# IMPACT OF SUSTAINABLE AGRICULTURE ON SECONDARY SCHOOL AGRICULTURAL EDUCATION TEACHERS AND PROGRAMS IN THE NORTH CENTRAL REGION

***Kehinde Aderemi Ajaiyeoba Agbaje, Graduate Assistant***
***Robert A. Martin, Professor and Head***
***David L. Williams, Professor***
Iowa State University

**Abstract**

*Concerns about the negative impact conventional agriculture is having on the environment have propelled the call for farming practices that are not only economically sound but also environmentally protective and socially acceptable. A cadre of agricultural researchers, educators, and farmers believe that the agricultural systems advocated by sustainable agriculture have great potential for addressing these concerns. The purpose of this study was to determine the impact of sustainable agriculture on secondary school agricultural education teachers and programs in the North Central Region. Likert-type scales were used to measure teacher perceptions of sustainable agriculture and the extent to which sustainable agriculture was taught in the curriculum. The findings revealed that sustainable agriculture has had a limited impact on secondary school agricultural education teachers and programs. Responding teachers were neutral in their perceptions of sustainable agriculture. Sustainable agriculture was taught to a moderate degree in programs of the respondents. There was a lack of evidence that sustainable agriculture was being taught from a systems perspective. However, agronomic topics basic to the understanding of sustainable agriculture were included in the curriculum, providing a foundation for curriculum innovation related to sustainable agriculture.*

## Introduction/Theoretical Framework

Advances in technology have led to systems of food and fiber production that have made U. S. agriculture the most productive in the world. These systems, commonly referred to as conventional agriculture, emphasize high yields achieved with large machines and high use of off-farm inputs including chemical fertilizers and pesticides. These practices have given rise to environmental and social concerns (Francis & Youngberg, 1990). The public perceives that conventional agriculture is focusing on short-term economic benefits at the expense of long-term social and environmental considerations (Fretz, 1991).

Sustainable agriculture has emerged as a system that recognizes the necessity for both environmental soundness and economic viability (Ikerd, 1992). 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). To some, sustainable agriculture is more of a goal, although others see it as practices; however, most do agree that future agricultural systems should be economically sound, environmentally protective, and socially acceptable (Northwest Area Foundation, 1994).

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. He stated that components of sustainable agriculture 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 (Fretz, 1991, p. 17).

Hamilton (1999) believed that the principles of sustainability have great potential in addressing the concerns facing the agricultural industry and society. He stated, "If food production systems and our relation to the natural resources we use to raise food are not grounded in the principles of sustainability, our future is in doubt" (p. 6). There are some issues that go to the core of who we are as human beings on a planet that nurtures our life, and challenge us to become a society of "lovers of the soil" (Kirschenmann, 2000). Flora (1990) emphasized the benefits of sustainable agriculture within the context of rural communities, distinguishing the characteristics of sustainable communities, diversified farming systems, better links to consumers and to markets, more participation and responsibility in community affairs, and legitimization of sustainable innovation generated by local farmers.

Aldo Leopold (1949), perhaps the best-know crusader of what has emerged as sustainable agriculture, believed in education as an effective tool to build a well-informed society that is able to make intelligent decisions concerning good management of the land. He said to his students at the University of Wisconsin:

> I am trying to teach you that this alphabet of 'natural objects' (soil and rivers, birds and beast) spell 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) recognized the importance of education as an indispensable tool in gaining an understanding of the land and the environment as a whole. He contended that the educational policy as well as the content, quality, and quantity of the education are equally important if we are to be successful in our conservation efforts. He said:

> When we ask 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 process 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).

Social reconstructionist theory contends that the school curriculum should confront learners with severe problems facing humankind and that these problems should be addressed by every discipline. Teachers can relate social problems to students goals using their interest to help find solutions. The community and its resources can be used in forming partnerships to engage students in hands-on learning opportunities (Mc Neil, 1996).

Wallace (1993) advised that educational programs be established for educating the public on the value of sustainable approaches and practices in the environment as well as agricultural systems. Regardless of changes and technical advancements, key ingredients in the development and acceptance of sustainable production systems in the future will be education and desire (Powers, 1994). Hungerford & Volk (1990) found that educational programs can influence the knowledge, attitudes, and behavior of learners and lead to greater environmental responsibility.

