Educational Delivery Methods to Encourage Adoption of Sustainable Agricultural Practices

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The growing public concern about groundwater contamination, pesticide residues, soil erosion, and wildlife habitat runs parallel to "an emerging interest by many farmers for a more cost-effective and environmentally benign agriculture" (USDA, 1990). But only a small number of farmers are using alternative farming systems (Board of Agriculture, 1989). The cause of the limited adoption of sustainable agricultural practices is the lack of dissemination of clear and reliable information. "Although science has accumulated a great base of knowledge of potential benefit to alternative agriculture, research and extension have not focused on integrating this knowledge into practical solutions to farmers' problems" (Board of Agriculture, 1989). The link between research and reality is still a tenuous one.

Some examples of alternative, sustainable, agricultural practices are crop rotation, integrated pest management, tillage practices, and animal-health maintenance. Information on these and other practices was given at two Central Iowa Extension conferences on sustainable agriculture. An external evaluation, months after the conferences, was needed to determine their effect and to discover what influenced adoption of specific sustainable agricultural practices. Results of the study might help in the search for more effective ways of program delivery, a concern for Extension as they manage a scarce resource--time (Radhakrishna et. al., 1991). According to Geasler (1989), Extension has not yet reached the point at which the first question asked by staff in program planning is "what method of program delivery would achieve the greatest adoption of information?"

Producers adopting alternative practices strive for profitable and ecologically sound ways to use the unique potentials of the physical, chemical, and biological resources of their farms. They must weigh all the features that make the practice they are considering for adoption either beneficial or injurious. The attributes most generally taken into consideration in the adoption of innovations are relative advantage, compatibility, complexity, trialability, and observability. The adoption process includes the four stages that precede adoption of an innovation: awareness, information seeking, evaluation, and trial (Rogers, 1983).

Purposes and Objectives

The purposes of this study were to compare the level of adoption and the level of information about sustainable agricultural practices of attendees and nonattendees, before and after a set of Extension programs, and to identify preferred delivery methods and the attributes of innovations that influenced adoption.

Objectives were to (1) compare management practices before and after the set of programs, (2) determine the attributes of sustainable agricultural practices that influenced their adoption, (3) identify preferred sources of information on sustainable agricultural practices, and (4) compare those who attended the conferences with those who did not.

Procedures

This was an ad post hoc, quasi-experimental study, with the population consisting of farmers (approximately 9,000) from nine central Iowa counties. The sample of 143 in the treatment group self-selected themselves by attending the two Extension conferences on sustainable agriculture. The control group of 143 was a stratified random sample of the farmers in the nine counties who did not attend. Population lists were supplied by County Extension Offices in the nine counties, and equal numbers of nonattendees to attendees in each county were randomly selected. The 286 central Iowa farmers received a mailed questionnaire in the spring of 1991. The mailed questionnaire was developed after a preliminary telephone study

involving five purposively selected farmers who were members of Practical Farmers of Iowa (PFI), an organization interested in sustainable agriculture. The questionnaire was reviewed for content validity by farmers who had been speakers at the two conferences, faculty and personnel from the College of Agriculture, and members of the Central Iowa Extension committee that organized and conducted the conferences.

Frequencies, means, and standard deviations were used to describe the responses. A conservative test, the Kruskal-Wallis, was used to determine whether adoption, level of information, and sources of information reported by attendees were significantly different at the .05 level from nonattendees. The 20 practices were grouped according to farming system categories for the purpose of reducing possible statistical error. The Kruskal-Wallis test was used to determine the mean change in adoption and level of information before and after the extension conferences. Participants were asked to reflect back on their practices prior to the 1990 cropping season (before the conferences) and also from then to the present. Rockwell (1989) called this method "post-then pre-evaluation." By asking participants after the program to describe their behavior (posttest) and then to recall their behavior before the program (pretest), the descriptions may be more accurate "because limited knowledge before the program prevents them from accurately assessing baseline behaviors" (Rockwell, 1989). Care must be taken when interpreting the differences between before and after, for changes might have occurred due to forces other than the one in question.

