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OPINIONS OF AGRICULTURAL EXTENSION AGENTS IN PUERTO RICO REGARDING SUSTAINA BLE AGRICULTURE

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ABSTRACT. The College of Agriculture in Puerto Rico is taking the initiative of implementing a training project on sustainable agriculture for both agronomists and farmers under the concept of training the trainers. The goal of the program is to foster the adoption of sustainable agriculture practices among the farmers in the mountanous region of Puerto Rico. The objectives of the program are to: (1) promote the use of sustainable farming practices among the farmers. (2) foster confidence in the economic viability of sustainable agricultural practices among the farmers and, (3) encourage sustainable agriculture practices among the farmers as an alternative to protect the environment.

The concerns of the agronomists for the training will be included based on Huerta, 1996. A study on in-service training on sustainable agriculture in Puerto Rico will be utilized in designing the project. A series of Focus Groups will be developed prior to the training with group of farmers representative from the target population. The purpose of the Focus Group will be to establish the needs and concerns of farmers in respect to sustainable agriculture, and to access their preferred source of information on the subject-matter area.

INTRODUCTION

Sustainable Agriculture involves the application of scientific knowledge to achieve beneficial production systems that generate acceptable, long-term economic return; protect the environment; protect human health and safety and support society's goals of production of high quality, reasonably priced food. According to the 1990 Farm Bill, sustainable agriculture includes conventional, organic, low input, and other alternative farming methods if they conserve resources and address economic, environmental and social concerns regarding farming systems, (NCCES, Program Statement on Sustainable Agriculture, 1992).

In the United States, sustainable agriculture, as an environmental friendly way to farm, is gaining popularity among "farm family" farmers and farmers-based support groups, such as the Practical Farmers of Iowa. But what about mainstream farmers? Is information on sustainable agriculture available to them? (Agunga, 1995).

There is a common tendency for advocates to blame mainstream farmers for rejecting sustainable agriculture. Gerber (1991) notes that sustainable agriculture has created a "discomfort in mainstream agriculture," meaning that commercial farmers are skeptical about this new method of farming. This discomfort is understandable because trying new ideas constitutes a risk that could mean huge financial losses. In addition, diffusion theory states that new ideas or innovations pose a threat to the status quo. Most innovations are

first rejected, then accepted and adopted, and ultimately changed if better ideas come along (Agunga, 1995).

The growing public concerns 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 environmental benign agriculture" (Agunga, 1995). But only a small number of
farmers are using alternative farming systems (Board of Agriculture, 1989). The cause of the limited adoption of sustainable agriculture 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 focus 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.

Strong education and training efforts will be needed to implement an effective sustainable agriculture component to Extension's current programs. Extension faculty must first be trained about sustainable agriculture. They must be able to apply subject-matter training to a sustainable agriculture. They must be able to supply subject-matter training to a sustainable system orientation. Faculty need not only a keen appreciation of the economic impacts of agriculture, but also of agriculture's impact on society and the environment (NCCES, Program Statement on Sustainable Agriculture, 1992).

In developing an inservice education program on sustainable agriculture, assessing learner needs is an important early step in the process. Involving the learners in the process of planning an inservice education program increases the likelihood of implementing relevant programs (Waters and Haskell, 1989). In addition to assessing learner needs, an attitudinal component can be very revealing and useful as an organizational development technique (Budford and Bedeian, 1988).

In 1994, Puerto Rico Extension was awarded a grant for $265,232 to develop a telecommunication technology that will facilitate the delivery of the local Extension's programming at the distance learning centers around the Island. Initially, three distance learning centers will be established in three of the five extension regions. The first subject matter to be delivered at the distance education centers will be on sustainable agriculture.

Purpose and Objectives:

The overall purpose of this research is to identify and assess the inservice needs of the Extension agents who belong to the three regions initially served by the distance education project. The results of the study will be used to plan and implement an inservice education program on sustainable agriculture at the distance. The specific objectives of the study are to:

1. Describe the extension agents with regard to selected characteristics including: gender, tenure, region, highest academic degree, and major area of study.
2. Determine the attitudes of extension agents toward sustainable agriculture.
3. Determine the meaning of sustainable agriculture for the extension agents.
4. Determine the availability of the innovation on sustainable agriculture according to the Extension agents.