A study conducted at Iowa State University found that extension personnel and farmers had similar educational needs with regard to sustainable agriculture. The "hot" topics included alternative field crops and rotations; niche marketing contracts; 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 (DeWitt, 1997). Alonge and Martin (1995) found that Iowa farmers had very positive perceptions about sustainable agriculture in terms of profitability and compatibility. A major constraint in the adoption of sustainable agricultural practices is ignorance about sustainable agriculture (Wallace, 1993).

The National Council for Agricultural Education (1996) developed and nationally disseminated instructional materials to help integrate sustainable agriculture into the secondary school agricultural education curriculum. Among the topics included were soil conservation, land use, water quality, and air quality, to be studied in conjunction with agricultural systems taught in the curriculum. State initiatives have also focused on the integration of sustainable agriculture into the curriculum. For example, the Wisconsin Rural Development Center (1991) developed a curriculum guide that included units on sustainable cropping and livestock systems. In Iowa, several educational tools (e. g., computer program, learning activities, videotape, and groundwater flow model) have been developed to support teaching and learning about sustainable agriculture (Williams, 1997). The scientific and technical elements of sustainable agriculture have the potential to enrich the high school agricultural education curriculum and align education with current developments in the agricultural industry (Williams & Dollisso, 1998, p. 55).

Williams and Wise (1997) found that Iowa agricultural education teachers perceived themselves as having additional things to learn about sustainable agriculture, and that their students rated themselves as only "knowing a little" about them. However, Williams (2000) found that agricultural education students believe that sustainable agriculture has the potential to have a positive impact on agriculture, providing a foundation for curriculum development where students can expand their knowledge of sustainable agriculture.

In regard to the role of education in changing the larger society, Mc Neil (1996, p. 46) stated that "teachers and students must try to transform their practices and consciousness as part of a larger strategy to change society." Williams (1997) concluded that agricultural education in secondary schools could be a partner in developing the agricultural industry of the twenty-first century by integrating sustainable agriculture into the curriculum.

## Purpose and Objectives

The purpose of this study was to determine the impact sustainable agriculture has had on secondary school agricultural education teachers and programs in the 12 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 the study were to: (1) identify the perceptions of secondary agricultural education teachers regarding sustainable agriculture and (2) assess the extent to which sustainable agriculture is taught in the secondary school agricultural education curriculum.

## Methods and Procedures

The study utilized a descriptive survey design to accomplish the objectives. The population for the study consisted of all (2,799) secondary school agriculture teachers in the 12 states of the North Central Region of the United States as listed in the 1996 Agricultural Education Directory. A random sample of 600 was selected from the population.

A mailed questionnaire was used to collect the data. Questions were generated from the literature, reviewed for content validity by a panel of judges knowledgeable about sustainable agriculture and agricultural education, and revisions made based on feedback. The questionnaire used a 5-point Likert-type scale to measure teachers' perceptions on 16 items related to sustainable agriculture. Another scale measured the extent to which sustainable agriculture was taught in the curriculum. In addition, some demographic data were collected for the purpose of describing the respondents.

Data-gathering procedures generated 298 usable responses. The Cronbach alpha coefficients for perceptions regarding

sustainable agriculture and the extent to which sustainable agriculture was taught in their curriculum were .62 and .86, respectively. The .62 coefficient is slightly below the .65 generally expected for research in education. The lower than desired response rate (49.6) and a lower reliability coefficient than expected on one scale are limitations of this study. Thus, the reader is cautioned not to apply the results of this study beyond the respondents. Means and standard deviations were used in analyzing the data.

## Results

*Demographic Characteristics of Respondents*

Of the teachers responding, 59.1% had taught agricultural education for 10 or more years, and 49.1% were 40 years of age or younger. These data suggest that the secondary school agricultural education profession in the North Central Region is fairly stable, providing a situation conducive to long-term curriculum reform that could include the teaching of sustainable agriculture.

*Perceptions of Teachers*

The data in Table 1 show the means and standard deviations for the 16 perception statements presented in descending order based on mean scores. The 5-point scale was interpreted as: 1 – 1.49 = strongly disagree; 1.50 – 2.49 = disagree; 2.50 – 3.49 = neutral, 3.50 – 4.49 = agree; and 4.50 – 5.00 = strongly agree.

