

PERCEPTIONS OF SUSTAINABLE AGRICULTURE: A LONGITUDINAL STUDY OF YOUNG AND POTENTIAL PRODUCERS

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The sustainable agriculture movement is an important one for educators because of increasing societal concern about the effects of agriculture on the environment. Three groups of young people were studied over a four-year period to determine what they perceived to be the consequences of adoption of sustainable agriculture practices. The most likely consequences were greater management requirements and changes in equipment. Potential producers were more likely than those somewhat older to expect positive consequences and to use dealers as a source of information. Neighbors, family, and friends were rated most highly as a source of information for all groups. Adoption/diffusion theory provided the base for studying the attributes of sustainable practices affecting adoption, and the attribute of complexity had the most influence. Recommendations were: (a) include observations of conservation practices in under-graduate programs, (b) establish networks of graduates, and (c) target dealers who cooperate with Extension in providing educational programs on sustainable agriculture.

Introduction

The environmental movement has important implications for agricultural education, and agricultural educators nationwide are interested in agricultural practices that are sustainable. The problem is how best to educate young producers so that they will adopt sustainable agricultural practices such as minimum tillage and reduced use of chemicals.

The adoption-diffusion model provides a theory base for explaining how people adopt new practices, and most of the research has focused on determining the characteristics of the different adopter categories (Rogers, 1995). For example, a Pennsylvania study of farm operators found that 11% were late adopters, 37% were late majority, 34% were early majority, 18% were early adopters, and none were classified as innovators (Rollins, 1993).

According to Rogers (1995), more research is needed on how the attributes of an innovation affect its rate of adoption. The adoption-diffusion model cites the following attributes as factors that affect adoption of innovations: relative advantage,

compatibility, complexibility, trialability, and observability. Relative advantage is the degree to which an innovation is better than what it supersedes, usually expressed in economic terms, but can include a societal value such as environmental protection. Compatibility includes consistency with existing values, experiences, and needs, while complexity involves the difficulty of understanding and using a new practice. Trialability means the use of a new idea on a limited basis, and observability refers to the visibility of the innovation (Rogers, 1995). In a study by Gamon, Harrold, and Creswell (1994), relative advantage, compatibility, and observability were strongly and positively related to adoption of sustainable agriculture practices.

A number of researchers have been interested in education about environmental issues. Scofield and Kahler (1993) found that a computer program was an effective instructional method for teaching high schoolers about sustainable agriculture. Alonge and Martin (1993) searched for a model to explain adoption of sustainable agriculture practices. Gamon et al. (1994) studied the effectiveness of conferences and found no significant differences between attendees and non attendees in adoption of

sustainable practices. When Bruening, Radhakrishna, & Rollins studied farmers (1992), water pollution, manure mismanagement, and nutrient mismanagement were the top environmental issues.

A study by Rollins in 1993 confirmed that there are multiple information sources for farmers to use. Bruening et al. (1992) found that newsletters (79%), manuals (68%), and magazines (68%) were used by high percentages of farmers to gain information about environmental issues. Governmental units were rated higher than neighbors or friends as sources of information.

More information is needed on the following questions. What do producers perceive as the consequences of adoption? Have there been changes over time? What delivery methods do producers prefer for information about sustainability, and have their preferences changed? What factors affect their adoption of practices?

Purpose and Objectives

This study's purpose was to assess changes in perceptions of young producers toward possible outcomes of adoption of sustainable agriculture practices and their preferences for sources of information. Specific objectives were as follows:

1. Assess producers' perceptions of possible outcomes resulting from adoption of sustainable agriculture practices, and determine if there were differences over time and among groups.
2. Assess information sources that young producers prefer to use in gaining information about sustainable practices, and determine if there were differences over time and among groups.
3. Assess the attributes of sustainable agricultural practices that influenced their adoption by producers, and determine if there

were differences over time and among groups.