5. Determine how extension agents associate the term of sustainable agriculture.
6. Describe the perceptions of extension agents regarding the persons or entities that influence the adoption of sustainable agriculture practices.
7. Determine the importance of specific sustainable agricultural concepts according to the Extension agents.

Table 1: The meaning of Sustainable Agriculture

	Meaning	RANK	MEAN	SD
1.	Sustainable Agriculture brings an image of obsolete technology	3	3.86	1.01
2.	Sustainable Agriculture seeks to replace innovative farming	1	4.21	.80
3.	Sustainable agriculture is a new phase for old method farmers used in the past	9	2.95	1.07
4.	Sustainable agriculture is a risky way to farm	5	3.77	1.12
5.	Sustainable agriculture is a concept that is unclear to me	4	3.86	1.13
6.	Sustainable agriculture is something Third World farmers do	2	4.02	0.93
7.	Sustainable agriculture is an economically sound to farm	6	3.46	0.95
8.	Sustainable agriculture is a life style choice	8	3.07	1.09
9.	Sustainable agriculture is a very efficient method for the farmer	7	3.21	0.95
Total			3.60	0.45

1.00-1.50= VERY LOW
1.51-2.50= LOW
2.51-3.50= NEUTRAL
3.51-4.50= HIGH
4.51-5.00= VERY HIGH

RANK 1= most positive
RANK 9= most negative
SD = Standard Deviation

Procedures

This was a descriptive study, with the population consisting of all agricultural extension agents from the three extension regions (Arecibo, Mayagüez, and San Juan), which were selected to initiate the distance education project on sustainable agriculture. An accessible population of 49 agricultural extension agents was included in the study. The population list was supplied by the State Extension Office. A cross check of the mailing list was conducted using the 1994 issue of the Personnel Directory of Puerto Rico, Agricultural Extension Service. Discrepancies between the mailing list and the directory were clarified by clerical personnel in the office of the Associate Director of Extension. The mailed questionnaire was a replication of the one developed by Agunga, 1995, in Ohio, with some minor modifications.

The questionnaire contained seven parts: The first part contained 9 items on the meaning of sustainable agriculture. A 5 point Likert scale from 1 of very low to 5 of very high was used. The second part had 6 items on the availability of sustainable agriculture innovations, and contained the same scale mentioned in the first part. The third part had 7 items regarding the attitudes of agricultural extension agents regarding sustainable agriculture, and the scale utilized was similar to the one described in the previous parts. Part fourth contained 8 items concerning the reactions of respondents when they hear the term sustainable agriculture. The scale was the same 5 point Likert scale described earlier, and the possible responses ranged from 1= totally disagree to 5= totally agree. The fifth part included 9 items on the people who influence farmer's decision making on sustainable agriculture. The scale was the same described in the fourth section. The next part had 28 items on the training needs of agricultural extension agents on sustainable agriculture. The scale was once again a 5 point Likert scale, and the possible responses ranged from 1= very unimportant, and 5= very important. All the items from the mentioned six parts were averaged and ranked in order to estimate the preference of respondents. Systat, a statistical program for the PC was utilized for the data analysis. Questions on the personal and organizational characteristics of the respondents were in the last section.

The questionnaire was reviewed for content validity by a panel of experts consisting of extension specialists, extension administrators, extension agents, and agronomists from other agricultural and environmental agencies. The panel was asked to evaluate the instrument by making comments and/or suggestions as to its simplicity, clarity, content, relevance, and appropriateness. A decision was made a *priori* to delete or modify any item identified as inappropriate or unclear by two or more members in the panel. Panel members also suggested items for addition and deletion. Based on faculty review and suggestions from the panel of experts, items that did not have a direct bearing on the study, were removed from the instrument. Since the instrument was validated in another locations, very few modifications were done other than the translation from English into Spanish.

