pinchot and Pinchot (1994) who contrasted the intelligent organization to a bureaucratic system that severely
limited the chances of people using their talents in a collective manner. An intelligent organization implements a "whole-systems thinking" approach to address issues and adjust to change without robbing units of local flexibility, using the intelligence of every member to produce results that show. The authors emphasized the establishment within the organization of "voluntary learning networks" that encourage all individual minds interacting to create a continuous and current knowledge that can be rapidly disseminated and applied. Here, members learn from experience how to do new things, rapidly apply what was learned in one place to others, and integrate learning across the organization, using it creatively and flexibly. Furthermore, learning within an intelligent organization springs from the wealth of communications in the team's collaboration within itself, with other teams, with suppliers, and with customers. These knowledge-based collaborations, the authors continued, become the superior system of control when embedded in shared mission and values, and operating at a high level of responsibility and self-management (pp.70-72).

**Agricultural policies**

Wilken (1991) observed that there is a rapidly growing demand for farm and forest products produced by using finite, degradable resources. The demand has two major components of population growth and increased incomes, thus necessitating growth as an additional dimension in the concept of sustainability. This demand growth has overwhelmed the capacity of agroecosystems to adjust, and research organizations to innovate. Therefore, the author concluded, policies aimed at bringing production and conservation into balance, as well as strengthening economic systems, are needed before resource losses reduce future options. He however cautioned that government policies that emphasize production without
compensatory incentives for conservation might actually subvert farmers’ sustainable efforts (p.112).

In the same vein, Powers (1994) suggested that new government policies should be designed to meet the needs and opportunities raised by change-driving factors such as population pressures, availability of energy, capital and land, increased environmental awareness, new technology, and economic concerns (p. 119). One of the benefits of appropriate policies was noted by McIsaac (1994) who recorded that a combination of technological and policy changes like conservation tillage, Conservation Compliance, and the Conservation Reserve Program, has contributed to reduced soil erosion rates in the United States in recent years. The Conservation Reserve Program (CRP) for example, has taken 20 million hectares of highly erodible land out of production for ten years, resulting in soils, wildlife, and water quality conservation (p. 263).

Similarly, Fretz (1991) stated that despite the nation’s remarkable productivity, the conventional agriculture’s heavy dependence on pesticides and synthetic fertilizers which has resulted in health, safety, and environmental hazards. Hence the public’s perception of modern agriculture is deteriorating as a result of a generally held belief that the short-term benefits of conventional mode of farming, are being taken at the expense of long-term consideration. Therefore, the author concluded that the land-grant universities, the United States Department of Agriculture (USDA), and both the state and federal governments, must work toward a national farm policy that makes it possible to focus on long-term agricultural sustainability rather than short-term benefits. So also programs must be developed to help farmers improve their management skills and acquire the information and the knowledge necessary to farm in a sustainable fashion (p. 57).
In her own contribution to the discussion on farm policy and sustainable agriculture, Merrigan (1992) chose to use examples from the United States Department of Agriculture's (USDA's) research, extension, and other programs to show what sustainable agriculture was not. She stated that sustainable agriculture was not herbicide-resistant plants which opponents believe would lead to an increased herbicide use and usher in a new chemical era that could leave the farmers on the pesticide treadmill (p. 49). A call was made for a massive support for the government legislation that would:

- Redirect taxpayer dollars away from research focused on chemical-intensive farming methods to research on sustainable agriculture.
- Use public resources to fund sustainable agriculture research rather than research on herbicide-resistant plants which is duplicative of private industry efforts, and
- Begin the process of establishing priorities for publicly funded agriculture research that put sustainable agriculture, small farms, and rural community first. (p. 51)

Perceptions regarding sustainable agriculture

In a study titled "Perceptions of Iowa Secondary School Agriculture Education Teachers and Students regarding Sustainable Agriculture," Williams and Wise (1997) set out with two major objectives of determining teacher and student self-perceived knowledge of eleven selected sustainable agricultural practices. The second objective was to determine the impact of sustainable agriculture as perceived by teachers and students. The selected practices included Rotational grazing, Narrow-strip inter-cropping, Fall seeded cover crops, Allelopathy or cover crop, and Low input livestock facilities. Others were Row banding herbicides, On-farm research, Integrated pest management, Late spring soil nitrate test, and Agroforestry. The sample for the study consisted of sixty teachers randomly selected from
the six Future Farmers of America (FFA) districts in Iowa and students enrolled in agricultural education classes at the eleventh and twelfth grade levels (pp. 15-20).

The results of the study revealed that teachers and students both felt that they had additional things to learn about the eleven practices, with the least knowledge indicated for "allelopathy" and "agroforestry." The teachers perceived they had most knowledge about rotational grazing, row banding of herbicides, filter-strips, and narrow strip inter-cropping. Regarding the impact of sustainable agriculture on agriculture and the environment, the findings suggested that the teachers perceived agricultural practices of rotational grazing, narrow strip inter-cropping, and Fall-seeded cover crops as being the greatest impact. On the other hand, the greatest impact students perceived from sustainable agriculture were conservation of soil, changes in equipment, protection of groundwater, safer food, protection of wildlife, and protection of woodlands (pp. 15-20).

Gamon and Scofield (1996) conducted a longitudinal study of various groups of young farmers on their perceptions of sustainable agriculture and preferred information sources. The results of the study indicated that although the farmers surveyed were positively inclined towards sustainable agriculture, there were relatively few changes over time and among groups in their perceptions. All of the young farmers and potential farmers were more likely than the older farmers to think sustainable agriculture would benefit society and result in safer food (p. 111). As for the usefulness of information sources on sustainable agriculture, the most highly rated sources were neighbors, family, friends, while other frequently accessed sources were seed/feed dealers, fertilizer/chemical dealers, and farm magazines and publications (p. 109).
Similarly, Sisk and Kotrlik (1996) studied the perceptions of extension agricultural agents in the southern region of the United States regarding sustainable agriculture. The results of the study implied that most sustainable agricultural practices can be successfully used in production systems. However, the respondents did not perceive that insects, weeds, or diseases can be successfully controlled without the use of pesticides (p. 127). The training needs of the agents as indicated by the study analysis included knowledge of sustainable agriculture concepts, trends, and competencies (p. 129).

Weeks (1988) conducted another study regarding the perceptions of selected educators on the quality of instruction in secondary vocational agriculture programs, drawing his sample from a population of vocational agriculture teachers, counselors, superintendents, and principals from 249 secondary schools in Iowa. The three areas that were studied were the agricultural program, the instruction, and the teaching methods used by the teachers. For the agriculture program, the teachers ranked "development of student leadership," "encouragement of student entrepreneurship," and "career planning and placement" 1st, 2nd, and 3rd respectively out of 20 items. "Use of current subject matter" was 10th, "use of an organized instructional plan" ranked 17th, and "use of objectives" ranked 18th. For the 13 instruction items, "selecting appropriate learning content" 8th and "organizing instruction around objectives" ranked 8th and 12th respectively (p. 44).

Curriculum Change and Development

A major purpose of this study was to determine the extent to which teachers teach sustainable agriculture topics in their curriculum. It is pertinent at this juncture to examine relevant literature dealing with the curriculum development process in the school system.
Toombs and Tierney (1993) gave a functional definition of “curriculum” as “an institution’s entire educational program. It is the locus of corporate responsibility for learning that engages faculty, trustees, administration, and students. The curriculum encompasses all the sectors of an institution involved with the process of teaching and learning” (p. 194).

The common concepts that can be used to construct a working definition for curriculum include a plan for learning, an instructional system, major subsystem of an institution, medium of student development, and an analogue to the structure of knowledge (Toombs and Tierney, 1993, p. 179). The curriculum design has three major components. The first component is the “Context” or the social and cultural influences, the environmental factors, and the organizational or institutional climate within which the curriculum is operating. The second component is the “Content” or the epistemology, and the Psychology of Field including the domains of learning. The last component the “Form” or the logistics, the instructional strategies, the expected outcomes, and the evaluation process for leaning (pp. 184-185).

Teachers play a very important role in curriculum development and implementation. As observed by Johnston (1995), the trend toward teacher involvement in curriculum decisions at the school level is not new, and some early examples of site-based management in the United States dated back to the 1920s (p. 137). According to Glatthorn (1994), most of the actual work of curriculum development is normally accomplished by a variety of specially selected teams of which teachers constitute an integral part. The Curriculum Task Force for example is composed of one principal from each level of schooling, one central office supervisor in the area of development, and several teachers who can work together and produce high-quality work (p. 90). Its responsibilities include the identification and
development of subject mastery goals or the end-states desired, the development of the curriculum content or the knowledge base for the subject under consideration, and the teaching materials and instructional strategies for achieving the goals (pp. 11-12).

After the development of the curriculum plan and the translation of the ideas that emerge into a usable format for education, the teachers in the schools then proceed to adapt the curriculum to their unique needs. They make effort to maintain a balance between the goals of the developers on one hand, and their unique educational needs on the other (Shkedi, 1995, p. 165). Teachers also decide the type and extent of curriculum integration and they are responsible for developing the syllabus, the yearly schedule, and the units of study for courses as well as the delivery methods (Glatthorn, 1994, p. 90).

Curriculum development is not a static but a dynamic process. Fraser (1963) contended that a variety of forces such as the continuing revolution in science and technology and the sharpening conflicts concerning values, converge to create a demand for reassessment of the school curriculum (p. 11). It was recommended that in order to keep content up to date, each curriculum area should be under continuous study and evaluation and should be reviewed periodically (p. 225). In the same vein, Leeper (1965) stated, "Change is everywhere. Nothing can remain static. The curriculum must reflect the changes in the world around us" (p. 7). He cautioned that while teacher involvement is a necessary condition for curriculum change, such involvement in itself is not sufficient to guarantee the desired results. With new curriculum projects have come rapid increases in the knowledge teachers must possess if they are to be successful innovators. (p. 7). The following guidelines were then proffered to assist the staff of the local school system in determining
what demands are made upon teachers by a curriculum innovation and what benefits may accrue to teachers who participate:

(1) The demands made upon teachers by the new project must be clear and reasonable.
(2) The competencies required to implement the new projects must be clear.
(3) The level of teacher competence required to utilize new materials or services effectively must be known.
(4) The selection and placement of teachers should be based upon information about individual teachers in relation to the requirements of the new materials.
(5) The amount of teacher freedom to innovate within the project must be ascertained.
(6) The opportunities provided by a new project for professional and personal growth on the part of the teachers must be clear. (p. 11)

The curriculum change process

The exposition of Alexander (1964) on the process of curriculum change in response to changing demands in the school system, still applies to the educational scenario of today. Alexander (1964) elucidated certain systematic steps that must be taken in the process of educational change. It begins with the original identification of a particular need for changing curriculum content, and proceeds through the change proposal, systematic try-out and appraisal, and culminates in the full diffusion of the desirable change in the school system. While any of the steps might be in existence at any time in some curriculum area and some school, a good school system seeks to develop and enhance curriculum change by instituting these steps as constant features of curriculum planning and in-service education (pp. 15-16).

Pratt (1980) proposed a systematic process for curriculum change and development and proposed a model to guide the process. Table 1 represents the main features of Pratt’s (1980, p. 108) model. As can be seen from Table 1, this model exhibits some similarities to
Table 1. Main procedures in organizing for curriculum development. (Pratt, 1980, p.108)

<table>
<thead>
<tr>
<th>Step</th>
<th>Question to ask</th>
<th>If “YES” is the Answer</th>
<th>If “NO” is the Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Is need fully met?</td>
<td>Maintain existing program</td>
<td>Ask the next question</td>
</tr>
<tr>
<td>2</td>
<td>Is need partially met?</td>
<td>Improve existing program</td>
<td>Ask the next question</td>
</tr>
<tr>
<td>3</td>
<td>Are curricula adequate?</td>
<td>Report deficiency</td>
<td>Ask the next question</td>
</tr>
<tr>
<td>4</td>
<td>Is curriculum change best solution?</td>
<td>Outline the parameters, Review constraints, Take inventory of resources. Ask the next question.</td>
<td>Refer need elsewhere</td>
</tr>
<tr>
<td>5</td>
<td>Is curriculum change feasible?</td>
<td>Obtain support, Organize work, Determine state of the art, Recruit developers.</td>
<td>Ask the next question</td>
</tr>
<tr>
<td>6</td>
<td>Is modification possible?</td>
<td>Take actions outlined in step 4</td>
<td>Refer the need elsewhere</td>
</tr>
</tbody>
</table>

Alexander’s (1964, pp. 15-16) systematic process for curriculum change in that it started with need identification and proceeded through obtaining support, organizing work, determining the state of the art, and recruiting developers to implement the plan.

Defining a constraint as a factor external to a system that limits the capability of the system, Pratt (1980) identified the type of constraints that frequently influence the curricular change process as the learners, politics, policy, external examinations, financial and material limitations, staffing, time, and the physical environment (p. 110). He argued that curriculum design is about allocation of resources towards certain ends and is hence essentially a political process (pp. 110-115). The attitude of teachers will determine the extent to which the curriculum is implemented in the school. Pratt (1980) then warned that political constraints must be taken into account when developing curricula and teachers must participate actively in the decision making process on curriculum change.
Policy constraints are important in that state or local educational policy may dictate the curriculum to an extent that leaves little latitude for innovation. For example, many jurisdictions place constraints on curriculum content by legislating the textbooks and other materials that may or may not be used in the classroom (Pratt, 1980, pp. 111-112). External examinations may place a constraint on curricula changes in cases where the students’ future depend on success in an examination since the conscientious teacher has no alternative but to prepare the learners to pass the examinations no matter how irrelevant the actual learning required. Therefore, the validity of examinations is of critical significance in curriculum development (p. 113).

The successful implementation of a curriculum demands that teachers be provided with the resources that the curriculum requires including specialized materials and in-service training to upgrade knowledge. Hence, any financial and material constraint would be critical in this regard (p. 113). The physical environment might pose a constraint to curriculum developers in determining what activities are possible at certain times of the year, while the amount of time available for developing, implementing, and teaching a curriculum might pose a big challenge. Pratt (1980) warned that these factors must be taken into account when developing a new curriculum or making a change in the old (pp. 114-115).

The curriculum content

Fraser (1963) stated that answers to the question “What to teach?” change as the society changes, as new knowledge is discovered, and as the problems and goals of the people change to reflect the beliefs, the values, and sometimes the prejudices of those who answer the questions. The author contended that if curriculum decisions are to be arrived at
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rationally, they must be based on the best evidence available about the society and its needs, the learners and how they learn, and evidence from the fields of knowledge that learners are to study (p. 216). The best evidence of one decade is likely to be outmoded or even obsolete in the next as social change moves at an unprecedented rate and as frontiers of knowledge advance (p. 217). The decisions to include or exclude particular school subjects or external activities should be based on: (a) the priorities assigned to the school and to other agencies, (b) data about learners and the society and developments in the academic disciplines, and lastly, (c) the human and material resources available in the school and community (p. 222).