Procedures

The population for this descriptive study included three groups of young producers: (a) an older group, (b) a younger group, and (c) a potential group (See Table 1). The first two groups were young people who either were attending or had attended a short-term Winter Program. They had chosen to stay home and farm rather than attend college but came to campus for several weeks during January and February to attend classes. The potential group consisted of students majoring in Agricultural Studies who were enrolled in a required agricultural careers class. The potential producers either grew up on farms or had worked on farms. Typically they were farming during breaks and on weekends. All expected to return to the farm or work in a career closely associated with farming. The three groups were chosen because they came from similar backgrounds, but represented different ages and periods in time. Data were collected over a period of four years, beginning in 1993.

Questionnaires were mailed in 1993 to the older group, those who had attended the Winter Program in the past ten years, from 1982-1992. After a follow-up mailing, the return rate for the older group was 45%. When responses were grouped by sections of the questionnaire to minimize the error that would result from multiple t-tests, there were no significant differences (.05 level) between early and late responses.

Data were collected from the younger group in 1993, 1994, and 1995 when they were on campus for the Winter Program. The potential group was surveyed during the 1995/ 1996 academic year. Because respondents were not randomly selected, results cannot be generalized to all young producers.

The researcher-generated questionnaire was based on a literature review of sustainable agriculture and questionnaires used in previous studies related to sustainability. Faculty and staff in

Table 1. Characteristics of the Three Groups in the Study

Characteristic	Older	Younger	Potential
Enrollment status	Winter students 1982-1992	Winter students 1993-1995	Undergraduates 1995-1996
Dates of data collection	1993	Winter, 1993 Winter, 1994 Winter, 1995	Fall, 1995 Spring, 1996
Number in population	97	104	84
Return rate	45%	98%	92%
Mean age at time of data collection	29 yrs	20 yrs	22 yrs

agricultural education reviewed the 37 questions for content validity. A test-retest check of reliability produced a Pearson's correlation of .87. Cronbach alpha reliabilities of individual parts of the questionnaire in various years ranged from .62 to .88, and overall reliabilities were between .87 and .88.

Analysis of Data

The data analyses were performed using SPSSpc, with a level of significance set beforehand at .05. Negative items were reversed for the analysis, and frequencies, means, standard deviations, and analyses of variance were calculated. For items with significant differences, the Tukey honestly significant difference comparison was used to identify means that differed. For each item a mean was calculated across all three groups.

Results

The researchers analyzed young producers' perceptions of the consequences of increased adoption of sustainable agriculture practices on a 5-point scale ranging from 1=Very Unlikely to 5=Very Likely (Table 2). The most likely consequences were: greater management requirements, changes in equipment, conservation of soil, and protection of

water quality. (Items in Tables 2, 3, and 4 are listed by magnitude of means for all three groups).

In all items with significant differences, the Tukey test was able to identify the specific groups. The potential producers tended to be significantly more sure than the younger and/or the older group of the benefits of sustainable agriculture.

When young producers were asked specifically about substituting non-chemical alternatives for pesticide and commercial fertilizers (Table 3), the items they chose as most likely outcomes were less groundwater contamination and improved health for farm families. The potential producers were significantly more likely than the other groups to think that substitutions of non-chemical alternatives for pesticides and commercial fertilizers would have positive results. There were no differences between the younger and the older group, an indication that, over time, predictions of likely results of non-chemical alternatives were similar. Similarly, Bruening et al. (1992) found that age (mean=53 yrs.) was independent of farmers' perceptions about the seriousness of environmental issues.