About 15 extension agents not participating in the study were selected for the pilot test. To determine the internal consistency of the different areas of the instrument, Cronbach's alpha model was used. Cronbach's alpha reliability coefficients were calculated for each section resulting in the following values: .88 for the meaning of sustainable

agriculture, .76 for the availability of sustainable agriculture, .82 for the attitudes toward sustainable agriculture, .72 for the association of the term sustainable agriculture, .90 for the people and entities that influence adoption of sustainable practices, and .94 for the training needs on sustainable agriculture, all acceptable figures according to Nunnally (1982).

The instrument was sent to the participants on October 2, 1995, along with a letter of the Extension Planning Director, explaining the purpose of the study. One participant, who was on a sick leave was eliminated from the study. Thus, the target population decreased to 48 agricultural extension agents. A tentative deadline of October 13 was established as the termination date for the return of all questionnaires. Ten days after the original mailing, 28 out of the 44 participants had responded with usable questionnaires. Two weeks after the original mailing date, a reminder note was sent to the non-respondents asking them to respond. Those who had not responded by October 27, 1995 received a second questionnaire, which was distributed by their supervisors. A final established deadline date of November 17 was set and by then, a total of 44 agents had responded, representing a 92% of the survey mailed. One questionnaire was received after the close of the data collection period, and was not included in the data analysis.

FINDINGS

The meaning of Sustainable Agriculture

The first part of the survey instrument included a 5 point Likert Type scale. The scale ranged from 1=Very Low to 5=Very High. Questions #1-6 were negatively worded. The negatively worded questions were reverse coded. The overall mean score for the scale was 3.60, which implies that attitudes toward sustainable Agriculture were favorable among participants. Table 1 shows the responses to individual items on the attitude scale. Individual items showing a more positive attitude by the respondents were, in descending order, items 2, 6, and 1 respectively, whereas the items showing a less positive attitude by respondent were beginning with the less favorable 3, 8, and 9.

Availability of Sustainable Agriculture Innovation

Table 2 shows the perceptions of county Extension agents toward the availability of Sustainable Agriculture innovation. The rating scale ranged from 1=Very Low to 5=Very High. Questions 3 and 6 were negatively worded. The negatively worded questions were reversed coded. The overall mean score for the scale was 3.66, which implies that the attitudes of county Extension agents toward the availability of Sustainable Agriculture innovation were favorable. Individual items showing a more positive attitude by the respondents were, in descending order, items 5 and 4 respectively, whereas the items showing a less positive attitude by respondents were beginning with the less favorable 2 and 6.

Table 2. Availability of Sustainable Agriculture Innovation

Item		RANK	MEAN	SD
1.	There is scientific proof that sustainable agriculture works	3	3.48	0.90
2.	Sustainable agriculture innovations are readily available	6	3.05	1.02
3.	Research on sustainable agriculture is still in its infancy.	4	3.43	0.95
4.	Researchers must investigate in the area of sustainable agriculture	2	4.22	0.89
5.	Extension agents must communicate findings on sustainable agriculture to farmers.	1	4.46	0.76
6.	I do not know where to get information on sustainable agriculture	5	3.34	1.24
	Total		3.66	0.55

1.00-1.50= VERY LOW
1.51-2.50= LOW
2.51-3.50= NEUTRAL
3.51-4.50= HIGH
RANK 1= most positive
RANK 6= most negative
SD= Standard Deviation
4.51-5.00= VERY HIGH

Table 3 shows the attitudes of county Extension agents toward sustainable agriculture. The rating scale ranged from 1=Very Low to 5=Very High. Ranking was provided in descending order. Questions 2, 4, and 7 were negatively worded. The negatively worded questions were reverse coded. The overall mean score for the attitudinal scale was 3.43, which implies that attitudes toward sustainable agriculture were neutral among County Extension agents. Items showing a more positive attitude by the respondent were, in descending order, items 3 and 7 respectively, whereas the items showing a less positive attitude by respondents were beginning with the less favorable 6 and 4.