Jacobs (1989) made similar observations that knowledge is growing at exponential proportions in all areas of study and the curriculum planner must wrestle not only with what should be taught, but also what can be eliminated from the curriculum (p. 3). In a call for an integrated curriculum, a suggestion was made that in order to avoid the problem of instructional units becoming a sampling of knowledge from many disciplines, teachers should be active curriculum designers and determine the degree, the scope and sequence of integration (pp. 9-10).

Schiro (1992) believed that the type of ideology or philosophy and the belief system espoused by educators about curriculum determine the type of knowledge they deem most worthy of teaching in schools. He conducted a study to investigate educators' perceptions regarding the types of changes that occur within their beliefs about curriculum over time. The study specifically examined the changes in curriculum ideologies or philosophy that occurred during the educational careers of 76 educators including 21 teachers who took a course on curriculum theories at Boston College. Four major curriculum ideologies that guided the
study were Social Academic, Social Reconstruction, Child Study, and Scholar Academic
ideologies (p. 276).

The findings of the study indicated that educators frequently change their curriculum
belief systems about once every four years and most of these changes occur because of
related changes in their professional or personal lives. These include changing the grade level
taught or having children who experience difficulties at school. The study results also
showed that although there was no single pattern of movement among ideologies that all
educators followed, there were some specific patterns of ideology change that accompany
specific turning points in educators’ lives. For example, when educators move from teacher
to administrator and their curriculum ideologies move toward the social efficiency ideology.
Also, age and chronological time were not significant indicators of the time the changes take
place (p. 276).

However, a major implication of Schiro’s (1992) study was that it is critical for
administrators to support and respect educators as they rethink their curriculum and
instructional beliefs and try out new curriculum and instructional procedures with learners.
Another implication is that moving educators from one grade level to another and from one
school to another could help them re-evaluate and clarify their curriculum and instructional
beliefs so they could be more efficient as curriculum developers (p. 277).

Educational resources for teaching sustainable agriculture

Williams (1997) stated:

Profitability, safe food, quality of life, conservation of natural resources,
protection of the environment, and global interdependence are valued in the
new vision of the agricultural industry. Agricultural education programs that
mirror this vision are teaching tomorrow’s agriculture today. .... An
agricultural industry with long-term goals for humankind allows agricultural education to focus more on the needs of students in developing curricula and in planning teaching and learning activities. Agricultural education in secondary schools can be a partner in developing the agricultural industry of the 21st century by integrating sustainable agriculture into the curriculum. (p. 10)

Instructional aids and materials

Iowa and Iowa State University, being on the cutting edge of the educational reform of traditional vocational agriculture programs throughout the nation, made available some teaching materials that were developed to support the integration of sustainable agriculture into the curriculum (Williams, 1997). The materials include:

1. Sustainable Agriculture Manager (SAM): This is an educational package that features a computer activity designed to involve students in making farming decisions related to nutrient management, integrated pest management, tillage systems, soil and water management, and wildlife protection.

2. Sustainable agriculture learning activities: These are materials featuring hands-on learning activities for students in the classroom, laboratory, and field. The activities range from earthworm management in the laboratory to building a trap to control horn files on cattle to implementing a pest management program.

3. Agriculture's impact on the living soil: This is a videotape supported instructional unit that features the "earthworm as your guide," and combines basic principles of biology in the study of the relationships between plants, animals, and the soil.

4. Earthworm Empire: The Living Soil: Written by Weber (1996), this resource publication is intended to enrich existing curricular in cross-disciplinary learning in the subject matters of earth science, environmental sciences, agriculture, biology,
language, arts, speech, history, conservation, and natural resources. The book provides hands-on problem solving experiences adapted for upper elementary through high school, FFA, 4H, Scouts, and similar groups. Major topics treated were The Vanishing Resource, Master Soil Builder, Recycling and Rearing, Universe Below, Managing the Empire, and Extensions. The lessons incorporated thought-provoking activities to stimulate creativity and critical thinking skills.

5. Groundwater flow model: This is a plexiglas model representing a "slice of earth" and can be used to demonstrate the movement of groundwater and potential sources of contamination.

Others are:


7. Research and Nutrient Management: This is another instructional package with curricular content for Advertising and sales campaign for nitrogen testing, Testing for nitrogen in crop production, Using Plat Map and soil survey to locate research sites, Swine manure management demonstration, and Nitrogen use requirements of the corn plant. Designed to provide teachers with a complete user-friendly curriculum in which to educate and excite students about research and nutrient management, the
manual contained lessons to reinforce learning and provide hands-on activities for the students.

8. Sustainable agriculture field and laboratory exercises: This is an instructional packet of instructional materials for agricultural education for both secondary schools and community colleges. It addresses the vocational agriculture competencies specified as minimum requirements for students by the Iowa Department of Education. Thirty-two sustainable agricultural topics were treated ranging from decision making in sustainable agriculture, alternative crops, contour lines for sustainability, through earthworm management, energy conservation, narrow-strip inter-cropping, to planting trees and shrubs, surface water quality study, sustainable swine production, and tillage practices.

The National FFA Foundation (1995, 1996) through the assistance of the National Council for Agricultural Education (NCAE) developed and published instructional materials on several sustainable agriculture topics to aid the effective teaching and integration of the subject within the secondary school agricultural education curriculum (p. 10). These instructional materials included the following:

1. *No-till Management*: Designed to be a functional component of an existing curriculum and not intended to be used in isolation, this materials packet contains instructional activities to assist teachers and students to understand and apply the management practices that are basic to no-till agriculture (Wood, 1995, p. iii). It is composed of seven teaching modules addressing seven topical issues on No-till Defined, No-till Fundamentals, Equipment Requirements, Cropping Systems, Use of Fertilizers and Chemicals in No-till Farming, Pest and Disease Control, and
Economics of No-till. The packet came with videotapes on seven topics, an interactive computer software called the "Residue Management Planning Program" to assist students in understanding the effect of tillage and management practices on soil erosion losses, and reference materials for students who want to study further.

2. Maximizing Economic Yield: This instructional package contains strategies that are agronomically sound, economically profitable, and environmentally responsible for achieving maximum economic yields or MEY from farming enterprises (Moss, 1995). Targeted for teaching high school students, the materials are designed for teachers to use as a supplement in their normal course offerings and can be infused into existing areas of study. They were not intended as a new curriculum. Consequently, teachers may select appropriate lessons and include them in several agricultural classes (pp. 1-2).

The materials are organized into five instructional units comprising the fundamentals of maximum economic yields, Maximizing economic yields and environmental conservation, Nutrient management to obtain maximum economic yields, Cultural practices to obtain maximum economic yields, and Maximum economic yields for specific crops. Each unit contains sections on "Objectives" that stated the expected outcomes for the students, "The Teachable Moment," for infusing the materials into existing curricula, and "Teaching Materials" describing the materials and references for teaching the unit. Others are: "Suggested Teaching Strategies" that contains instructions for using the materials, supplemental activities, and "Coming to Terms" that gives a vocabulary listing of unfamiliar terms found in
the unit. All the units provide technical information for both the teacher and the student as well as suggested student activities and experiments.

3. In Applied Environmental Science, Birkenholz and Garton (1996) stated:

The environment and its protection is a major issue facing this country and many other countries in the world. Americans have become more conscious and concerned for the conservation of their environment. The agricultural industry has not been immune to environmental concerns. The industry of agriculture is directly related to the environment through its use of natural resources in the production of our food and fiber.... The environment and concerns over its conservation are major issues facing citizens as we prepare to enter the 21st century. Individuals, organizations, corporations, and government agencies are calling for educational programs to increase the awareness and knowledge of the environment and the conservation of its resources." (p. iii)

In line with this statement, the Applied Environmental Science (AES) instructional materials were developed to assist teachers who seek to enhance the environmental consciousness of their students. They were designed to supplement existing instruction in agricultural education and natural resources, and as independent units of instruction on environmental concerns. They could also be used as hands-on learning activities to enliven the educational experience for students and teachers. The intended student outcomes included the ability to explain the significance of environmental issues and specify recommended practices for the conservation of the environment. Students should also be able to identify the basis for the practices related to the environment and analyze and evaluate environmental issues. In addition, the ability to identify and develop plans to address local environmental issues is also a desired outcome (p. iii).

The AES consists of an introductory unit and seven advanced units that are structured to encourage students to investigate areas of environmental concerns. The seven environmental emphasis areas are: a) Identification and management of ecosystems, b)
Management of waste, c) Chemicals and the environment, d) Soil conservation, e) Land uses, regulations, and ordinances, f) Water quality, and g) Air quality. Each unit is divided into topics that are further split into lessons.

Each topic is organized under (I) Desired student outcome(s), (ii) Study Questions, and (iii) Equipment, supplies, references, and available teaching aids like videos, films, transparency masters, and computer software. Each lesson is in turn treated under two columns with the headings "Directions for the teacher," and "Procedures and/or Content Outline." The former contains study questions, suggestions for motivating and creating interest in the students, and relevant activities and experiments. It ends with evaluation or assessment of the student learning. The latter section contains the content of the lesson and the recommended teaching methodology.

**Summary of Literature Review**

The literature review has shown that the teaching of sustainable agriculture in secondary schools is an effort worth pursuing. The review has also showed that agriculture teachers in secondary schools occupy a strategic place in the development of appropriate curriculum and teaching of sustainable agriculture. It has also provided an understanding of the process of curriculum development for schools and the change process to improve the curriculum, as well as the basic principles to guide the content of the curriculum.

The literature review also shed light on the history and development of the sustainable agriculture movement in the nation and on the need to hasten the pace of sustainable agriculture education in secondary schools in the interests of the present generation of students who would be the future agriculturists of the nation. It has established
that students need to be taught about sustainable agricultural practices now in order to enhance the journey towards agricultural sustainability.

The literature review suggested that it was not clear as to what extent teachers teach sustainable agriculture in secondary schools, what perceptions they hold, and how their perceptions affect the teaching of sustainable agriculture. Also, reliable data are needed on the extent of integration of sustainable agriculture subjects within the agricultural education curriculum and on the extent of incorporation of specific topics about sustainable agricultural practices.

The review also revealed that a vast array of well-designed instructional resources for teaching sustainable agriculture in form of books, publications, computer software, videotapes, films, and activities is available for teachers of agriculture in secondary schools. It was not clear as to what extent the teachers are availing themselves of these resources. The rationale is that if they are using these resources effectively, it will show up in their curriculum. Therefore, this literature review has provided a framework for conducting this study and for asking a variety of research questions.

**Research Questions**

This study attempted to answer the following questions:

1. What are the perceptions of secondary school agriculture teachers regarding sustainable agriculture in the twelve states of the North Central Region of the United States?

2. To what extent do the secondary school agriculture teachers teach selected sustainable agriculture subjects in their curriculum?
3. What are the perceptions of secondary school agriculture teachers about the usefulness, the credibility, and the benefits of selected information sources on sustainable agriculture to farmers?

4. Do some significant differences exist among the teachers' perceptions of sustainable agriculture, the extent to which they teach the subject, and the use, the credibility, and the benefits of information sources when grouped by related demographic factors?

5. What type of "model" can be developed for guiding the successful infusion and incorporation of sustainable agriculture within the secondary school agricultural education curriculum?
CHAPTER III. METHODS AND PROCEDURES

The purpose of this study was to identify the perceptions of secondary school agricultural educators regarding sustainable agriculture, the extent to which they teach the subject, and the use, credibility, and benefits of selected information sources.

The objectives of the study were to: (1) identify the perceptions of secondary agricultural education teachers regarding sustainable agriculture; (2) assess the extent to which teachers teach sustainable agriculture in their secondary school agricultural education curriculum; (3) identify the teachers' perceptions regarding the use, credibility, and benefits of information sources on sustainable agriculture and related topics; (4) determine the relationships, if any, between the selected demographic variables of the teachers and their perceptions regarding sustainable agriculture, the extent to which they teach it, and the use, credibility, and benefits of information sources; and (5) articulate the implications of the findings to secondary school agricultural education curriculum and suggest recommendations.

A model for effectively incorporating sustainable agriculture into the secondary school agricultural education curriculum was developed based on the literature review and the results of the study. The methods and procedures for the study are presented in this chapter under the sub-headings: Research Design, Population and Sampling, Instrumentation, Data Collection, Data Analysis, Limitations of the Study, and Assumptions for the Study.

Research Design

The study utilized a descriptive survey design to assess the perceptions of secondary school agricultural educators regarding sustainable agriculture, the extent to which they teach
the subject, and the use, credibility, and benefits of selected information sources. A self-administered questionnaire was used to collect the data. The questionnaire was mailed to a stratified randomly selected sample of agriculture teachers in twelve states of the North Central Region of the United States. This method allows for the utilization of descriptive statistics as tools for organizing, simplifying, and summarizing basic information from an otherwise unwieldy mass of data (Hopkins et al., 1996, p. 2). A self-administered mailed questionnaire was used to collect data for the study as it allows for minimization of sampling error at relatively low cost, and savings of scarce resources - time and money (Salant and Dillman, 1994, p. 36). The following information was requested from the respondents:

1. Perceptions regarding sustainable agriculture.
2. The extent to which teachers teach sustainable agriculture topics in their programs.
3. How useful, credible, and beneficial to farmers the teachers perceived selected information sources to be.
4. Demographic characteristics:
   a) Gender (Female or Male).
   b) Years of teaching experience (1-10, 11-20, 21-30, 31 or more).
   c) Age in Years (22-30, 31-40, 41-50, 51 and Over).

**Population and Sample**

The population for the study consisted of all secondary school agriculture teachers in the twelve states of the North Central Region of the United States namely Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. The defined population was a total of 2,799 teachers as listed in the
Agricultural Educators' Directory 1996. According to Salant and Dillman (1994, p. 55), a sample of 333 usable questionnaires was considered adequate to make estimates with a sampling error of no more than ± 5 percent at the 95 percent confidence level for a relatively varied population of this size. In order to make allowance for ineligibles, non-respondents, and non-usable questionnaires, the sample size was increased to 600. Table 2 presents the distribution of the respondents and the number of questionnaires returned and analyzed for the twelve states in the North Central Region covered by the study.

Table 2. Distribution of selected teachers of agriculture and the questionnaire return rates in the twelve states of the study.