None of the 16 statements had means considered as "strongly agree," 6 had "agree" ratings, 8 had "neutral" ratings, 2 had "disagree" ratings, and none rated "strongly disagree." Several of the statements with the highest means were related to economics. Respondents valued sustainable agriculture only if the practices were profitable and perceived that farmers would only use practices that were economically sound. Statements related to management practices, government programs, and farms with both crop and livestock enterprises were also among statements receiving "agree" ratings. Management becomes more important as farmers consider environmental and social factors along with the economic dimension in their farming operations. Teachers also "agreed" that government farm programs should encourage the use of sustainable agriculture practices; however, there was a high degree of variability among teachers on this issue as indicated by the l.03 standard deviation for item 4.

Respondents were "neutral" about statements 7 through 12 (Table 1), including their beliefs about sustainable agriculture and their perceptions about farmer implementation of sustainable agriculture practices. Teachers were also "neutral" about the importance of including sustainable agriculture in their curricula, and that advocates of sustainable agriculture have an antifarmer attitude. Thus, teachers appear to be unsure of McIsaac's (1996) view that sustainable agriculture has the potential to enhance the quality of life for farmers and society as a whole.

Teachers disagreed with two of the items, as indicated by means of 2.36 and 2.45. These issues were related to nonpracticability of sustainable agricultural practices and the availability of enough information to make decisions, suggesting a potential need for additional farmer education on sustainable agriculture.

Table 1
*Means and Standard Deviations for the Perceptions of Teachers Regarding Sustainable Agriculture*

| Rank* | Perception Statement | N | Mean | S.D. |
|---|---|---|---|---|
| 1 | It is essential that agricultural practices used on a farm be economically viable. | 292 | 4.38 | 0.68 |
| 2 | If sustainable agriculture practices reduced the profitability of farmland, farmers would not adopt them. | 292 | 4.02 | 0.87 |

*Table Continues*

Table 1 (Continued)

| Rank* | Perception Statement | N | Mean | S.D. |
|---|---|---|---|---|
| 3 | Use of sustainable agricultural practices requires that farmers change farm management practices. | 292 | 3.73 | 0.78 |
| 4 | I would support government farm programs that encourage the use of sustainable agriculture practices. | 291 | 3.71 | 1.03 |
| 5 | Adoption of sustainable agriculture practices will be easier for farmers who have both crop and livestock enterprises. | 292 | 3.63 | 0.89 |
| 6 | Most farmers will adopt sustainable agriculture practices if these practices do not reduce profits. | 291 | 3.58 | 0.91 |
| 7 | Sustainable agriculture practices would work well on any farm. | 291 | 3.44 | 0.96 |
| 8 | All farmers can adopt sustainable agriculture practices. | 291 | 3.39 | 0.97 |
| 9 | My beliefs about using sustainable agriculture practices are very strong. | 292 | 3.28 | 0.80 |
| 10 | Teaching about sustainable agriculture practices is an important part of my curriculum. | 292 | 3.24 | 0.92 |
| 11 | Sustainable agriculture practices would not work well on some farms. | 291 | 3.11 | 0.98 |
| 12 | Government has no business telling farmers how to use their land. | 291 | 2.95 | 1.03 |
| 13 | The purpose of farmland is to use it to derive maximum financial gain. | 290 | 2.67 | 1.09 |
| 14 | Advocates of sustainable agriculture practices have an "antifarmer" attitude. | 292 | 2.50 | 0.87 |
| 15 | Most sustainable agriculture practices are not practical for the average farmer. | 291 | 2.45 | 0.79 |
| 16 | The farmer has enough information to make decisions about using sustainable agriculture practices. | 291 | 2.36 | 0.89 |

*The items were ranked by the researchers based on mean scores. Scale: 1 = Strongly Disagree to 5 = Strongly Agree.

*Extent Sustainable Agriculture Was Taught*

Table 2 reports the means and standard deviations for each of the eight sustainable agriculture topics. The 5-point scale was interpreted as: 1 – 1.49 = none; 1.50 – 2.49 = low; 2.50 – 3.49 = moderate; 3.50 – 4.49 = high; and 4.50 – 5.00 = very high.