Table 3. Attitude towards Sustainable Agriculture

Item		RANK	MEAN	SD
1.	Information on the benefits of sustainable agriculture will increase farmer's likelihood of adopting sustainable agriculture	3	3.84	1.8
2.	Farmers are not quite ready to practice sustainable agriculture	5	3.18	1.04
3.	Agricultural agents need to understand the importance of sustainable agriculture	1.	4.16	0.99
4.	I do not enough about sustainable agriculture to inform others	6	2.63	1.08
5.	There are innovative farmers in my county practicing sustainable agriculture	4	3.55	0.93
6.	Information on sustainable agriculture is being provided	7	2.61	0.95
7.	Extension agents should not be expected to provide sustainable agriculture information to farmers	2	4.07	1.06
	Total		3.43	0.65

1.00-1.50= VERY LOW
1.51-2.50= LOW
2.51-3.50= NEUTRAL
3.51-4.50= HIGH
4.51-5.00= VERY HIGH

RANK 1= most positive
RANK 7= most negative
SD= Standard Deviation

When I hear the term Sustainable Agriculture

Table 4 shows the reaction of respondents when they hear the term Sustainable Agriculture. The overall mean was 4.09, which means that in general, the terms were rated high by the participants. Individual items showing greater agreement were, in descending order those related to the environment protection, and health and safety respectively, whereas the items showing a greater disagreement by respondents were beginning with the item with the greatest disagreement, profitability and small scale agriculture respectively.

Table 4. When I hear the term Sustainable agriculture

Item		RANK	MEAN	SD
1.	Profitability readily comes to mind	8	2.51	1.06
2.	Productivity readily comes to mind	6	3.16	1.09
3.	Small-scale agriculture readily comes to mind	7	2.61	0.95
4.	Environmental protection readily comes to mind	1	4.67	0.53
5.	Health and safety readily comes to mind	2	4.60	0.59
6.	Back to the land movement readily comes to mind	4	4.14	0.64
7.	Organic farmers readily comes to mind	5	4.07	0.68
8.	Low chemical inputs readily comes to mind	3	4.48	0.53
	Total		3.78	0.89

1.00-1.50= TOTALLY DISAGREE
1.51-2.50= DISAGREE
2.51-3.50= NEUTRAL
3.51-4.50= AGREE
4.51-5.00= TOTALLY DISAGREE

RANK 1= HIGHER MEAN
RANK 8= LOWER MEAN
SD= Standard Deviation

People who influence farmer's decision making on Sustainable Agriculture

Table 5 shows the rating of participants on people who influence decision making on sustainable agriculture. The overall mean for the participants was 3.57. Thus, in general terms, participants agreed that the mentioned people influence notably decision making on Sustainable Agriculture. For ranking considerations, the means were coded in descending order and ranged from 1 to 9. Overall, the most influential source were the Sustainable Agriculture farmers, followed by the availability of markets for organic producers, with means of 4.05 and 3.98 respectively. Chemical companies and peer groups were the least influential groups according to the respondents, with a mean of 2.79 and 2.95 respectively.

Table 5. People who influence farmer's decision making on sustainable agriculture

Item		RANK	MEAN	SD
1.	Chemical companies	9	2.79	1.49
2.	Sustainable agriculture farmers	1	4.05	0.65
3.	Extension agents	3	3.95	0.66
4.	Government policies on farm subsidies	7	3.10	1.17
5.	Peer groups	8	2.95	1.49
6.	The mass media	6	3.67	0.75
7.	Availability of markets for organic producers	2	3.98	0.77
8.	Environmental groups	4	3.83	0.85
9.	Soil Conservation Services	5	3.79	0.72
	Total		3.57	0.49