When respondents were asked how frequently they used various sources of information in determining farming practices (Table 4),

Table 2. Producers' Perceptions of Likely Results of Sustainable Agriculture

Results of sustainable agriculture	Older ^a	Younger ^b	Potential ^c	F-ratio (df=2)	Tukey HSD
	1982-1992 (n=45) M SD	1993-1995 (n=102) M SD	1995-1996 (n=77) M SD		
Greater management requirements	4.39 ^a .78	4.03 ^b .88	4.35 ^c .68	4.80*	c>b a>b
Changes in equipment	4.39 ^c .69	4.08 ^b .69	3.96 ^b .94	3.94*	a>c
Conservation of soil	3.70 ^c .88	3.68 ^b .88	4.27 ^c .83	12.14***	c>ab
Protection of water quality	3.78 ^c .88	3.66 ^b .88	4.22 ^c .70	11.65***	c>ab
Increased labor requirements	4.00 ^c .99	3.84 ^b .99	3.55 ^b 1.02	3.60 ^c	a>c
Protection of wildlife/ wildlife habitat	3.73 .90	3.65 .84	3.96 .85	2.90	
Reduced use of chemicals	3.89 1.01	3.63 1.02	3.64 .99	1.17	
Protection of wetlands	3.39 ^c .92	3.50 ^b .92	3.95 ^c .93	7.82***	c>ab
Better rural communities	2.91 1.10	2.85 ^b .88	3.22 ^c 1.05	3.27*	c>b
More small farms	2.77 1.38	2.63 1.11	2.56 1.11	.47	
Protection of woodlands	3.50 ^c .88	3.39 ^b .86	3.94 ^c .86	9.17***	c>ab
Safer food	3.16 1.16	3.48 ^b .88	3.74 ^c .85	5.55**	c>b

(table continues)

Results of sustainable agriculture	Older ^a	Younger ^b	Potential ^c	F-ratio (df=2)	Tukey HSD
	1982-1992 (n=45)	1993-1995 (n=102)	1995-1996 (n=77)		
	M SD	M SD	M SD		
Benefits for society	2.98 ^a 1.07	3.38 ^b .85	3.92 ^c .90	16.37***	c>ab b>a
Benefits for citizens of Iowa	3.16 ^a 1.13	3.32 ^b .80	3.90 ^c .72	14.36***	c>ab
More livestock	3.18 1.11	3.39 .88	3.32 .88	.74	
Lower profits for farmers*	2.42 ^a 1.12	2.54 ^b .92	3.18 ^a .96	12.30***	c>ab
More expensive food ^d	2.43 ^a 1.15	2.58 ^b .98	3.28 ^a .93	14.41***	c>ab
Grand mean/ standard deviation of all results	2.53 .49	3.49 .45	3.65 .44	2.65	

Note: Scale: 1=Very Unlikely, 2=Somewhat Unlikely, 3=Unsure, 4=Somewhat Likely, 5=Very Likely; The Tukey honestly significant difference comparison was used to identify which means differed; Items are arranged by magnitude of means across all groups.

^dNegatively stated item. Means of negative items were reversed in grand mean.

*p<.05 **p<.01 ***p<.001

neighbors, family, and friends were rated most highly as a source of information. Young and potential producers tended to use sources more than the older groups. Dealers were a frequently-used source (above 3.5) of information on sustainable agriculture, more often than the Natural Resource Conservation Service. Gamon et al. (1994) also found dealers toward the top, but the farmers in Bruening & Martin's study (1992) rated the Conservation Service higher than chemical and fertilizer dealers as a source of information.

This study assessed attitudes toward four of the attributes of innovation described by Rogers

(1995): relative advantage, complexity, observability, and compatibility. Questions making up Table 2 and Table 3 measured attitudes indicating the level of compatibility of sustainable agriculture practices with existing values of the respondents. Table 5 displays ratings of questions related to relative advantage, complexity, and observability. The young producers rated almost all of the questions above the mid-point on the 5-point scale (Table 5), an indication that each attribute had some influence on their adoption of sustainable practices. The item with the most influence was necessary financing.