<table>
<thead>
<tr>
<th>States</th>
<th>No. Sent</th>
<th>No. Returned</th>
<th>No. Analyzed</th>
<th>% Analyzed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illinois</td>
<td>71</td>
<td>52</td>
<td>41</td>
<td>57.7</td>
</tr>
<tr>
<td>Indiana</td>
<td>53</td>
<td>43</td>
<td>29</td>
<td>67.4</td>
</tr>
<tr>
<td>Iowa</td>
<td>49</td>
<td>29</td>
<td>25</td>
<td>51.0</td>
</tr>
<tr>
<td>Kansas</td>
<td>36</td>
<td>20</td>
<td>17</td>
<td>47.2</td>
</tr>
<tr>
<td>Michigan</td>
<td>30</td>
<td>5</td>
<td>5</td>
<td>16.7</td>
</tr>
<tr>
<td>Minnesota</td>
<td>46</td>
<td>30</td>
<td>23</td>
<td>50.0</td>
</tr>
<tr>
<td>Missouri</td>
<td>71</td>
<td>42</td>
<td>33</td>
<td>46.5</td>
</tr>
<tr>
<td>Nebraska</td>
<td>28</td>
<td>18</td>
<td>16</td>
<td>57.1</td>
</tr>
<tr>
<td>N. Dakota</td>
<td>24</td>
<td>17</td>
<td>16</td>
<td>66.7</td>
</tr>
<tr>
<td>Ohio</td>
<td>123</td>
<td>69</td>
<td>58</td>
<td>47.2</td>
</tr>
<tr>
<td>S. Dakota</td>
<td>20</td>
<td>10</td>
<td>9</td>
<td>45.0</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>59</td>
<td>30</td>
<td>26</td>
<td>40.1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>600</td>
<td>357</td>
<td>298</td>
<td>49.7</td>
</tr>
</tbody>
</table>

Instrumentation

The instrumentation for the study was a carefully developed questionnaire to identify and assess the perceptions of secondary school agriculture teachers regarding sustainable agriculture, the extent to which they teach the subject in their curriculum, and the use, the credibility, and the benefits of selected information sources. The instrument (Appendix A)
was composed of four parts: Part A dealt with the perceptions of teachers regarding selected
about agricultural practices, and it had 16 items. Part B addressed the extent to which
teachers teach sustainable agriculture and had 8 items representing selected sustainable
agriculture practices. Part C concentrated on the use, credibility, and benefits of a variety of
information sources on sustainable agriculture, and has 16 items constituting identified
sources of information on sustainable agriculture. Part D was designed to gather
demographic information about the respondents namely gender, years of teaching experience
and age. Part E was to elicit open-ended comments or suggestions about teaching sustainable
agricultural practices.

In line with a recommendation by Simonson (1979), Part A utilized a 5-point Likert-
type scale (1-5) to assess the perceptions of respondents about farmers’ adoption of
sustainable agriculture by indicating their agreement or disagreement with certain statements
regarding sustainable agriculture. Descriptors of the scale were 1= Strongly Disagree (SD),
2= Disagree(D), 3=Neutral(N), 4=Agree(A), and 5=Strongly Agree(SA).

Similarly, another 5-point Likert-type scale (1-5) was used for Part B to indicate the
extent to which respondents taught sustainable agriculture in their programs. This time, the
descriptors were 1=None, 2=Low, 3=Moderate, 4=High, and 5=Very High.

Part C was divided into three columns A, B, and C that were designed to measure
three dimensions of the information sources, namely, use, credibility and benefits based on
the recommendation of the North Central 216 Committee, a project of the United States
Department of Agriculture (USDA) North Central Experiments Stations. In Column A,
respondents were asked to indicate their perception of the extent to which they believed that
farmers used the sources of information on sustainable agriculture. A Likert-type scale (1-5)
was used with the descriptors 1=Not at all, 2=Very little, 3=Sometimes, 4=Often, and 5=Always. Use was defined as the frequency at which the source of information was accessed or sought.

In Column B of Part C, respondents were requested to indicate the extent to which they believed that farmers find the sources of information to be credible. Another 5-point Likert-type scale (1-5) was utilized with the descriptors 1=Not credible, 2=Low credibility, 3=Moderately credible, 4=Highly credible, and 5=Very highly credible. Credibility was defined as the extent to which the information source was trusted.

The last column of Part C, Column C, respondents were asked to indicate the extent to which they believed that farmers found the information from each source to be beneficial. Similarly, a 5-point Likert-type scale was used, with the descriptors 1=Of no benefit, 2=Somewhat beneficial, 3=Beneficial, 4=Highly beneficial, and 5=Very highly beneficial. "Beneficial" was defined as the extent to which the information filled a need for farmers. Part D of the instrument contained three questions asking for gender of the respondents, age, and years of experience. The last section, Part E asked for the respondents' comments or suggestions about teaching sustainable agricultural practices.

**Data Collection**

Data collection was implemented through the use of the instrument developed for the study as described above. A code number was assigned to each questionnaire to keep track of the responses coming in and to identify the teachers who needed to be sent a reminder letter. The instrument was mailed on October 6, 1997, to the teachers with a cover letter stating the purpose of the study and soliciting the respondents' voluntary participation. The Iowa State
University Human Subject Review Committee approved the questionnaire and cover letter (Appendix B). A self-addressed prepaid return envelope was enclosed in each package to facilitate response.

The first mailing yielded a response of 244 questionnaires. A reminder letter (Appendix C) was sent to non-respondents in the second week of November, 1997. An additional response of 113 questionnaires was obtained, bringing the response rate to 59.5 percent. Data collection was closed on January 12, 1998. In all, a total of 357 questionnaires were returned, 298 were usable, giving a usable response rate of 49.7 percent.

The Analysis of Variance test (ANOVA) of the Statistical Package for the Social Sciences (SPSS) was used to determine whether any differences existed among the early and late respondents based on their age and years of teaching experience as recommended by Miller and Smith (1983). No statistically significant differences were found between the two groups. Therefore, the results can be generalized from the respondents to the sample (Miller and Smith, 1983).

Data Analysis

The collected data were organized and prepared for entry into the computer by checking the code numbers and sorting out the non-usable questionnaires, after which data from the usable questionnaires were entered into the computer in the computation facilities of Iowa State University. The Statistical Package for the Social Sciences (SPSS) Program and sub-programs were utilized to analyze the entered data. Cronbach's alpha measure of reliability was used to determine the internal consistency of the instrument.
The statistical procedures employed in analyzing the data included the SPSS frequencies of means and standard deviations for the following variables:

1. The perceptions of teachers regarding sustainable agriculture.
2. The extent to which teachers teach sustainable agriculture topics in their curriculum.
3. The teachers' perceptions regarding the extent of use, the credibility, and the benefits of sources of information on sustainable agriculture.

The SPSS One Way Analysis of Variance was used to test for any significant differences that might exist in the perceptions of teachers on the above variables when the teachers were grouped by:

a. Age.

b. Years of teaching experience.

When significant differences were found, the SPSS post hoc Least Significant Differences and the Scheffe tests were used to determine the relative amount of difference.

**Limitations of the Study**

This study was conducted under the following limitations:

1. The study was limited to the North Central Region of the United States comprising Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.

2. The study was limited to secondary school teachers of agriculture in the twelve States of the North Central Region as listed above.

3. The descriptive research design utilized in conducting the study may not produce all the related functions of the perceptions of secondary school agriculture teachers
regarding sustainable agriculture, the extent to which the subject is taught in the curriculum, and the use, credibility, and benefits of the information sources.

**Assumptions for the Study**

The following assumptions were made:

1. Secondary school agriculture teachers are familiar with the topic - sustainable agriculture.
2. Teachers were interested in incorporating sustainable agriculture into their curriculum.
3. The teachers understood the questions in the questionnaire and answered them correctly according to their perceptions.
4. The collected data represented the genuine perceptions of the secondary school agriculture teachers.
CHAPTER IV. FINDINGS

The purpose of this study was to determine the perceptions of secondary school agriculture teachers regarding sustainable agriculture, the extent to which they teach the subject, and their perceptions about the use, the credibility, and the benefits of selected information sources on sustainable agriculture. A secondary purpose was to identify the implications to agricultural education and to make recommendations for development of a model for incorporating sustainable agricultural practices into the curriculum.

The objectives of this study were to: (1) identify the perceptions of secondary agricultural education teachers regarding sustainable agriculture; (2) assess the extent to which teachers teach sustainable agriculture in their secondary school agricultural education curriculum; (3) identify the teachers' perceptions regarding the use, credibility, and benefits of selected information sources on sustainable agriculture and related topics; (4) determine the relationships, if any, between the selected demographic variables of the teachers and their perceptions regarding sustainable agriculture; and (5) design a model for infusing sustainable agriculture into the curriculum.

In this chapter, the results obtained from the statistical analysis of the collected data are presented. The chapter is organized into seven sections, comprising: (1) Reliability Tests; (2) Demographic Information; (3) Perceptions of respondents regarding selected statements about sustainable agriculture; (4) Extent to which respondents teach sustainable agriculture topics in their curriculum; (5) Perceptions of respondents regarding selected sources of information on sustainable agriculture and related topics; (6) Comments made by
respondents; and (7) Designing of a model for infusing sustainable agriculture into the curriculum.

**Reliability Tests**

Cronbach's alpha method was used to determine the internal consistency of the instrument and the results are presented in Table 3. The alpha coefficient was computed for the 16 items on Perceptions of respondents regarding sustainable agriculture, 8 items on Extent to which respondents teach sustainable agriculture topics, and for the 16 items each on the Use, Credibility, and Benefit of the selected information sources, making a total of 72 items.

The alpha coefficients for the perceptions regarding sustainable agriculture the extent to which teachers teach sustainable agriculture topics in their curriculum were 0.62 and 0.86.

Table 3. Results of reliability tests for the instrument.

<table>
<thead>
<tr>
<th>Sections</th>
<th>Number Of items In section</th>
<th>Cronbach's Alpha coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceptions of respondents regarding sustainable agriculture</td>
<td>16</td>
<td>0.62</td>
</tr>
<tr>
<td>Extent to which teachers teach sustainable agriculture topics</td>
<td>8</td>
<td>0.86</td>
</tr>
<tr>
<td>Use of information sources on sustainable agriculture</td>
<td>16</td>
<td>0.88</td>
</tr>
<tr>
<td>Credibility of information sources on sustainable agriculture</td>
<td>16</td>
<td>0.84</td>
</tr>
<tr>
<td>Benefits of information sources on sustainable agriculture</td>
<td>16</td>
<td>0.89</td>
</tr>
<tr>
<td>Total</td>
<td>72</td>
<td>0.82</td>
</tr>
</tbody>
</table>

Mean coefficient = 0.82
respectively. The coefficient for the usefulness of information sources was 0.88; credibility was 0.84; and the coefficient for the benefits of the information sources was 0.89. The mean alpha coefficient was 0.82 for the four areas and this was considered as satisfactory to proceed with data analysis and interpretation. Nunnally (1982) recommended a minimum of 0.65 alpha coefficient value for research in education.

**Demographic Information of the Respondents**

The demographic characteristics of the secondary school agricultural educators who responded to the questionnaire in the area of study, the twelve states of the North Central Region, are presented in this section. A total of 600 questionnaires were mailed to the teachers and 298 usable questionnaires were obtained. The respondents were asked to respond to three demographic questions namely gender, age in years, and years of teaching experience.

The distribution of respondents by age grouping is shown in Figure 1. Fifty-one (17.9 %) of respondents were aged between 22 and 30 years, 89 (31.2 %) were aged between 31 and 40 years, 100 (35.1 %) between 41 and 50 years, and 45 (15.8 %) were 51 years and over. Ten respondents did not disclose information about their ages. According to the distribution, over 66 % or 189 of the respondents were aged between 31 and 50 years while a little over 15 % or just 45 respondents fell between the smallest age group of 51 years and over.

The maximum age indicated for those who responded to the distribution of respondents by the number of years of teaching is depicted in Figure 2. Eighty-nine or 30.9 % of the respondents stated that they had between 1 and 10 years of teaching experience
Figure 1. Distribution of the respondents by age in years (n=285).

Figure 2. Distribution of respondents by years of teaching experience (n=288).
while 107 or 37.2% and 79 or 27.4% of the respondents had between 11 and 20 and 21 and 30 years of teaching experience respectively. Only 13 or 4.5% of the respondents have been teaching for more than 31 years. The maximum Age indicated by those who responded to the question was 68 years. The maximum years of teaching experience indicated by those who responded was 45 years. Ten of the respondents chose not to disclose their years of teaching experience.

As for gender, 27 of the respondents or 9.2% were females and 264 constituting the majority or 90.7% were males. Figure 3 depicts the distribution of respondents by gender. Four (4) respondents did not state their gender.
Perceptions of Respondents about Sustainable Agriculture

The perceptions of respondents regarding sustainable agriculture are presented in this section. The respondents were asked to indicate their agreement or disagreement with 16 statements concerning some aspects of sustainable agriculture. A five-point Likert-type scale was used to score the items with 1 indicating "strongly disagree," 2 indicating "disagree," 3 indicating "neutral," 4 indicating "agree," and 5 indicating "strongly agree." Table 4 shows the mean scores and the standard deviations for the statements ranked in descending order. Generally, the mean scores indicated that teachers tended to agree with statements 1 to 6, they tended to be neutral about items 7 to 11, and they tended to disagree with items 12 to 16.