The return rate was 76 percent for attendees and 57 percent for nonattendees. Because late respondents are considered similar to nonrespondents, those who responded to the first mailing were compared with those who responded to the second mailing on seven questions chosen randomly from the research instrument. The Kruskal-Wallis test for generating a probability of a greater Chi-square statistic revealed one significant difference in the reported use of farm machinery dealers as an information source; therefore, there was potential for nonresponse error.

Cronbach's alpha reliability coefficients were calculated for each section, resulting in the following values: .88 for degree of adoption, .93 for level of information, and .77 for sources of information, all acceptable figures according to Nunnally (1982).

Findings

Attendees and nonattendees were similar in age; for both groups, the largest segment was the 40-49 year-old group (29% for attendees and 28% for nonattendees). For both attendees and nonattendees, the largest segment was the income level between $30,000-$49,000 (26% of attendees and 33% of nonattendees). Both groups had increased their level of information and adoption of sustainable agriculture since 1989. There were no significant differences at the .05 level between the two groups in either level of information (Table 1) or adoption of practices (Table 2). This finding was comparable to that of Tolchinsky (1989), who studied the level of adoption of Integrated Pest Management (IPM) practices in corn by farmer cooperators and noncooperators of an IPM Extension program. In both studies, it is possible that nonattendees could have been indirectly receiving Extension's information through other sources such as chemical dealers, farm magazines, or neighbors who were Extension cooperators.

Attendees and nonattendees listed the same top five sources of information consulted for making management decisions related to sustainable agriculture. The top five were not in the same order for both groups, and attendees rated Extension significantly higher as a source of information than did nonattendees. For both groups, fertilizer and herbicide dealers had the highest means (Table 3). In a study on adoption of soil-conservation practices (Gamon, 1992), neighbors, friends, and family were the preferred source, but agribusinesses and Extension were in the top five. Tolchinsky's respondents (1989) included dealers and Extension agents in their top five preferred sources for pesticide information.

Both attendees and nonattendees were at or beyond stage two in the innovation-diffusion process, the stage of "seeking more information," as defined by Rogers (1983). Many had reached stage three, "evaluation," or stage four, "trial". An interesting finding was that those who had attended the sustainable agriculture conferences thought they were more helpful in refining current practices than in beginning to use new practices.

Three of the five attributes of innovations--

Table 1. Probability of attendance at Extension conferences affecting mean change in level of information of sustainable agriculture practices

Practice	Mean[a] change in level of information: Attendees[b]	Nonattendees[c]	P>CHISQ[d]
Diversify cropping system	.226	.127	.999
Soil and leaf test for nitrogen needs	.376	.273	.677
Reduce rate of nitrogen	.419	.255	.674
Supplement commercial fertilizer with animal or green manure	.151	.145	.249
Scout field to determine if weed control is needed	.226	.164	.686
Scout field to determine if insect control is needed	.204	.200	.594
Control weeds through increased cultivation	.258	.109	.637
Control insects through crop rotation	.086	-.018	.336
Reduce herbicide application	.161	.055	.864
Discourage livestock dunging in shelters	.032	.055	.661
Use of intensive pasture grazing rotation	.151	.127	.294

[a]Mean = expressed as change in level of information: l=not informed; 2=slightly; 3=moderately; 4=well; 5=highly

[b]Attendees: N=95

[c]Nonattendees: N=56

[d]p>CHISQ = probability of a greater Chi-square

Table 2. Mean adoptiona of farming systems before the 1990 cropping season and for the 1990 cropping season to the present as affected by attendance at Extension conferences on sustainable agriculture.