Table 3. Producers' Predictions of Results of Non-Chemical Alternatives for Pesticides and Commercial Fertilizers

Results of non-chemical alternatives	Older ^a	Younger ^b	Potential ^c	F-ratio (df=2)	Tukey HSD
	1982-1992 (n=45)	1993-1995 (n=102)	1995-1996 (n=77)		
	M SD	M SD	M SD		
Less groundwater contamination	3.80 .97	3.73 1.09	3.92 .95	.82	
Improved health for farm families	3.64 1.00	3.62 .99	3.88 .76	2.00	
Improved soil conditions	3.00 ^a 1.11	3.17 ^b 1.09	3.55 ^c .97	4.60*	c>ab
Lower overall production costs	3.07 1.34	3.35 1.15	3.17 1.15	1.07	
Better quality products	2.73 ^a 1.05	2.64 ^b 1.03	3.22 ^c .94	7.81***	c>ab
Higher profits for farmers	2.62 1.25	2.55 1.18	2.79 1.06	.95	
Higher yields under adverse conditions	2.07 ^a .96	2.22 1.06	2.54 ^b 1.10	3.38*	c>a
Fewer insects	2.00 .85	1.93 ^b .95	2.32 ^c 1.02	3.92*	c>b
Fewer weeds	1.93 .84	1.90 ^b 1.03	2.30 ^c .97	4.00 ^a	c>b
Grand mean/standard deviation of all alternatives	2.76 .74	2.79 ^b .70	3.07 ^c .65	4.38*	c>b

1=Very unlikely, 2=Somewhat Unlikely, 3=Unsure, 4=Somewhat Likely, 5=Very Likely; The Tukey honestly significant difference comparison was used to identify which means differed; Items are arranged by magnitude of means across all groups.

*p < .05 **p < .01 ***p < .001.

Table 4. Producers' Use of Sources of Information

Use of sources of information	Older ^a	Younger ^b	Potential ^c	F-ratio (df=2)	Tukey HSD
	1982-1992 (n=45) M SD	1993-1995 (n=102) M SD	1995-1996 (n=77) M SD		
Neighbors, family, and friends	3.78 .82	3.80 ^b .84	4.11 ^c .83	3.46^{**}	c>b
Fertilizer and chemical dealers	3.76 .72	3.78 .82	3.81 1.04	.05	
Farm magazines and publications	3.60 ^b .81	3.47 ^b .77	4.22 ^c .82	20.63^{***}	c>ab
Seed/feed dealers	3.20 ^b .79	3.75 ^b .73	3.73 ^b .94	7.77^{***}	c>a b>a
County Extension Service	3.11 ^b 1.04	3.30 ^b .76	3.91 ^c .83	16.35^{***}	c>ab
Natural Resource Conservation	3.04 ^b .88	3.32 ^b .76	3.67 ^c 1.03	8.11 ^{***}	c>ab
Farm machinery dealers	2.76 ^b .86	3.40 ^b .86	3.44 ^b 1.03	9.35 ^{***}	c>a b>a
Farm organizations	2.87 ^b .92	3.10 ^b .84	3.64 ^c .89	13.54 ^{***}	c>ab
Personal consultation with Extension specialists	2.71 ^b 1.12	3.03 ^b .92	3.70 ^c .95	17.55 ^{***}	c>ab
Livestock dealers	2.33 ^b 1.11	3.24 ^b .93	3.45 ^c 1.02	19.03 ^{***}	c>aa b>a
Iowa State University Experiment Station	2.89 .98	2.75 ^b .95	3.31 ^c 1.16	6.56 ^{***}	c>b
Practical Farmers of Iowa	2.07 ^b 1.23	2.52 ^b 1.11	3.14 ^b 1.19	13.18 ^{***}	c>ab

(table continues)

Use of sources of information	Older ^a	Younger ^b	Potential ^c	F-ratio (df=2)	Tukey HSD
	1982-1992 (n=45)	1993-1995 (n=102)	1995-1996 (n=77)		
	<u>M</u> <u>SD</u>	<u>M</u> <u>SD</u>	<u>M</u> <u>SD</u>		
High school agriculture teachers	1.91 ^a .93	2.06 ^b .95	2.66 ^c 1.19	10.25***	c>ab
Grand mean/standard deviation of all sources	2.94 ^a .48	3.19 ^b -44	3.61 ^c .54	18.98***	c>ab b>a

1=Very unlikely, 2=Somewhat Unlikely, 3=Unsure, 4=Somewhat Likely, 5=Very Likely; The Tukey honestly significant difference comparison was used to identify which means differed; Items are arranged by magnitude of means across all groups.