The highest mean ratings were obtained for the statements "It is essential that agricultural practices that are used on a farm are economically viable," and "If sustainable agricultural practices were to reduce the profitability of farmland, farmers would not adopt them," with mean scores above 4.0. These items also had the lowest variability with standard deviations of 0.68 and 0.87 respectively. They indicated strong agreement with the statements. The next highest rated items were the statements "Use of sustainable agricultural practices requires that farmers change farm management practices," and "I would support government farm programs that encourage the use of sustainable agricultural practices," with mean scores of 3.73 and 3.71 respectively. Although these scores indicated strong agreement with issues addressed by the statements, the latter statement had a high variability of 1.03. The last three statements, "Advocates of sustainable agricultural practices have an "anti-farmer" attitude," "Most sustainable agricultural practices are not practical for the average farmer," and "The farmer has enough information to make decisions about using sustainable agricultural practices," were rated between 2.50 and 2.36, indicating disagreement. The
Table 4. Means and standard deviations ranked in descending order of the perceptions of selected teachers of agriculture regarding sustainable agriculture.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Perception Statements</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>It is essential that agricultural practices that are used on a farm are economically viable.</td>
<td>292</td>
<td>4.38</td>
<td>0.68</td>
</tr>
<tr>
<td>2</td>
<td>If sustainable agricultural practices were to reduce the profitability of farmland, farmers would not adopt them.</td>
<td>292</td>
<td>4.02</td>
<td>0.87</td>
</tr>
<tr>
<td>3</td>
<td>Use of sustainable agricultural practices requires that farmers change farm management practices.</td>
<td>292</td>
<td>3.73</td>
<td>0.78</td>
</tr>
<tr>
<td>4</td>
<td>I would support government farm programs that encourage the use of sustainable agricultural practices.</td>
<td>291</td>
<td>3.71</td>
<td>1.03</td>
</tr>
<tr>
<td>5</td>
<td>Adoption of sustainable agricultural practices will be easier for farmers who have both crop and livestock enterprises.</td>
<td>292</td>
<td>3.63</td>
<td>0.89</td>
</tr>
<tr>
<td>6</td>
<td>Most farmers will adopt sustainable agricultural practices if these practices do not reduce profits.</td>
<td>291</td>
<td>3.58</td>
<td>0.91</td>
</tr>
<tr>
<td>7</td>
<td>Sustainable agricultural practices would work well on any farm.</td>
<td>291</td>
<td>3.44</td>
<td>0.96</td>
</tr>
<tr>
<td>8</td>
<td>All farmers can adopt sustainable agricultural practices.</td>
<td>291</td>
<td>3.39</td>
<td>0.97</td>
</tr>
<tr>
<td>9</td>
<td>My beliefs about using sustainable agricultural practices are very strong.</td>
<td>292</td>
<td>3.28</td>
<td>0.80</td>
</tr>
<tr>
<td>10</td>
<td>Teaching about sustainable agricultural practices is an important part of my curriculum.</td>
<td>292</td>
<td>3.24</td>
<td>0.92</td>
</tr>
<tr>
<td>11</td>
<td>Sustainable agricultural practices would not work well on some farms.</td>
<td>291</td>
<td>3.11</td>
<td>0.98</td>
</tr>
<tr>
<td>12</td>
<td>Government has no business telling farmers how to use their land.</td>
<td>291</td>
<td>2.95</td>
<td>1.03</td>
</tr>
<tr>
<td>13</td>
<td>The purpose of farmland is to use it to derive maximum financial gain.</td>
<td>290</td>
<td>2.67</td>
<td>1.09</td>
</tr>
<tr>
<td>14</td>
<td>Advocates of sustainable agricultural practices have an &quot;anti-farmer&quot; attitude.</td>
<td>292</td>
<td>2.50</td>
<td>0.87</td>
</tr>
<tr>
<td>15</td>
<td>Most sustainable agricultural practices are not practical for the average farmer.</td>
<td>291</td>
<td>2.45</td>
<td>0.79</td>
</tr>
<tr>
<td>16</td>
<td>The farmer has enough information to make decisions about using sustainable agricultural practices.</td>
<td>291</td>
<td>2.36</td>
<td>0.89</td>
</tr>
</tbody>
</table>

Scale for Perceptions: 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree.
statement "Teaching about sustainable agricultural practices is an important part of my curriculum," ranked 10th with a mean of 3.24 among the sixteen statements. The statement "Government has no business telling farmers how to use their land" has the highest variability in this category with a standard deviation of 1.09.

When grouped by age, the only item out of the 16 perception items where significant statistical difference was detected among the groups was item 12 which stated, "Government has no business telling farmers how to use their land." Table 5 shows the significant statistical differences in the respondents' reaction to this statement. The table shows that significant differences existed between age group 22 - 30 years and age group 51 years and over, and between age group 31 - 40 years and age group 51 years and over. Group 4, the oldest age group rated this item higher than the remaining 3 groups. The youngest age group, 22-30 years gave the lowest rating to this item.

When grouped by respondents' years of teaching experience, again, item 12 was the only item in which significant differences existed in the groups. Table 6 shows the significant differences in the respondents' perception when grouped by years of teaching.

Table 5. Significant means, standard deviations, and F-value regarding the selected teachers' perceptions on item #12, Part A when grouped by age.

<table>
<thead>
<tr>
<th>Item Rank</th>
<th>Age Group (years)</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>F-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>22-30</td>
<td>51</td>
<td>2.69</td>
<td>0.95</td>
<td>5.92***</td>
</tr>
<tr>
<td></td>
<td>51&amp;over</td>
<td>45</td>
<td>3.47</td>
<td>1.03</td>
<td></td>
</tr>
<tr>
<td></td>
<td>41-50</td>
<td>100</td>
<td>3.17</td>
<td>0.97</td>
<td>5.92***</td>
</tr>
<tr>
<td></td>
<td>51&amp;over</td>
<td>45</td>
<td>3.47</td>
<td>1.03</td>
<td></td>
</tr>
</tbody>
</table>

Level of statistical significance: *p< .10  **p< .05  ***p< .01
Table 6. Significant means, standard deviations, and F-value regarding the selected teachers' perceptions on item #12 when grouped by years of teaching experience.

<table>
<thead>
<tr>
<th>Item Rank</th>
<th>Years of Teaching</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>1-10</td>
<td>88</td>
<td>2.69</td>
<td>1.07</td>
<td>6.73***</td>
</tr>
<tr>
<td></td>
<td>31&amp;over</td>
<td>13</td>
<td>3.46</td>
<td>0.88</td>
<td></td>
</tr>
</tbody>
</table>

Level of statistical significance: *p< .10  **p< .05  ***p< .01

These results are similar to those observed in Table 5 in that the group with the greatest number of years of teaching experience tended to agree more with the statement. The group with the least years of teaching experience also agreed but it was not rated as high on the scale. The difference observed in the two tables is in the standard deviations (S.D.) in which Group 1 in Table 5 had the least S.D. while the reverse was the case in Table 6 in which Group 4 had the least S.D.

The Extent to which Respondents Teach Sustainable Agriculture Topics in their Curriculum

The Part B of the questionnaire contained eight farming practices used by some farmers. Each respondent was asked to indicate the extent to which each topic is taught in his or her program. A five-point Likert-type scale was used to score the items with 1 indicating "None," 2 indicating "Low," 3 for "Moderate," 4 for "High," and 5 indicating "Very high." Table 7 shows the means and standard deviations regarding the extent to which the selected sustainable agriculture topics were taught by the teachers in their program.

Table 7 indicates that all 8 topics were taught by most respondents but to varying degrees. Items 5 and 6, "Soil testing" and "Soil erosion control" had the highest ratings above 4 indicating High or Very high. These two items also had the lowest standard deviations of
.78 and .82 respectively. "Crop rotation" had a mean value above 3.5, indicating "Moderate" to "High," The rest of the items had mean ratings above 3, indicating "Moderate," In descending order, these were Insect resistant crops, Integrated Crop Management (IPM), Herbicide resistant crops, Reduced use of chemicals, and Reduced use of fertilizers. The last two items, "Reduced use of chemicals" and "Reduced use of fertilizers" were accorded the lowest ratings of 3.30 and 3.07, respectively.

Table 7. Means and standard deviations ranked in descending order regarding the extent to which teachers teach sustainable agriculture topics in their curriculum.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Sustainable Agriculture Topics</th>
<th>N</th>
<th>Mean</th>
<th>S. D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Soil testing</td>
<td>291</td>
<td>4.32</td>
<td>0.78</td>
</tr>
<tr>
<td>2</td>
<td>Soil erosion control</td>
<td>291</td>
<td>4.31</td>
<td>0.82</td>
</tr>
<tr>
<td>3</td>
<td>Crop rotation</td>
<td>291</td>
<td>3.58</td>
<td>1.00</td>
</tr>
<tr>
<td>4</td>
<td>Insect resistant crops</td>
<td>291</td>
<td>3.41</td>
<td>0.99</td>
</tr>
<tr>
<td>5</td>
<td>Integrated Pest Management</td>
<td>289</td>
<td>3.37</td>
<td>1.02</td>
</tr>
<tr>
<td>6</td>
<td>Herbicide resistant crop</td>
<td>291</td>
<td>3.37</td>
<td>1.03</td>
</tr>
<tr>
<td>7</td>
<td>Reduced use of chemicals</td>
<td>290</td>
<td>3.30</td>
<td>0.89</td>
</tr>
<tr>
<td>8</td>
<td>Reduced use of fertilizers</td>
<td>289</td>
<td>3.07</td>
<td>0.91</td>
</tr>
</tbody>
</table>

Scale for extent taught: 1=None, 2=Low, 3=Moderate, 4=High, 5=Very High.

However, it could be observed that items 2 and 8, "Integrated Pest Management" and "Herbicide resistant crops" had the highest standard deviations of 1.02 and 1.03 respectively.

The data indicate that these topics are being taught.

When the Analysis Of Variance (ANOVA) test was used to determine whether any significant statistical differences existed based upon group response on the extent to which respondents teach sustainable agriculture topics in their programs when grouped by age, no significant differences were detected. However, when the same test was conducted when
respondents were grouped by the number of years of teaching, significant statistical differences were observed between Groups 2 (11-20 years teaching experience). Table 8 shows the means, the standard deviations and the F-value for the extent to which respondents teach "Crop rotation" when grouped by years of teaching experience. Group 3 (21-30 years) rated the item significantly higher at 3.89 than Group 2 (11-20 years) with a rating of 3.43, and Group 3 also has the lower standard deviation of .83 as opposed to Group 2's 1.09.

Table 8. Significant means, standard deviations, and F-value regarding the extent to which selected teachers of agriculture teach "Crop rotation" in their programs when grouped by their years of teaching.

<table>
<thead>
<tr>
<th>Item Rank</th>
<th>Years of Teaching</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>11-20</td>
<td>107</td>
<td>3.43</td>
<td>1.09</td>
<td>4.23**</td>
</tr>
<tr>
<td></td>
<td>21-30</td>
<td>79</td>
<td>3.89</td>
<td>0.83</td>
<td></td>
</tr>
</tbody>
</table>

Level of statistical significance: *p< .10  **p< .05  ***p< .01

Perceptions of Respondents Regarding Sources of Information on Sustainable Agriculture and Related Topics

This part contains 16 items representing different information sources on sustainable agriculture and related topics used by farmers and landowners. For each item and under three columns addressing Use, Credibility, and Benefits, the respondents were requested to indicate their perceptions of the extent to which they believed the information source served the farmers. For the column on "Use", the respondents were asked to indicate the extent to which they believed that farmers used the sources of information, use being defined as the frequency the source is accessed or sought. For the column on "Credibility", the respondents were asked to indicate the extent to which they believed that farmers found the sources of
information to be credible, credibility being defined as the extent to which the information source is trusted by the farmers. In the last column on "Beneficial", the respondents were requested to indicate the extent to which they believed that farmers found the information source to be beneficial, beneficial being defined as the extent to which the information source filled a need for farmers.

Use of Information Sources

The items for this column were scored on a five-point Likert-type scale with 1 indicating "Not at all," 2 indicating "Very little," 3 for "Sometimes", 4 for "Often," and 5 indicating "Always." Table 9 shows means and standard deviations ranked in descending order of the extent to which respondents believed the 16 stated information sources on sustainable agriculture and related topics were accessed or sought by farmers.

The six most popular sources of information used by farmers as perceived by the respondents were magazines, neighbors, friends, family members, local chemical dealers, and local fertilizer dealers in that order. The mean scores for these six items ranged from 3.75 to 3.46 and the standard deviations between .75 and 1.02. Family members had the highest standard deviation of 1.02. The six least useful information sources to farmers and landowners as perceived by the respondents were commodity promotion boards, television and radio programs. Others were: university specialists, machinery dealers, and county meetings with mean scores ranging between 2.62 and 3.21, all with standard deviations below the value of 1 (one) and a range of .85 to .97. Newsletters, tours, local seed dealers, and newspapers came in between the two extremes.
Table 9. Means and standard deviations ranked in descending order regarding the extent to which selected teachers of agriculture believed the information sources on sustainable agriculture and related topics were used by farmers.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Information Sources</th>
<th>N</th>
<th>Mean</th>
<th>S. D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Magazines</td>
<td>282</td>
<td>3.75</td>
<td>0.75</td>
</tr>
<tr>
<td>2</td>
<td>Neighbors</td>
<td>279</td>
<td>3.75</td>
<td>0.93</td>
</tr>
<tr>
<td>3</td>
<td>Friends</td>
<td>281</td>
<td>3.74</td>
<td>0.85</td>
</tr>
<tr>
<td>4</td>
<td>Family members</td>
<td>282</td>
<td>3.61</td>
<td>1.02</td>
</tr>
<tr>
<td>5</td>
<td>Local chemical dealers</td>
<td>281</td>
<td>3.47</td>
<td>0.90</td>
</tr>
<tr>
<td>6</td>
<td>Local fertilizer dealers</td>
<td>282</td>
<td>3.46</td>
<td>0.89</td>
</tr>
<tr>
<td>7</td>
<td>Newsletters</td>
<td>282</td>
<td>3.42</td>
<td>0.82</td>
</tr>
<tr>
<td>8</td>
<td>Tours</td>
<td>281</td>
<td>3.40</td>
<td>0.76</td>
</tr>
<tr>
<td>9</td>
<td>Local seed dealers</td>
<td>281</td>
<td>3.40</td>
<td>0.89</td>
</tr>
<tr>
<td>10</td>
<td>Newspapers</td>
<td>282</td>
<td>3.22</td>
<td>0.93</td>
</tr>
<tr>
<td>11</td>
<td>County meetings</td>
<td>280</td>
<td>3.21</td>
<td>0.96</td>
</tr>
<tr>
<td>12</td>
<td>Machinery dealers</td>
<td>281</td>
<td>3.21</td>
<td>0.88</td>
</tr>
<tr>
<td>13</td>
<td>University specialists</td>
<td>281</td>
<td>3.20</td>
<td>0.94</td>
</tr>
<tr>
<td>14</td>
<td>Radio programs</td>
<td>281</td>
<td>3.04</td>
<td>0.97</td>
</tr>
<tr>
<td>15</td>
<td>Television programs</td>
<td>280</td>
<td>2.91</td>
<td>0.85</td>
</tr>
<tr>
<td>16</td>
<td>C. P. B.</td>
<td>281</td>
<td>2.62</td>
<td>0.90</td>
</tr>
</tbody>
</table>

*Scale: 1=Not at all, 2=Very little, 3=Sometimes, 4=Often, 5=Always
Legend: C. P. B. = Commodity promotion boards.

Table 10 shows the significant statistical differences in the group responses on perceived use of information sources when respondents were grouped by age. Significant differences existed between age group 1 (22-30 years old) and group 2 (31-40 years old) for the item "Newsletters." Group 1, the younger age group rated the item significantly higher than Group 2. For magazines, significant differences were indicated between Groups 1 and 2,
and between Group 1 and the oldest age classification, Group 4 (51 years and over). Again, Group 1 rated this item significantly higher than Groups 2 and 4.

For the item "Commodity promotion boards," which received generally low ratings by the four age groups, the ANOVA test indicated significant differences between Groups 2 and 4. Group 4 rated this item significantly higher than Group 2. The same trend was observed for the item "University Specialists" where again, significant differences were indicated between Groups 2 and 4, and Group 4 rated the item significantly higher than Group 2. Lastly, for the item "Friends," significant differences were indicated between Groups 1 and 2 and Group 1 rated the item significantly higher than Group 2.