Respondents indicated that all eight topics were taught to some extent in their programs; however, none of the topics was taught at the "very high" level. Soil testing, soil erosion control, and crop rotation were taught to a "high" extent. Five topics -- insect-resistant crops, integrated pest management, herbicide-resistant crops, reduced use of chemicals, and reduced use of fertilizers -- were taught at "moderate" levels. Fretz (1991) concluded that such practices are needed to address the environmental and safety problems facing conventional agricultural systems. There was a high degree of variability among the respondents for some topics, as indicated by the high standard deviations (1.00 or over) for three of the topics. On the other hand, the relative low standard deviations for the "soil testing" and "soil erosion control," .78 and .82, respectively, indicate a relatively high level of agreement among the respondents.

## Conclusions and Recommendations

Sustainable agriculture has had a limited impact on the secondary school agricultural education teachers and programs included in this study. Responding teachers were unsure of their beliefs about sustainable agriculture, rating 8 of the 16 perception statements as "neutral." Teachers valued sustainable agriculture only if the practices were profitable and perceived that farmers would only use practices that were economically sound. Less value was placed on the environmental and social dimensions of sustainable agriculture. Responses were "neutral" as to the importance of sustainable agriculture in their own curriculum. However, respondents did agree that sustainable agriculture requires changes in management practices, agreeing with Fretz (1991) that "thinking" is embedded in sustainable agriculture.

Table 2
*Means and Standard Deviations for the Extent Sustainable Agriculture Topics Were Taught in the Curriculum*

| Rank* | Sustainable Agriculture Topics | N | Mean | S. D. |
|---|---|---|---|---|
| 1 | Soil testing | 291 | 4.32 | 0.78 |
| 2 | Soil erosion control | 291 | 4.31 | 0.82 |
| 3 | Crop rotation | 291 | 3.58 | 1.00 |
| 4 | Insect-resistant crops | 291 | 3.41 | 0.99 |
| 5 | Integrated pest management | 289 | 3.37 | 1.02 |
| 6 | Herbicide-resistant crops | 291 | 3.37 | 1.03 |
| 7 | Reduced use of chemicals | 290 | 3.30 | 0.89 |
| 8 | Reduced use of fertilizers | 289 | 3.07 | 0.91 |

*The topics were ranked by the researchers based on mean scores. Scale: 1 = None to 5 = Very High.

Sustainable agriculture was being taught to a moderate degree by the respondents. Topics with a multidisciplinary or systems dimension (i. e., insect-resistant crops, integrated pest management, herbicide-resistant crops, reduced use of chemicals, and reduced use of fertilizers) were included in the curriculum to a moderate degree. Such learning addressing significant state and national problems is consistent with the framework of social reconstructionism (Mc Neil, 1996).

Respondents indicated that basic agronomic concepts were included in the agricultural education curriculum to a "high" degree. Soil testing, soil erosion control, and crop rotation were taught at a "high" degree. Such learning can serve as a foundation for the teaching of sustainable agriculture. Keeney (1989) advocated that sustainable agriculture must be based on sound agronomic principles.

The literature revealed that future agricultural systems must become more environmentally friendly and socially acceptable along with being economically sound. In light of this vision for sustainable agriculture and the above conclusions, recommendations are offered to the agricultural education profession for teacher in-service and curriculum-development initiatives. It is recommended that teachers take advantage of professional development activities to help them evaluate the dimensions of sustainable agriculture. Experiences in decision-making with sustainable agriculture systems that include economic, environmental, and social factors should be included in teacher in-service education programs.

In regard to curriculum development, sustainable agriculture values should be infused into the philosophy for secondary school agricultural education programs and content that aligns with the new philosophy included in the curriculum. Opportunities for decision-making that concurrently consider economic, environmental, and social factors should be developed to

facilitate learning related to sustainable agriculture systems.

This study revealed a need for professional development of teachers and curriculum development related to sustainable agriculture in the north central region. Thus, it is recommended that leadership be taken by the agricultural education profession to meet these needs through state, regional, and/or national initiatives. Cooperation among entities of the profession, collaboration with universities and sustainable agriculture centers, and partnerships with industry should be developed to help secondary school agricultural education programs become a partner in realizing the vision espoused by proponents of sustainable agriculture.

Additional research is needed to identify factors that support and inhibit the integration of sustainable agriculture into the secondary school agricultural education curriculum in the North Central Region. The relationship among the use of sustainable agriculture practices by farmers, teacher beliefs about sustainable agriculture, and the inclusion of sustainable agriculture in the secondary school curriculum also should be investigated.

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