^ap < .05 ^bp < .01 ^cp < .001.

Conclusions and Recommendations

Changes over time

There were only minor changes over time and among the three groups of young and potential producers in their levels of agreement with statements about likely results of sustainable agriculture, leading to the conclusion that the societal environment trend had little impact on perceptions of the respondents in the study. The potential producers were more positive about the benefits of sustainable agriculture than the other two groups, who were both actively involved in production. It might be concluded that those actively involved had more realistic views of the changes in machinery and management required.

Sources of information

Preferred sources of information were neighbors, family, and friends, dealers, and farm publications. The younger group and the potential group were significantly more likely than the older group to use dealers for information on sustainable agriculture, an indication that dealers are increasing in importance as a source of information for producers.

Adoption of practices

Potential producers were more likely than the younger group to report that the attribute of observability would influence their adoption of sustainable practices. We might conclude that societal influence plays a strong role in the actions of potential producers, and that they want to see how a practice is working for someone else before they try it.

The following recommendations are based on the results of this study and a review of relevant literature:

1. Undergraduate education should consider the attribute of observability and therefore use field trips and demonstration plots to teach sustainable practices.
2. Agricultural programs should establish networks of graduates who enter production agriculture and devise methods to meet their needs for continuing education related to sustainability.
3. Agricultural Education and Extension need to target dealers as an educational audience

Table 5. Producers' Adoption of Sustainable Agriculture Practices

Attributes influencing adoption of sustainable practices	Older ^a 1982-1992 (n=45) M SD	Younger ^b 1993-1995 (n=102) M SD	Potential ^c 1995-1996 (n=77) M SD	F-ratio (df=2)	Tukey HSD
<u>Complexity</u>					
Necessary financing	3.37 1.05	3.63 .87	3.74 1.13	1.74	
Availability of equipment	3.12 ^a .88	3.25 ^b .89	3.78 ^c .84	10.93***	c>ab
<u>Relative Advantage</u>					
Improvement of environment	3.12 ^a .82	3.14 ^b .71	3.76 ^c .83	16.37***	c>ab
Short term profitability	3.40 1.03	3.39 .82	3.51 -.94	.42	
Reduction of yields ^d	3.70 ^a .96	3.63 ^b .99	2.74 ^c 1.38	16.08***	ab>c
<u>Observability</u>					
Opportunity to observe	3.35 1.02	3.22 ^b -.73	3.63 ^c .91	5.13**	c>b
Opinions of other farmers	2.88 ^a .93	3.14 ^b .83	3.50 ^c 1.08	6.51**	c>ab
Grand mean/standard deviation of all attributes	3.28 ^a .55	3.34 .50	3.52 ^c .48	3.93 ^a	c>a

Note: Scale: 1=Never, 2=Seldom, 3=Sometimes, 4=Frequently, 5=Always; Means of negative items were reversed; The Tukey honestly significant difference comparison was used to identify which means differed; Items are arranged by magnitude of means across all groups.

Negatively stated item. Means of negative items were reverse coded in grand mean.

^ap < .05 ^bp > .01 ^cp < .001.

and assist them with teaching/learning 4. methods effective in providing programs on sustainable agriculture to young producers.

More research should be conducted on how agricultural education can address environmental concerns. Examples of

questions to be answered are: Does level of education or educational aspiration affect perceptions toward sustainable agriculture? How do perceptions held by producers compare with perceptions held by agricultural educators at the secondary, postsecondary and university level?

5. Agricultural educators should provide young producers, potential young producers, and those who intend to work in the sales and service field with experiences with sustainable agriculture.
6. Young producers are an important audience for agricultural educators, and sustainability of the environment is an important societal trend. Networks of support and encouragement could play an important role in the adoption of sustainable practices.

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