When respondents were grouped by years of teaching experience, significant differences were indicated for items 'Commodity promotion boards," Neighbors," and "Friends." Table 11 depicts these group differences. For item "Commodity promotion boards," significant differences were indicated between Groups 2 (11-20 years of teaching) and 4 (31 and more years of teaching), with Group 4 rating the item significantly higher than Group 2 at a mean score of 3.18 over 2.67 for Group 2. Group 4 also had a lower standard deviation of .75 against .91 for Group 2. For the item "neighbors," the same trend was observed as for Item "Commodity promotion boards," where again, significant differences were indicated for Groups 2 and 4. The group with most years of teaching experience, Group 4 rated item "Neighbors" significantly higher with a mean score of 4.00 as against Group 2's mean score of 3.59. This time around, the standard deviation for Group 4 was even much lower than the standard deviation for Group 2 at .45 against .89 for Group 2. For the item "Friends," significant differences were observed between Groups 1 and 2. Group 1 (1-10 years of teaching) rated the item significantly higher than Group 2 with a mean score of 3.91
Table 10. Significant means, standard deviations and F-values for the perceptions of the extent of use of information sources on sustainable agriculture and related topics when selected teachers of agriculture were grouped by age.

<table>
<thead>
<tr>
<th>Item</th>
<th>Age Group (years)</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newsletters</td>
<td>22-30</td>
<td>47</td>
<td>3.57</td>
<td>0.74</td>
<td>2.70**</td>
</tr>
<tr>
<td></td>
<td>31-40</td>
<td>87</td>
<td>3.21</td>
<td>0.89</td>
<td></td>
</tr>
<tr>
<td>Magazines</td>
<td>22-30</td>
<td>47</td>
<td>4.11</td>
<td>0.76</td>
<td>5.06***</td>
</tr>
<tr>
<td></td>
<td>31-40</td>
<td>87</td>
<td>3.61</td>
<td>0.77</td>
<td></td>
</tr>
<tr>
<td></td>
<td>22-30</td>
<td>47</td>
<td>4.11</td>
<td>0.76</td>
<td>5.06***</td>
</tr>
<tr>
<td></td>
<td>51&amp;over</td>
<td>44</td>
<td>3.64</td>
<td>0.78</td>
<td></td>
</tr>
<tr>
<td>C. P. B.</td>
<td>31-40</td>
<td>87</td>
<td>2.49</td>
<td>0.94</td>
<td>2.68**</td>
</tr>
<tr>
<td></td>
<td>51&amp;over</td>
<td>43</td>
<td>2.95</td>
<td>0.95</td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>31-40</td>
<td>87</td>
<td>2.99</td>
<td>0.99</td>
<td>4.37**</td>
</tr>
<tr>
<td>Specialists</td>
<td>51&amp;over</td>
<td>44</td>
<td>3.59</td>
<td>0.92</td>
<td></td>
</tr>
<tr>
<td>Friends</td>
<td>22-30</td>
<td>47</td>
<td>4.09</td>
<td>0.86</td>
<td>4.47***</td>
</tr>
<tr>
<td></td>
<td>31-40</td>
<td>87</td>
<td>3.54</td>
<td>0.89</td>
<td></td>
</tr>
</tbody>
</table>

Scale: 1=Not at all, 2=Very little, 3=Sometimes, 4=Often, 5=Always
Level of statistical significance: *p< .10 **p< .05 ***p< .01
Legend: C. P. B. = Commodity promotion boards.

Table 11. Significant means, standard deviations, and F-values for the perceptions on the extent of use of information sources on sustainable agriculture and related topics when selected teachers of agriculture were grouped by years of teaching experience.

<table>
<thead>
<tr>
<th>Item</th>
<th>Years of Teaching</th>
<th>N</th>
<th>Mean</th>
<th>S.D</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>C. P. B.</td>
<td>11-20</td>
<td>106</td>
<td>2.44</td>
<td>0.87</td>
<td>3.47**</td>
</tr>
<tr>
<td></td>
<td>31&amp;over</td>
<td>11</td>
<td>3.18</td>
<td>0.75</td>
<td></td>
</tr>
<tr>
<td>Neighbors</td>
<td>11-20</td>
<td>105</td>
<td>3.59</td>
<td>1.00</td>
<td>3.00**</td>
</tr>
<tr>
<td></td>
<td>31&amp;over</td>
<td>11</td>
<td>4.00</td>
<td>0.45</td>
<td></td>
</tr>
<tr>
<td>Friends</td>
<td>1-10</td>
<td>84</td>
<td>3.91</td>
<td>0.82</td>
<td>3.12**</td>
</tr>
<tr>
<td></td>
<td>11-20</td>
<td>106</td>
<td>3.55</td>
<td>0.89</td>
<td></td>
</tr>
</tbody>
</table>

Scale: 1=Not at all, 2=Very little, 3=Sometimes, 4=Often, 5=Always
Level of statistical significance: *p< .10 **p< .05 ***p< .01
Legend: C. P. B = Commodity promotion boards.
against 3.55 for Group 2. The standard deviations were .82 and .89 for Group 1 and Group 2, respectively.

**Credibility of the Information Sources**

Again, this section was scored on a five-point Likert-type scale with 1 indicating "Not credible," 2 indicating "Low credibility," 3 for "Moderately credible" 4 for "Highly credible" and 5 for "Very highly credible." Table 12 depicts the means and standard deviations in descending order of the extent to which respondents believed the information sources were credible or trusted by farmers and landowners. As shown in the table, most sources of information were rated moderately credible. The six sources of information that were rated highest on the scale were university specialists, tours, county meetings, family members, magazines, and friends in that order, with means ranging from 3.88 to 3.52, and standard deviations between .72 and .89. University specialists topped the list of credibility with a mean of 3.88. The six sources that were rated lower on the scale were television programs, commodity promotion boards, newspapers, machinery dealers, radio programs, and local seed dealers with means ranging between 2.97 and 3.32, and standard deviations from .75 and .87. At the mid-point of the range of rating were newsletters, neighbors, local fertilizer and local chemical dealers with means ranging from 3.43 and 3.38 and standard deviations between .77 and .82.

When respondents were grouped based on their age, significant differences between groups on perceptions regarding the credibility of the information sources were indicated for tours, magazines, and radio programs. Table 13 depicts these differences. As shown in the
Table 12. Means and standard deviations ranked in descending order regarding the extent to which selected teachers of agriculture believed that farmers find the sources of information on sustainable agriculture and related topics to be credible.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Information Source</th>
<th>N</th>
<th>Mean*</th>
<th>S. D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>University Specialists</td>
<td>279</td>
<td>3.88</td>
<td>0.87</td>
</tr>
<tr>
<td>2</td>
<td>Tours</td>
<td>281</td>
<td>3.81</td>
<td>0.73</td>
</tr>
<tr>
<td>3</td>
<td>County meetings</td>
<td>277</td>
<td>3.66</td>
<td>0.83</td>
</tr>
<tr>
<td>4</td>
<td>Family members</td>
<td>279</td>
<td>3.59</td>
<td>0.89</td>
</tr>
<tr>
<td>5</td>
<td>Magazines</td>
<td>281</td>
<td>3.55</td>
<td>0.72</td>
</tr>
<tr>
<td>6</td>
<td>Friends</td>
<td>279</td>
<td>3.52</td>
<td>0.83</td>
</tr>
<tr>
<td>7</td>
<td>Newsletters</td>
<td>281</td>
<td>3.43</td>
<td>0.77</td>
</tr>
<tr>
<td>8</td>
<td>Neighbors</td>
<td>276</td>
<td>3.41</td>
<td>0.82</td>
</tr>
<tr>
<td>9</td>
<td>Local fertilizer dealers</td>
<td>281</td>
<td>3.39</td>
<td>0.79</td>
</tr>
<tr>
<td>10</td>
<td>Local chemical dealers</td>
<td>281</td>
<td>3.38</td>
<td>0.79</td>
</tr>
<tr>
<td>11</td>
<td>Local seed dealers</td>
<td>279</td>
<td>3.32</td>
<td>0.75</td>
</tr>
<tr>
<td>12</td>
<td>Radio programs</td>
<td>274</td>
<td>3.24</td>
<td>0.82</td>
</tr>
<tr>
<td>13</td>
<td>Machinery dealers</td>
<td>281</td>
<td>3.21</td>
<td>0.77</td>
</tr>
<tr>
<td>14</td>
<td>Newspapers</td>
<td>280</td>
<td>3.09</td>
<td>0.84</td>
</tr>
<tr>
<td>15</td>
<td>Commodity prom. boards</td>
<td>275</td>
<td>3.07</td>
<td>0.87</td>
</tr>
<tr>
<td>16</td>
<td>Television programs</td>
<td>280</td>
<td>2.97</td>
<td>0.84</td>
</tr>
</tbody>
</table>

*Scale: 1= Not credible, 2=Low credibility, 3=Moderately credible, 4= Highly credible, 5= Very highly credible.

Table, significant differences were indicated between Group 1 (22-30 years old) and Group 3 (41-50 years old) with regards to tours. Group 1, the younger age group, rated tours significantly higher at mean score of 4.07 than Group 3, the older age group, with a mean score of 3.67. Both means have standard deviations below the value of 1. For magazines, significant differences were observed between Group 1 and Group 2 (31-40 years old), and between Groups 1 and 3. Group 1, the youngest age categories of the four groups rated the item significantly higher than Group 2, the next youngest age group. Just like tours, Group 1 again rated magazines significantly higher than Group 3. As for item radio programs,
Table 13. Significant differences, standard deviations, and F-values regarding the extent to which selected teachers of agriculture believed that farmers find the sources of information on sustainable agriculture and related topics to be credible when grouped by age in years.

<table>
<thead>
<tr>
<th>Item</th>
<th>Age Group (years)</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tours</td>
<td>22-30</td>
<td>46</td>
<td>4.07</td>
<td>0.71</td>
<td>3.28**</td>
</tr>
<tr>
<td></td>
<td>41-50</td>
<td>99</td>
<td>3.67</td>
<td>0.67</td>
<td></td>
</tr>
<tr>
<td>Magazines</td>
<td>22-30</td>
<td>46</td>
<td>3.85</td>
<td>0.82</td>
<td>3.25**</td>
</tr>
<tr>
<td></td>
<td>31-40</td>
<td>87</td>
<td>3.48</td>
<td>0.71</td>
<td></td>
</tr>
<tr>
<td></td>
<td>22-30</td>
<td>46</td>
<td>3.85</td>
<td>0.82</td>
<td>3.25**</td>
</tr>
<tr>
<td></td>
<td>41-50</td>
<td>99</td>
<td>3.49</td>
<td>0.66</td>
<td></td>
</tr>
<tr>
<td>Radio programs</td>
<td>41-50</td>
<td>98</td>
<td>3.11</td>
<td>0.77</td>
<td>2.71**</td>
</tr>
<tr>
<td></td>
<td>51&amp;over</td>
<td>43</td>
<td>3.44</td>
<td>0.73</td>
<td></td>
</tr>
</tbody>
</table>

Scale: 1= Not credible, 2=Low credibility, 3=Moderately credible, 4=Highly credible, 5=Very highly credible.
Level of statistical significance: *p< .10  **p< .05  ***p< .01

Significant differences were observed between the two oldest age categories, Group 3 (41-50 years old) and Group 4 (51 and more years old). Group 4 rated radio programs significantly higher than Group 3.

When the respondents were grouped according to years of teaching experience, the ANOVA and Scheffe tests revealed no significant statistical differences between the groups.

Benefits of the Information Sources

This section was also scored on a five-point Likert-type scale with 1 indicating "Of no benefit," 2 indicating "Somewhat beneficial," 3 for "Beneficial" 4 for "Highly beneficial," and 5 indicating "Very highly beneficial." Table 14 shows the means and the standard deviations of the respondents' perceptions of the extent to which the information sources...
Table 14. The means and standard deviations ranked in descending order indicating the extent to which selected teachers of agriculture believed that farmers found the information sources on sustainable agriculture and related topics to be beneficial.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Item</th>
<th>N</th>
<th>Mean*</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tours</td>
<td>281</td>
<td>3.85</td>
<td>0.83</td>
</tr>
<tr>
<td>2</td>
<td>University Specialists</td>
<td>279</td>
<td>3.69</td>
<td>0.88</td>
</tr>
<tr>
<td>3</td>
<td>County meetings</td>
<td>278</td>
<td>3.56</td>
<td>0.94</td>
</tr>
<tr>
<td>4</td>
<td>Magazines</td>
<td>280</td>
<td>3.52</td>
<td>0.84</td>
</tr>
<tr>
<td>5</td>
<td>Family members</td>
<td>279</td>
<td>3.47</td>
<td>0.96</td>
</tr>
<tr>
<td>6</td>
<td>Friends</td>
<td>279</td>
<td>3.46</td>
<td>0.90</td>
</tr>
<tr>
<td>7</td>
<td>Neighbors</td>
<td>276</td>
<td>3.44</td>
<td>0.89</td>
</tr>
<tr>
<td>8</td>
<td>Local chemical dealers</td>
<td>281</td>
<td>3.40</td>
<td>0.83</td>
</tr>
<tr>
<td>9</td>
<td>Newsletters</td>
<td>280</td>
<td>3.38</td>
<td>0.82</td>
</tr>
<tr>
<td>10</td>
<td>Local fertilizer dealers</td>
<td>281</td>
<td>3.37</td>
<td>0.82</td>
</tr>
<tr>
<td>11</td>
<td>Local seed dealers</td>
<td>278</td>
<td>3.31</td>
<td>0.79</td>
</tr>
<tr>
<td>12</td>
<td>Machinery dealers</td>
<td>281</td>
<td>3.18</td>
<td>0.83</td>
</tr>
<tr>
<td>13</td>
<td>Radio programs</td>
<td>275</td>
<td>3.10</td>
<td>0.93</td>
</tr>
<tr>
<td>14</td>
<td>Newspapers</td>
<td>280</td>
<td>3.05</td>
<td>0.86</td>
</tr>
<tr>
<td>15</td>
<td>C. P. B.</td>
<td>276</td>
<td>3.01</td>
<td>0.97</td>
</tr>
<tr>
<td>16</td>
<td>Television programs</td>
<td>280</td>
<td>2.92</td>
<td>0.90</td>
</tr>
</tbody>
</table>

*Scale: 1= Of no benefit, 2= Somewhat beneficial, 3= Beneficial, 4= Very beneficial, 5= Very highly beneficial.

Legend: C. P. B. = Commodity promotion boards.

filled the needs of the farmers and landowners. As can be observed from the table, tours, university specialists, county meetings, magazines, family members, and friends were rated as the six most beneficial sources of information by the respondents, while television programs, commodity promotion boards, newspapers, radio programs, machinery and local seed dealers were rated as the six least beneficial sources. Coming in between were neighbors, local chemical dealers, newspapers, and local fertilizer dealers. The standard deviations for the means ranged from .79 to .97.
When respondents were grouped by their age in years to see whether any significant statistical differences existed between the groups on their responses, significant differences were indicated for magazines. Table 15 represents the significant differences observed in the groups.

Table 15. Significant means, standard deviations, and F-value regarding the extent to which selected teachers of agriculture believed that farmers found the information sources on sustainable agriculture and related topics to be beneficial when grouped by their ages in years.