Systems	Before 1990 Cropping Season: Attendees[b]	Nonattendees[c]	P>CHISQ[d]	1990 Cropping Season to Present: Attendees	Nonattendees	P>CHISQ
Cropping Me	2.29	2.54	.212	2.48	2.61	.360
SD[f]	0.91	1.20		0.98	1.17	
Tillage	2.77	2.84	.552	3.01	2.94	.785
	1.19	0.91		1.17	0.86	
Fertility	2.91	2.86	.823	3.12	3.08	.459
	0.98	0.92		0.97	0.90	
Pest management	3.24	3.36	.35 1	3.45	3.47	.629
	1.04	1.16		0.96	1.11	
Livestock	1.33	1.58	.351	1.42	1.71	.519
	0.81	1.01		0.82	1.10	

[a]Adoption: l=aware; 2=gathering more information; 3=trial use; 4=fine tuning; 5=permanent use.

[b]Attendees: N=95

[c]Nonattendees: N=56

[d]p>CHISQ = Probability of a greater Chi-square.

[e]M=Mean

[f]SD = Standard deviation

Table 3. Probability of differences between attendees and nonattendees in degree of use of information sources

Source	Attendees[a] Mean[c]	Nonattendees[b] Mean	P>CHISQ[d]
Fertilizer and herbicide dealers	3.46	3.61	.296
County Extension Service	3.43	3.00	.006**
Farm magazines and publications	3.42	3.41	.956
Soil Conservation Service	3.30	3.00	.080
Neighbors, family, friends	3.22	3.33	.595
Iowa State University Experiment Station	3.14	2.74	.033*
Personal consultation with Area Extension Crop Production Specialist	2.77	2.08	.ooo**
Seed dealers	2.76	2.80	.759
Farm organizations	2.59	2.22	.039*
Livestock feed dealers	2.48	2.61	.658
Farm machinery dealers	2.46	2.35	.444
Practical Farmers of Iowa	2.15	1.72	.030*
High school agriculture teachers	1.53	1.47	.958

[a]Attendee: N=95

[b]Nonattendee; N=56

[c]Mean: 1=Never; 2=Seldom; 3=Sometimes; 4=Frequently; 5=Always.

[d]p>CHISQ = Probability of a greater Chi-square.

*Significant at .05 level.

**Significant at .01 level.

relative advantage, compatibility, and observability--were strongly and positively related to adoption of sustainable agricultural practices. Trialability was positively related, but not strongly. As might be expected, complexity was negatively related.

Respondents were interested in long-term profitability of a practice rather than simply short-term. Over 90 percent of the central Iowa farmers ranked long-term profitability as somewhat to highly influential, whereas the influence of short-term profitability had a normal distribution curve.

Respondents were highly informed on these topics: reduction in use of fall plowing, use of postemergence herbicides, soil testing for phosphorus and potassium needs, and taking credit for past season's legume crop when calculating fertilizer needs. They were not well-informed regarding diversification of cropping systems, soil and leaf testing for nitrogen needs, discouragement of livestock dunging in shelters, pasture fat-rowing, and strip cropping to reduce erosion.

Conclusions and Recommendations

The effect of attendance at two central Iowa Extension sustainable agriculture conferences was studied. There was an overall trend toward increased level of information and adoption of sustainable agricultural practices, but there were no significant differences between the farmers who attended and those who did not. Also, there were no significant differences for level of information and adoption of practices before and after the conferences. This finding suggests that it is time for Extension educators to change their emphasis on meetings and conferences as methods for reaching clientele. New delivery methods and educational approaches are vital.

Extension needs to target chemical dealers for increased programming efforts related to sustainable agriculture; they were the top source of information for both attendees and nonattendees. All agribusinesses should be seen as important partners in the agricultural education process. Also, Extension needs to continue and increase providing unbiased, research-based, information to farm magazines and other publications. They should consider increasing field demonstration days to assist farmers who are at the trial stage of adoption of practices.

Agricultural educators in central Iowa should focus future sustainable agriculture programs on crop diversification and on testing for nitrogen needs. They should give less focus to those that are close to being fully adopted, such as reduction of fall plowing and use of postemergence herbicides. Long-term profitability of practices should be emphasized.

This study was a timely one, because the public is demanding that producers provide safe agricultural products while protecting the environment. Follow-up studies on degree and extent of adoption of sustainable practices over time are needed.

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