<table>
<thead>
<tr>
<th>Item</th>
<th>Age Group</th>
<th>N</th>
<th>Mean</th>
<th>S. D.</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magazines</td>
<td>22-30</td>
<td>45</td>
<td>3.93</td>
<td>0.84</td>
<td>5.20***</td>
</tr>
<tr>
<td></td>
<td>31-40</td>
<td>88</td>
<td>3.50</td>
<td>0.90</td>
<td></td>
</tr>
<tr>
<td></td>
<td>41-50</td>
<td>99</td>
<td>3.43</td>
<td>0.77</td>
<td></td>
</tr>
<tr>
<td></td>
<td>51&amp;over</td>
<td>43</td>
<td>3.30</td>
<td>0.74</td>
<td></td>
</tr>
</tbody>
</table>

Scale: 1= Of no benefit, 2= Somewhat beneficial, 3= Beneficial, 4= Very beneficial, 5= Very highly beneficial.
Level of statistical significance: *p< .10 **p< .05 ***p< .01

As shown in Table 15, statistically significant differences were indicated between Group 1 (22-30 years old), the youngest age category and the rest of the three age categories. Group 1 rated magazines significantly higher than Groups 2 (31-40 years old), 3 (41-50 years old), and Group 4 (51 and more years old). A definite trend is observed in that the younger the age group, the higher the rating accorded to the item, or the older the age group, the lower the rating indicated. However, when the respondents were grouped by their years of teaching experience in the business, no statistically significant differences were observed between the groups.
Comments Made by Respondents

In the concluding part of the questionnaire, comments or suggestions about sustainable agricultural practices were solicited from the respondents. This section contains the comments from both usable and non-usable questionnaires that were returned. For ease of analysis, the comments are grouped into five categories:

Comments related to sustainable agriculture information needs of teachers.

- Great questionnaire on a very timely topic. Keep up the good work. I would like to have some of the results of the study if possible. We have some farmers practicing sustainable agriculture in NW Ohio and doing it well.
- Sustainable agriculture is an area that the agriculture teacher needs to be better informed about. I think there needs to be a video documentary put together covering sustainable agriculture and related topics to serve as a study guide for use at high school level.
- Sustainability is an area of agriculture that must continue to be taught and adopted. Teachers in high schools need more information.
- I simply need more information. I have only been back teaching one year.
- I would like to receive research-based information that could be incorporated into the classroom.
- I farm also. I believe that there is not enough information out to high school programs. I also believe that some of the responses are not cut and dry.
- Yes, I would like more information on sustainable agriculture to present to my agriculture classes.
- Please send me the results of this survey.

Comments related to economic profitability of sustainable agriculture.
- You need practical ideas that are cost-efficient.
- Education and need while maintaining profitability is a difficult problem. Changing present practices involves changing an aging farmer. It is hard to "teach an old dog new tricks" unless the reward is such that it finds difficult to refuse.
- Sustainable agriculture is important from an economic point of view.
- We are developing more sustainable agricultural practices on our 160-acre school farm. In the 3 of five years of operation, profits and quality of farmland are increasing.
- Sustainable agriculture must be worth the efforts of the farmers and the farmer must believe in the practice.
- Present technologies and uses need to be better advertised. Profitability of sustainable agriculture is the number one issue. Competition from chemicals companies is also an important issue.
- I believe sustainable agriculture needs to be seen as less of a competitor and more of a cooperative beneficial practice!
- Sustainable agriculture takes more planning and more daily chores although it is great for the environment and reduces out-of-pocket costs. It may be good for farmers with fewer acres who do not have a lot of capital or borrowing power.
- I believe sustainable agriculture is already partially in place in most profitable farms. Ability to demonstrate its profitability will sell it to the majority.
- Sustainable agriculture must be profitable.

Comments related to long-term sustainability of sustainable agricultural practices.
- Many farmers/ranchers currently are using sustainable agriculture practices to at least some extent simply because these practices allow them to continue using their land year after year.

- Large corporate agricultural production is a disaster waiting to happen.

- I strongly feel that sustainable agriculture is the key to the success of agriculture. We are merely stewards of the soil. Only practices pertaining to that stewardship will ensure the future of our agriculture and other resources.

- Sustainable agriculture has its pluses and minuses.

Comments related to the adoption of sustainable agriculture by farmers.

- A major roadblock to adopting more sustainable agriculture practices is inability to integrate more sustainable agriculture programs into the present-day land values and equipment costs.

- Many sustainable practices are common sense skills that farmers got away from. There is need to remind them from time to time.

- Farmers have to see to believe or trust the source very much.

- Too many farmers do not change practices until they have to.

- I think sustainable agriculture practices need to become more acceptable to farmers, but knowing farmers, I am not sure how!

- I believe sustainable agriculture should be used whenever feasible and possible. However I feel it has gotten a bad rap from some leading producers.

Negative comments.

- Sustainable agricultural practices are just another way to keep the farmer down!

- I am not convinced that sustainable agriculture is a hot topic.
- I have lost my confidence in no-till corn this last year. You could obviously see the difference in the KFA plot versus field cultivation in no-till soybeans.

- I did not answer Part C (Use, Credibility, and Benefits of Sources of Information on sustainable agriculture and related topics) because I can't speak from a farmer's viewpoint. I have not talked to enough farmers about sustainable agriculture.

- Every few years, we have a new concept or idea. If we keep all the stuff from each, a pattern develops: we keep going in a circle.

**Government intervention in sustainable agriculture and general comments.**

- I am very interested in sustainable agriculture programs. My masters thesis is entitled "The infusion of sustainable agriculture into the Wisconsin High School Agriculture Education Curriculum."

- I do not mind government making decisions for farmers as long as they are using farmers to make the decisions. Al Gore and his private agenda scares me when thinking about the effects of environmental decisions on farmers.

- I feel it is hard to deal with large operations because of dollars. We should have been doing something 25 years ago, but greed took over and I am afraid government intervention may be the norm.

- Missouri needs more on-farm testing.

- The success of the various sources is closely related to the skills of the people doing the presentation, skill as related to communication ability, expertise and teaching.

- I attended one tour in 1992 and various workshops at agriculture teacher's conference.

- We continue to abuse the use of all chemicals used on our soils.

- I teach Shop and Aquaculture, however, sustainable agriculture is very important
- It seems that the efforts are keyed to small, out of the ordinary types of business activities.

- Good luck with the information collection.

An analysis of the comments made by the teachers suggested the following:

1. Most agriculture teachers in high schools have a positive attitude towards sustainable agriculture and are eager to teach the subject when the problems confronting them are addressed.

2. Teachers have strong feelings about the economic profitability of sustainable agriculture.

3. Agriculture teachers in high schools in the study are deficient in the following areas:
   a. Adequate information on sustainable agriculture to teach effectively, especially on the economics of sustainable agricultural production.
   b. Effective methodologies and techniques for teaching sustainable agriculture.
   c. Good teaching aids and materials for sustainable agriculture topics

4. There is a need for training secondary school agriculture teachers to increase their knowledge on sustainable agriculture.

5. There is a need to address the issues regarding adoption of sustainable agricultural practices by farmers and landowners.
CHAPTER V. DISCUSSION

The purpose of this study was to determine the perceptions of secondary school agriculture teachers regarding sustainable agriculture, the extent to which they teach the subject, and their perceptions about the use, the credibility, and the benefits of selected information sources on sustainable agriculture. A secondary purpose was to identify the implications to agriculture education and to make recommendations for improving the sustainable agriculture curriculum.

The objectives of this study were to: (1) identify the perceptions of secondary agricultural education teachers regarding sustainable agriculture; (2) assess the extent to which teachers teach sustainable agriculture in their secondary school agricultural education curriculum; (3) identify the teachers' perceptions regarding the use, credibility, and benefits of selected information sources on sustainable agriculture and related topics; and (4) determine the relationships, if any, between the selected demographic variables of the teachers and their perceptions regarding sustainable agriculture.

This chapter is presented under the sub-headings: (1) Demographic characteristics of the respondents; (2) Perceptions regarding sustainable agriculture; (3) The extent to which respondents taught sustainable agriculture; (4) Perceptions about selected information sources on sustainable agriculture; (5) Comments made by the respondents, and (6) Development of a model to guide the infusion of sustainable agricultural practices into the curriculum.

Overall, the respondents in this study had positive perceptions and basic understanding of sustainable agricultural practices although they indicated that they needed
to increase their knowledge so they could teach the subject effectively. The respondents were also willing to incorporate the teaching of sustainable agricultural practices into their curriculum.

Demographic Information

This study confirmed that the agricultural education profession is dominated by male, although 10% of the respondents were female. Two thirds of the respondents were between 31 and 50 years of age. A similar trend was observed for the years of teaching experience. Nearly two thirds of the respondents had between 11 and 30 years of teaching experience. This information suggested that the secondary agricultural education profession is a fairly stable one. This situation augurs well for the benefit of the profession in that any strategic long-term plan to develop the teaching skills and sustainable agriculture knowledge base of secondary school teachers is likely to take root and be a sustainable part of the program. Hence the chances of such efforts yielding good returns in the interest of full scale integration of sustainable agriculture education into the curriculum are high.

Perceptions Regarding Sustainable Agriculture

The analysis of the results suggested that respondents had positive perceptions about sustainable agricultural practices in general. This finding is in line with the study conducted by Gamon and Scofield (1996, pp. 102-112) with young and potential farmers. The findings of the study indicated that respondents were positively inclined toward sustainable agriculture, especially the older farmers who perceived that sustainable agriculture would benefit society and result in safer food (p. 111).
One other finding of this study was that most respondents gave high ratings to the statement that sustainable agricultural practices would work well on any farm. This agreed with the findings of a similar study conducted by Sisk and Kotrlik (1996, pp. 124-132) on the perceptions of extension agents in the southern region of the United States about sustainable agriculture. The results indicated that most sustainable agricultural practices can be successfully used in production systems (Sisk and Kotrlik, p.127).

However, one expects that if the teacher-respondents in this case held positive perceptions about sustainable agricultural practices to the extent they indicated, the teaching of the subject would show up in their curriculum accordingly. This issue is discussed later on in this chapter in the section on the extent to which respondents teach sustainable agriculture in their programs.

The results of the study suggested that the respondents had strong feelings about the profitability of sustainable agriculture implying that economic profitability is a required condition for the acceptance of sustainable agriculture by farmers. This is in line with one of the basic requirements for agricultural sustainability as stated by Ensign (1988 p. 3), and by the National Research Council (1991, p. 2).

The high degree of variability among the teachers' responses to issues dealing with support for government farm programs that encourage the use of sustainable agricultural practices, government intervention in land use decision making, and derivation of maximum financial gains being the major purpose of farmland may be due to the fact that these issues are controversial in nature and tend to generate strong opposing views and hot debates among people. After all, people possess the rights to espouse any political views or beliefs.
However, most respondents did not feel that advocates of sustainable agricultural practices have an "anti-farmer" attitude. This finding confirmed McIsaac's (1996, p. 5) view that sustainable agriculture must be economically viable and enhance the quality of life for farmers and the society as a whole.

The respondents' disagreement with the issues of non-practicability of most sustainable agricultural practices for the average farmer and availability of enough information to make decisions confirms Nowak's (1992) elucidation of the reasons why farmers do not adopt conservation practices. Nowak (1992, pp. 14-16) stated that one major reason was the lack or scarcity of decision-making information for sound economic and agronomic analysis.

The Extent to Which Respondents Teach Sustainable Agriculture in Their Curriculum

The teachers indicated that they teach all the eight sustainable agriculture topics in their curriculum, many to a high degree. This is in line with their positive perceptions about sustainable agriculture in general. However, the analysis of the results revealed that the only perception statement dealing with teaching of sustainable agriculture ranked 10th among the 16 perception statements. One tends to suspect also that if the teachers taught sustainable agriculture to the extent they implied they did, the only perception statement on teaching and curriculum should have ranked one of the highest on the list. This was not found to be so, suggesting that the teaching of sustainable agricultural practices was not a priority with the teachers.

The respondents indicated that they taught Soil testing, Soil erosion control practices, and Crop rotation the most in their program. This may be because these topics are integral
components of the Soil Sciences which have become integrated within the agricultural education curriculum in secondary schools for a long time.

The topics - Herbicide resistant crops, Reduced use of chemicals, and Reduced use of Fertilizers had low ratings, suggesting lower preferences accorded by teachers to the teaching of these topics in their programs. This information tends to confirm the suspicion that teaching of sustainable agriculture was not a priority with the teachers. The irony is that these three lowest-rated topics are fundamentally critical to the concept of sustainable agriculture and they should enjoy high teaching preferences as the top three topics. According to Fretz (1991, p 15-17), the environmental health and safety problems we are presently facing were caused by the excessive use of chemicals and off-farm fertilizers which he described as high-input and resource-depleting resources. He concluded that this situation was a compelling reason for looking at alternatives to the conventional agriculture systems. It is logical therefore, to suppose that the teaching of reduced use of chemicals and fertilizers should be a priority in the agricultural education curriculum.

Age of the teachers did not have any influence on the extent to which the teachers teach sustainable agriculture in their curriculum as revealed by the ANOVA test. This suggests that age had nothing to do with the extent to which teachers teach sustainable agriculture in their curriculum. However, the years of teaching experience affected the extent to which they teach Crop rotation only, implying that older teachers who had more teaching experience tended to teach Crop Rotation in their curriculum more than teachers with less years of teaching experience.
Use of Information Sources

This study revealed that teachers perceived magazines, neighbors, friends, family members, and local seed, chemical and fertilizer dealers as being the most useful sources of information to farmers. This finding was in line with the findings of Gamon and Scofield (1996, pp. 102-112) in a longitudinal study of various groups of young farmers on their perceptions of sustainable agriculture and preferred information sources. The young farmers rated neighbors, family, farm magazines and publications, seed/feed dealers, and fertilizer/chemical dealers as the most useful sources of information. This trend is encouraging in that farm magazines have been found to carry current information on agricultural issues that farmers might find useful to make decisions. The close proximity of neighbors, family members, and sometimes friends, make them the first people to contact when farmers need information, especially when the need for the information is urgent.

Local chemical and fertilizer dealers topped the list of sources of information sometimes sought by farmers. This trend is expected because this group of individuals are in business to make money. They therefore normally possess aggressive advertising skills and expertise as 'potent tools of trade.' Since their products are made specifically to solve farm problems encountered by the farmers on the path of profit maximization, they tend to "bombard" farmers with a lot of information in a bid to convince them to buy their products. From the perspective of sustainable agricultural practices, this appears to be an irony because sustainable agriculture basically preaches that farmers reduce the use of off-farm chemicals, fertilizers, and other inputs. How then does one expect farmers to seek information on sustainable agricultural practices from businesses that do not believe in the reduction of the buying of their products?
The respondents accorded a low preference to university specialists as a source of information to consult on sustainable agriculture. The reason for this might be that sustainable agriculture is a relatively new field and was developed as an overarching, interconnected framework of technologies, practices and systems in response to the problems currently facing agriculture (Fretz, 1991, p 15) when compared to conventional agriculture which has dominated the land grant universities’ research and education scenario for a long time. Merrigan’s (1992, p. 49) call for a massive support for the government legislation that would redirect taxpayer dollars away from research focused on chemical-intensive farming methods to research on sustainable agriculture, seems to be appropriate here.

It is not surprising that radio and television programs were rated lowest regarding their use by farmers judging from the public perception that radio and television "commercials" were often exaggerated and not based on sound and convincing research.

Credibility and Benefits of the Information Sources

It is not surprising that university specialists topped the credibility list and were rated second to tours on the benefit list, implying that they are among the most trusted and most beneficial sources of information on sustainable agriculture. It can be argued that information from university specialists was highly trusted and credible because such information is normally based on the results of research studies and experiments conducted by the specialists.

The other most highly trusted and beneficial sources of information were tours, county meetings, family members, magazines, and friends. This trend is expected because as for tours, "seeing is believing" and live situations are not likely to lie because the evidence
would be there to see. People tend to remember more and understand better what they saw and complement it with what they heard. During farm tours, farmers could make instant judgement on what they saw and the opportunity to ask questions and clarify issues they might find confusing is normally provided. County meetings usually provide an avenue for farmers and specialists to share useful information based on experience and research respectively. Farmers tend to trust family members and friends because of the close relationships between them.

The number of years of teaching experience had no significant effect on the way the teachers perceived the credibility and benefits of the information sources to farmers. This indicates that age has no influence of practical significance on the respondents' perceptions of the credibility and benefits of information sources.

Comments made by the Respondents

The respondents indicated that they require training on sustainable agriculture in order to develop their knowledge base in the area. This finding agreed with the findings of a similar study conducted by Williams and Wise (1997) on the perceptions of Iowa secondary school agriculture teachers and students about sustainable agriculture. In this study, the teachers indicated that they had additional things to learn about the sustainable agricultural practices under investigation (pp. 15-20).

The negative comments made by some teachers indicated their lack of complete knowledge about the community in which they live and earn their livelihood. Agriculture is a community-based program and the members of the community are expected to be knowledgeable about important issues like sustainable agriculture. This knowledge is
essential to the achievement of common goals through collective action and every individual playing his or her role in the community. The teachers' role is to ensure that the students they teach acquire a balanced agricultural education that includes and integrates sustainable agriculture subject matter.

**Development of a Model to Guide the Infusion and Integration of the Teaching of Sustainable Agriculture into the Curriculum**

The model developed by this researcher (Figure 4) was inspired by the statement of Palmer and Neal (1994) when they said, "Cross-curricular environmental education can become an essential part of the school curriculum without turning the whole establishment upside down. This has been done successfully in schools throughout the United Kingdom and across the world." This statement was made in response to the concern for the majority of teachers who were interested and willing to further environmental education but lacked local guidance and were restricted by other demands on their time including the compulsion to follow the set examination syllabus and the lack of institutional support (p. 67).

Palmer and Neal (1994) argued that the secondary school curriculum should be balanced, not only in the allocation of time and resources to different subjects and cross-curricular themes, but also to the way in which the subjects are taught. They suggested working through the subject base as a starting point, ensuring the dispensation of curriculum material in a way that is sympathetic to environmental education, and then proceeding through the implementation of environmental education as a cross-curricular theme (pp. 69-70).
Figure 4. Model for effective infusion and integration of Sustainable Agriculture into the Secondary School Agricultural Education Curriculum.
This model is based on the need to get teachers/curriculum specialists, the university specialists, and sustainable agriculture organizations to work together to infuse the teaching of sustainable agricultural practices into secondary school agricultural education curriculum. The model starts with the need of the industry within the society to combat the human health and environmental problems caused by the conventional practices of agriculture. These problems are accentuated by "the ignorance of the general public about sustainable issues" (Wallace, 1994, p. 6). According to Weber (1996), appreciation for agriculture is a quality that must be instilled in the future leaders of the nation so that together with both rural and urban dwellers, everybody could work together for a strong and environmentally sound agriculture. He advised that "a good place to start is the nations' classrooms where there is much opportunity for additional effort in this area" (p. 3). Hence the necessity to develop an appropriate curriculum that incorporates sound education on sustainable agricultural practices.

After the identification of the need(s), the teachers as curriculum specialists, proceed to work at shaping the curriculum with input and information support from university specialists and sustainable agriculture organizations. The responsibility of the university specialists is to conduct farm-based research into sustainable agricultural practices that are economically viable, environmentally safe, and socially responsible and effective education delivery methodologies. The goal is to develop a database on proven sustainable agricultural practices and education delivery strategies that curriculum developers may access to guide decision making on curriculum structure, content, and delivery methodologies. This is in line with the finding of this study that the university specialists as a group, was rated as the most credible and one of the most beneficial sources of information on sustainable agriculture.
The responsibility of organizations such as the Leopold Center for Sustainable Agriculture is to support the sustainable agriculture research activities and assist in bringing together the specialists, farmers, educators, agri-businesses and other relevant organizations to share experiences and information. Also, the Practical Farmers of Iowa can make their resources available to conduct research and share their sustainable agriculture knowledge with educators and other farmers. They could also make their farms available for secondary school visits and tours for students to learn more about sustainable agriculture. This is in line with one of the findings of this study that tours were perceived by educators as one of the most credible and beneficial sources of information on sustainable agriculture.

After sustainable agriculture has been infused into the new curriculum by the curriculum developers, it could undergo a pilot test in a few secondary schools for reliability and content validation by teachers of agriculture. If the new curriculum passed the test, arrangements could be made for statewide dissemination in other secondary schools. If there is the need to modify or make adjustments to the curriculum before it could pass the pilot test, this should be done in a timely manner to avoid redundancy.

After the dissemination of the new curriculum, evaluation studies should be conducted on a periodic basis to assess how the needs of the industry are being met. Finally, the arrows in the model indicates that effective two-way and all-time communications among the groups constituting the model, will be the key to the success of fully infusing and integrating sustainable agricultural education into the secondary school agriculture curriculum. This view agrees with the affirmation of Pinchot and Pinchot (1994) that one of the characteristics of an intelligent organization is effective two-way and across the board communications.
CHAPTER VI. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The summary of the study, its major findings, conclusions and recommendations, are presented in this final chapter.

Summary

The present agricultural education curriculum in secondary schools has not given due recognition to the teaching of sustainable agricultural practices when compared to the teaching of other agricultural subjects like Agricultural Mechanics, Plant Science, Animal Science, Agricultural Marketing, Food Processing, and Agribusiness to mention a few. In response to the need to achieve the goals of sustainability and resource preservation in agricultural production, the need to develop an appropriate curriculum that would incorporate the teaching of sustainable agricultural practices becomes obvious. This type of curriculum would ensure that the future farmers of the nation and consumers are knowledgeable in sustainable agricultural practices and environmental preservation issues.

The teachers in the classrooms who are also shouldered with the responsibility of developing and implementing the curriculum, occupy a strategic position in ensuring that secondary school students receive an education that incorporates a balanced mix of traditional agricultural subjects and sustainable agricultural practices. The perceptions of the teachers are important because they influence and affect the composition of the curriculum. This in turn influence what they teach to the students and the extent to which they teach it.
Purpose

The major purpose of this study was to identify the perceptions of secondary school agricultural educators regarding sustainable agriculture, the extent to which they teach sustainable agriculture, and the use, the credibility, and the benefits of selected information sources on sustainable agriculture.

The objectives of the study were to: (1) identify the perceptions of secondary agricultural education teachers regarding sustainable agriculture; (2) assess the extent to which teachers teach sustainable agriculture in their secondary school agricultural education curriculum; and (3) identify the teachers' perceptions regarding the use, credibility, and benefits of selected information sources on sustainable agriculture and related topics. The three remaining objectives were to: (4) determine the relationships, if any, between the selected demographic variables of the teachers and their perceptions regarding sustainable agriculture, the extent to which they teach it, and the use, credibility, and benefits of information sources; (5) articulate the implications of the findings to secondary school agricultural education curriculum, and (6) develop a model for effective infusion of sustainable agricultural practices into the curriculum.

Procedures

A descriptive survey method was employed in conducting the study and a questionnaire was developed to enhance the gathering of data addressing the objectives. The questionnaire was composed of 72 items, 16 on perceptions, 8 on the extent teachers teach sustainable agricultural topics, and 16 each on the use, credibility, and benefits of 16
selected information sources. Five different Likert-type scales were developed to measure the five constructs.

The sample for the study was randomly selected from a population made up of all secondary school agricultural education teachers in twelve states of the North Central Region of the United States as listed in the Agricultural Educators Directory 1996. The population size was 2,799 and the sample size was 600. The states covered by the study were: (1) Illinois, (2) Indiana, (3) Iowa, (4) Kansas, (5) Michigan, (6) Minnesota, (7) Missouri, (8) Nebraska, (9) North Dakota, (10) Ohio, (11) South Dakota, and (12) Wisconsin.

The Statistical Package for the Social Sciences (SPSS) Main frame computer facilities were used to analyze the data collected. The programs used were Frequencies, Means, Standard Deviations, and the Analysis of Variance (ANOVA). The alpha level for all tests was set a priori at .05.

**Findings**

The analysis of the demographic data provided by the respondents indicated that about 91 percent of the respondents were male while only 9 percent were female. No gender-based analysis was conducted because of this disproportionate ratio. The data analysis indicated that about two-thirds of the respondents were between 21 and 50 years of age about the same proportion had teaching experiences ranging from 11 to 30 years.

The analysis of the responses to the perception statements suggested that the teachers were positively inclined to sustainable agriculture and they had a fair understanding of the subject. The statements on economic viability and profitability of sustainable agriculture received the highest ratings. The statement relating to the teaching of sustainable agriculture
in the respondents' programs did not receive a priority rating despite the professed positive perceptions of the respondents.

The analysis of the data on the extent to which respondents taught sustainable agriculture topics in their curriculum showed that all the eight topics listed were taught to varying degrees, but Soil testing, Soil erosion control practices, and Crop rotation were taught mostly by the respondents. Reduced use of chemicals and fertilizers, and Herbicide resistant crops were least taught by the respondents. Overall, neither age nor the years of teaching experience of the respondents had any influence of practical importance on the extent to which respondents taught the topics.

The analysis of the responses of the respondents about the extent to which they perceived the 16 information sources on sustainable agriculture to be useful, credible, and beneficial to the farmers yielded an interesting information. The respondents listed magazines, neighbors, friends, family members, and local chemical and fertilizer dealers as the most useful sources of information to farmers. Commodity promotion boards, television and radio programs, university specialists, machinery dealers, and county meetings were rated as the least useful sources.

Regarding credibility and benefits of the information sources, university specialists, tours, county meetings, family members, magazines and friends, were rated as the most credible and the most beneficial sources of information to farmers. The least credible and the least beneficial sources were television programs, commodity promotion boards, newspapers, machinery dealers, radio programs and local seed dealers. Age and the years of teaching experience of the respondents had no impact on their perceptions in general.
A model to enhance the effective teaching of sustainable agriculture topics in the curriculum was suggested. The highlight of the model was the emphasis on the need for teachers to work together with the industry, the university specialists, and sustainable agriculture organizations to infuse the teaching of sustainable agricultural practices into the secondary school agricultural education curriculum. Regular two-way communication channels among everybody was also emphasized as the key to the success of their endeavors.

Conclusions

The following conclusions were drawn from the study:

1. Respondents held positive perceptions about sustainable agricultural practices.
2. Respondents have a fair understanding of sustainable agriculture but adequate information, training, and appropriate teaching resources were not available to them.
3. Respondents presently teach sustainable agricultural practices to a moderate extent in their curriculum. Soil testing, soil erosion control, and crop rotation were the most popular topics that respondents were teaching. The least likely topics taught by the respondents were herbicide resistant crops, reduced use of chemicals, and reduced use of fertilizers.
4. Teachers perceived that magazines, neighbors, friends, family members, and local chemical and fertilizer dealers are used by farmers as sources of information on sustainable agriculture.
5. Teachers perceived that university specialists, tours, county meetings, family members, magazines and friends were rated credible and beneficial sources of information on sustainable agriculture.
Teachers need more information and training on sustainable agriculture before they can teach it effectively in their curriculum.

Teachers lack effective methodologies and techniques for teaching sustainable agriculture.

Instructional resources are available for teaching sustainable agriculture.

**Recommendations**

Based on the findings and conclusions of the study, and the comments of the teachers, the following recommendations are being made to improve the integration and teaching of sustainable agriculture subject matter into the secondary school agricultural education curriculum:

1. Activating the model for infusion and integration of sustainable agriculture into the secondary school curriculum.

2. The secondary school curriculum should be reviewed periodically by advisory committees to reflect new topic areas as sustainable agriculture.

3. Researchers and specialists in sustainable agriculture should cooperate with curriculum developers to develop instructional materials for teachers.

4. Curricula for teacher preparation programs and in-service training should include sustainable agricultural practices in order to prepare the teachers adequately to teach the subject.

5. Adequate provision should be made for agriculture teachers in secondary schools to undergo periodic training in sustainable agriculture using appropriate teaching methods.
Recommendations for Further Research

1. Studies focusing on teachers who indicated that they teach sustainable agriculture in their programs are needed. Information on what they teach and if they are willing to share their experience with other teachers would be useful in curriculum development and helping other teachers.

2. Studies focusing on evaluation in quantitative terms of the actual percentage of time devoted to the teaching of sustainable agriculture within the secondary schools and the actual content of the curriculum, are also recommended. Data from such studies would be useful to curriculum developers in appropriate time allocation to various agriculture subjects including sustainable agriculture.

3. Further studies could also concentrate on evaluation and detailed documentation on regional basis, sustainable agricultural practices that have stood the test of time and are worthy of being incorporated into the curriculum.

Implications and Educational Significance

This study has shed light on the status of sustainable agriculture education within the larger picture of secondary school agricultural education curriculum. It has generated useful data that curriculum developers can use in the process of developing an effective curriculum for incorporating sustainable agriculture into secondary school agricultural education program. It has also provided recommendations for further studies that could hasten the pace of the integration process as well as a model for guiding such integration in a systematic manner in order to obtain effective results.
Agricultural educators would find the information useful in the area of self-examination of their responsibilities and present practices to determine the extent to which they are fulfilling their obligation of ensuring that students obtain a balanced education while under their supervision. Such critical self-examination could lead to genuine efforts to improve on areas where educators fell short of expectations. It is the duty of agricultural educators to ensure that the leaders of tomorrow who are presently in their care, are equipped with the necessary knowledge and tools they would require to cope successfully with change in their local, national and global societies.

University specialists would also find the information useful in reflecting on their current research agenda to determine if sustainable agricultural practices are receiving comparable attention when compared to other agricultural areas. Such critical reflection could lead to a review of the research agenda to include more efforts in sustainable agricultural practices. In this way, a database of current information in the area could be developed. Agricultural educators and curriculum developers could access this information for decision making on curriculum development and reviews issues.

Finally, these efforts combined with similar efforts in the community could hasten our journey towards sustainability in agriculture and in ensuring a safer, cleaner, and long-lasting environment.
APPENDIX A. SURVEY INSTRUMENT WITH COVER LETTER

SUSTAINABLE AGRICULTURAL PRACTICES

"Sustainable agriculture is the appropriate use of crop and livestock systems and agricultural inputs supporting these activities, which maintain economic and social viability while preserving the high productivity and quality of land."
(Leopold Center for Sustainable Agriculture, 1989).

Part A. Perceptions regarding sustainable agriculture

Instructions: This part of the questionnaire is designed to assess the perceptions of agricultural educators regarding sustainable agriculture. Please indicate your agreement or disagreement with the following statements by circling any number between 1 and 5 in the response category given.

For example, circle "1" if you strongly disagree with the statement.

<table>
<thead>
<tr>
<th>Statement</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;I support using sustainable agricultural practices&quot;</td>
<td>SD</td>
<td>D</td>
<td>N</td>
<td>A</td>
<td>SA</td>
</tr>
</tbody>
</table>

1. Use of sustainable agricultural practices requires that farmers change farm management practices. 

2. Sustainable agricultural practices would work well on any farm. 

3. I would support government farm programs that encourage the use of sustainable agricultural practices. 

4. Adoption of sustainable agricultural practices will be easier for farmers who have both crop and livestock enterprises. 

5. The farmer has enough information to make decisions about using sustainable agricultural practices. 

6. Most farmers will adopt sustainable agricultural practices if these practices do not reduce profits.
7. It is essential that agricultural practices that are used on a farm are economically viable.

8. If sustainable agricultural practices were to reduce the profitability of farmland, farmers would not adopt them.

9. Sustainable agricultural practices would not work well on some farms.

10. All farmers can adopt sustainable agricultural practices.

11. The purpose of farmland is to use it to derive maximum financial gain.

12. Advocates of sustainable agricultural practices have an "anti-farmer" attitude.

13. Government has no business telling farmers how to use their land.

14. Most sustainable agricultural practices are not practical for the average farmer.

15. My beliefs about using sustainable agricultural practices are very strong.

16. Teaching about sustainable agricultural practices is an important part of my curriculum.
B. Extent selected topics are taught in sustainable agriculture.

**Instructions:** The items in this section are farming practices that are used by some farmers. Please indicate the extent to which this topic is taught in your program.

*Use the following scale:*

- Extent taught
  - 1 = None
  - 2 = Low
  - 3 = Moderate
  - 4 = High
  - 5 = Very high

<table>
<thead>
<tr>
<th>PRACTICE</th>
<th>EXTENT TAUGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop rotation</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Integrated Pest Management</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Reduced use of chemicals</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Reduced use of fertilizers</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Soil testing</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Soil erosion control practices</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Insect resistant crops</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Herbicide resistant crops</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>

Part C. Sources of Information

The following items are some sources of information used by farmers/landowners. As an Agricultural Educator, you are being asked to indicate your perception of the extent to which you believe that farmers use these resources.

**Column A:** Use of sources of information on sustainable agriculture and related topics.
In Column A, please indicate the extent to which you believe that farmers use selected sources of information. Use is defined as the frequency the source is accessed or sought.

**Column B:** Credibility of the sources of information on sustainable agriculture and related topics.
In Column B, please indicate the extent to which you believe that farmers find the sources of information to be credible. Credibility is defined as the extent to which the information source is trusted.

**Column C:** Beneficial information on sustainable agriculture and related topics.
In Column C, please indicate the extent to which you believe that farmers find the information from a source to be beneficial. Beneficial is defined as the extent to which the information fills a need for farmers.
Please rate each source using the following scales.

<table>
<thead>
<tr>
<th>COLUMN A: USE</th>
<th>COLUMN B: CREDIBLE</th>
<th>COLUMN C: BENEFICIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 = Not at all</td>
<td>1 = Not credible</td>
<td>1 = Of no benefit</td>
</tr>
<tr>
<td>2 = Very little</td>
<td>2 = Low credibility</td>
<td>2 = Somewhat beneficial</td>
</tr>
<tr>
<td>3 = Sometimes</td>
<td>3 = Moderately credible</td>
<td>3 = Beneficial</td>
</tr>
<tr>
<td>4 = Often</td>
<td>4 = Highly credible</td>
<td>4 = Highly beneficial</td>
</tr>
<tr>
<td>5 = Always</td>
<td>5 = Very highly credible</td>
<td>5 = Very highly beneficial</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCES</th>
<th>COLUMN A: USE</th>
<th>COLUMN B: CREDIBLE</th>
<th>COLUMN C: BENEFICIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tours</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Television programs</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Newsletters</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Magazines</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Newspapers</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Radio programs</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>County meetings</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Commodity promotion boards</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>University specialists</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Neighbors</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Machinery dealers</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Local seed dealers</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Local fertilizer dealers</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Local chemical dealers</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Friends</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Family members</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>

Demographic Information

To describe the people participating in this study, please respond to the following items. Check only one or all that apply to you or fill in the blank where needed.

1. Gender: Female_______ Male_______
2. Age _______ Years
3. Years of teaching _______

5. General Comments:

Do you have any comments or suggestions about sustainable agricultural practices?

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

Thank you for your help. Please place the questionnaire in the enclosed envelope and return it to the addressee.

Code_______
September 1997

Dear Teacher of Agriculture,

The sustainability of agricultural production systems appears to be a topic of great interest today. Many farmers have shared their opinions about sustainable agriculture. However, input is needed from teachers of agricultural subjects regarding various elements of the sustainable agriculture movement.

We need your help! We would like you to complete the enclosed questionnaire. The purpose of this study is to identify attitudes regarding sustainable agriculture, identify knowledge and importance of selected sustainable agricultural practices, and identify sources of information on sustainable agriculture.

The data from this study will be used to complete a regional research project and a Ph.D. program in agricultural education. The information you provide will be kept strictly confidential and results will be reported only in group summary form. All survey forms will be destroyed upon analysis of the data.

Please take 15 minutes to complete the questionnaire and return it in the envelope provided.

If for any reason you do not want to participate in the study, please return the blank survey form.

We sincerely hope that you participate in the study and help provide a better understanding of sustainable agriculture and how it may impact what should be taught.

Sincerely,

Robert A. Martin
Professor

Kehinde A. Agbaje
Project Assistant

enclosure
APPENDIX B. HUMAN SUBJECTS REVIEW COMMITTEE APPROVAL FORM

Last Name of Principal Investigator                AGBAJE

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

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

13. ☐ Consent form (if applicable)

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

15. ☑ Data-gathering instruments

16. Anticipated dates for contact with subjects:
   First Contact                                     Last Contact
   April 28, 1997                                    July 31, 1997
   Month/Day/Year                                     Month/Day/Year

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

    Not applicable                                     Month/Day/Year

18. Signature of Departmental Executive Officer     Date       Department or Administrative Unit
    ___________________________   4/30/97             Agricultural Education & Studies

19. Decision of the University Human Subjects Review Committee:
    ☑ Project Approved          ☐ Project Not Approved       ☐ No Action Required

    Patricia M. Keith           4/30/97
    Name of Committee Chairperson     Signature of Committee Chairperson
November, 1997

Dear Teacher in Agriculture,

Some few weeks ago, we sent you a questionnaire on The Perceptions of Secondary School Agriculture Teachers Regarding Sustainable Agriculture Practices. Up to this date, we have not heard from you. We need your help. Please take a few minutes to help us by filling out and returning the questionnaire in the stamped-addressed envelope that was sent to you. The confidentiality of your participation is fully ensured and only grouped data will be used in our analysis.

However, if you choose not to participate in the study, please return the questionnaire to us. We would highly appreciate your participation in order to make this study a meaningful one.

In case you have sent back your questionnaire but it is still in transit, please disregard this letter. Thank you very much for your anticipated cooperation.

Sincerely,

Dr. Robert A. Martin
Professor

Kehinde A. Agbaje
Graduate Student
BIBLIOGRAPHY


Keeney, D. (1989). From the Director. IN Leopold Center for Sustainable Agriculture (Ed.). *The First Year.* Iowa State University, Ames, IA.


Leopold Center for Sustainable Agriculture (1989). *The First Year.* Iowa State University, Ames.


ACKNOWLEDGEMENTS

I am immensely grateful to my Major Professor, Dr. Robert A. Martin for his superb guidance and supervision of this work. Without his professional expertise, articulate judgment and painstaking supervision, motivation and words of encouragement at all times, this work would have been impossible. I am very grateful to him from the bottom of my heart. Dr. Gaylan Scofield assisted me in the analysis of my data, while Dr. David Williams provided additional guidance in my literature review and Mr. Eldon Weber provided some of the materials I needed. I am very grateful to them. I also extend my warmest thanks to the other members of my committee, Dr. Joe Burris, Dr. Wade Miller, and Dr. Julia Gamon for their words of encouragement and help at all times.

Dr. Larry Trede's and Dr. Allan Kahler's support and encouragement contributed to my success. They deserve my thanks. I am very grateful to Dr. Sally Williams who replaced the late Dr. Mike Warren on my committee. Dr. Cornelia Flora, the Director of the North Central Regional Center for Rural Development (NCRCRD) proved to be a very kind and completely de-racialized friend. I am very grateful for the opportunity she gave to me to work with her and her versatile team. I owe her many thanks and gratitude from the bottom of my heart. I am grateful to Dr. Rich Pirog, Dr. Jerry DeWitt, and the rest of the folks at Leopold Center for Sustainable Agriculture for their help regarding my literature review.

The teachers in the twelve states of the North Central Region who took the time to respond to the questionnaire despite their busy fall schedule deserve my thanks and appreciation. Without their support, this study would not have been possible. I also appreciate their useful comments and suggestions.
I also want to thank my fellow graduate students at the Dept. of Agricultural Education & Studies for their help and kindness and for providing fun activities to relax our tired bodies and brains! Cheryl Abrams, Linda Drennan, and Gina, our able secretaries in the department deserve special thanks as well for providing much needed administrative support, love, and encouragement to all of us.

Single parenting of three actively-growing kids, two of them in their teens, a part-time job that brings in an income that falls far short of paying the essential bills - graduate tuition fees, house rent, utilities, food, car insurance (liability only), kids' medical bills, out-of-pocket expenses etc., and a state of physical loneliness the intensity of which is known only to those who have ever experienced it, do not constitute a "sane" scenario for undertaking doctoral studies of any kind and in any particular field for that matter. These were the odds I had to constantly battle with on a daily basis in the course of the long years of my graduate studies!

To God be the glory because despite these "impossible challenges," I was able to complete this graduate work successfully and obtain my doctoral degree without throwing in the towel! (I even made good grades in my course work and was honored in 1994 by the Gamma Sigma Delta Society for consistently high GPA!) Don't ask me how I did it because I don't have an answer. All I knew was that the wonderful God woke me up every morning, equipped me with the strength and motivation I needed to tackle the "impossibles," and sent me forth to do the best I possibly could. At night, many times in the early hours of the new day, this same God brought me back home to lay my weary head down and get some sleep, only to wake me up the following morning to continue where I left off the previous day.
He did send "a few good people" my way with some badly needed help, and at such times, such people shared my burden and made it lighter and easier to bear. But many a times, I tended to "crumble" under the excruciatingly painful weight of the burdens, and made a decision within myself to "throw in the towel." At such times, I would fall flat on my back, weep bitter tears, and tell God, "Sorry Father, I quit! I can't go on any more!" And believe me, I really did quit in my heart of hearts and I meant it and God knew I meant it too! After wetting my pillow with agonizing and bitter tears, I would find myself drifting into sleep, only to wake up the following morning with songs in my heart and in my mouth singing praises to God! I would almost forget that last night ever happened! Sometimes, the "state of impasse" persisted for several days, and I would find myself just going through the motions but managing to keep a happy and responsible front with my children in order not to hamper their spiritual development in the Lord in any way. But in the end, God always brought a relief and put me back on track. Glory is to His holy Name.

I remain indebted to God forever for my salvation in Christ Jesus and for this accomplishment which only He has made possible in His miraculous way. To Him be the glory for evermore! (Amen). Next, I am deeply grateful to those faithful servants of the Lord at the Campus Baptist Church, who selflessly nurtured and encouraged my spiritual growth and that of my children. Pastor Charles and Mrs. Ruth Alber, Pastor George and Mrs. Dottie Hatfield, Pastor Bob and Mrs. Virginia Cowley, Pastor Bruce and Mrs. J. R. Thompson (now in Oskaloosa), and Pastor Kevin and Mrs. Carla Mungons. Without the factual bible studies, Sunday sermons, love, and constant prayer support of these wonderful men and women of God, I would have fallen by the wayside and my dream of obtaining this doctoral degree would have remained a dream!
I need to mention however, that the special ministry of Pastor Kevin Mungons and Pastor Bruce Thompson before him, contributed greatly to my success because I could not even begin to imagine how to cope with my heavy responsibilities during the course of my studies if my teen boys had gone the way of the world and its ugly statistics for lack of spiritual guidance and discipline. Pastor Bruce Thompson and Pastor Kevin Mungons ensured that this did not happen through their indefatigable efforts in spiritual discipleship ministry to my boys and the rest of the teens in our church. In addition, only the Captain of our Salvation can adequately reward the immense contribution and selfless efforts of Keith and Tamra Nemec, the people who drive and operate the church buses and vans on Wednesdays and other special days, and the other AWANA/Youth Leaders in spiritually shaping the lives of our youths. The collective efforts of these wonderful men and women of God gave me the much needed peace of mind to concentrate without undue distractions and worry about the kids. I do not have the words to express my special thanks to these wonderful men of God! I can assure them though, that Jesus has prepared special rewards for them here and in eternity.

I am also very grateful to all those who offered their support in many forms, especially in opening their hearts and their homes to my children at the times I had to travel out of Ames for professional meetings in Denver, Colorado, Washington DC, Little Rock, Arkansas, Lincoln, Nebraska, Madison, Wisconsin etc. In this regard, I am extremely grateful to Pastor and Mrs. Hatfield, Rick and Wendy Reger, Grandma Virginia Kunkel, Rick and Dee Powers (now in Minnesota), Grandma and Grandpa Philips, Professor Sunday and Hazel Tim, Sheila Rowe (my very good friend), Carrie Hasselman, etc. I am also grateful to Grandma and Grandpa Dunker for babysitting my little girl every Thursday morning before
her school started in the fall semester of 1997 when I had to be on campus early. I also thank all those who showed me special love during my recuperation from an auto tire accident in February of 1994. My special thanks go to Dr. Sally Logsdon, a special friend and sister in the Lord, for the support in various forms she gave to me over the years.

Lastly, my special thanks go to Mrs. Mary Warren and her late husband for the special love and support they extended to my kids and me. We are very proud to be special members of their extended Nigerian/American family. May Dr. Mike Warren's kind and humble soul rest in perfect peace (Amen).