1.00-1.50= STRONGLY DISAGREE
1.51-2.50=DISAGREE
2.51-3.50=NEUTRAL
3.51-4.50=AGREE
4.51-5.00=STRONGLY AGREE

RANK 1= MOST AGREE
RANK 9= MOST DISAGREE
SD= Standard Deviation

Training Needs on Sustainable Agriculture

Table 6 shows the training needs of county Extension agents on sustainable agriculture. According to the participants, the areas with highest perception of training were integrated pest management, nonchemical weed control method, and education, communication, extension on sustainable agriculture. The means were 4.75, 4.68, and 4.68 respectively. The mean obtained by the nonchemical weed control and Education Communication/Extension in Sustainable Agriculture were the same. However, non chemical control was placed second, due to a lower standard deviation, which shows a greater consistency among the respondents. Restoration of the family farm and agricultural problems in other countries (same mean and standard deviation) were the areas with the lowest perception of training among Extensionists. The obtained mean in the areas with the lowest perception for training (3.89) still showed that the mentioned areas might be considered for inclusion in a training on sustainable agriculture. A high overall mean (4.36) assured a need for training of Extensionists on diverse areas.

Table 6. Training needs on Sustainable Agriculture

	Training Needs	RANK	MEAN	SD
1.	Integrated insect pest management	1	4.75	1.49
2.	Proper farm management practices	8	4.50	0.63
3	Natural resource conservation	7	4.55	0.66
4.	Nonchemical weed control methods	2	4.68	0.56
5.	Organic matter management	9	4.50	0.67
6.	Water quality with respect to agrichemicals	4	4.64	0.57
7.	Soil testing for organic content	6	4.57	0.59
8.	Farm safety	25	4.07	0.95
9.	Innovative farming systems	5	4.59	0.54
10.	Biotechnology	13	4.41	0.69
11.	Alternative sources of energy	23	4.16	0.81
12.	Crop rotations	17	4.32	0.67
13.	Green manure crops	15	4.39	0.69
14.	On-farm energy conservation	24	4.16	0.97T
15.	Food safety and pesticide residues	14	4.39	0.66
16.	Organic certification programs	22	4.16	0.68
17.	Animal well-being	21	4.18	0.76
18.	Recycling farm waste	13	4.41	0.66
19.	The economics of sustainable agriculture	17	4.32	0.66
20.	System theory including biological systems	12	4.41	0.58
21.	Systems theory as it relates to social system	20	4.19	0.76
22.	Agricultural problems in other countries	27	3.89	0.75
23.	Specialized machinery in sustainable agriculture	16	4.36	0.78
24.	Education/ communication/ Extension in sustainable agriculture	3	4.68	0.60
25.	Image of agriculture	10	4.48	0.63
26.	Restoration of the family farm	27	3.89	0.75
27.	Social justice / ethics	26	3.93	0.87
28.	Impact of sustainable agriculture on rural communities	19	4.27	0.87
	TOTAL		4.36	0.24

100-1.50=	VERY UNIMPORTANT	RANKING 1= MOST IMPORT
1.51-2.50=	Unimportant	RANKING 27= Less import
2.51-3.50=	REGULAR	SD= Standard Deviation
3.51-4.50=	Important	4.51-5.00=Very Important

Distribution by highest degree

Table 7 shows that half of participants (50%) held Master's degree, 48% held a Bachelor's degree, and 1 participant (2%) had a Doctoral degree.

Table 7. Highest Academic Degree of County Extension Agents

Highest Academic Degree	F	%
Bachelor Degree	21	48
Master's Degree	22	50
Doctoral Degree	1	2
TOTAL	44	100

Area of Specialization

Table 8 reports data concerning the area of specialization. A high percentage (44%) of the participants held their degree in agronomy. The next most prevalent group held a major in animal science (26%).

Table 8. Area of Specialization

Area of Specialization	F	%
Agronomy	19	44
Agricultural Economics	3	7
Agricultural Education	4	9
Horticulture	4	9
Animal Science	11	26
Crop Protection	1	2
General Education	1	2
Total	43	99

Years Tenure with Puerto Rico Agricultural Extension Service

Table 9 reports data on the years of experience of the county Extension agents. Respondents were nearly equally distributed among four of six categories of tenure. The mentioned categories represented employment between 1 and 20 years. Tenure between 6-10 years represented 27% of the respondents, whereas tenure between 6-10 years and 16-20 obtained 18%. Half of the respondents (50%) had a tenure between 6-15 years.

Table 9. Tenure with Puerto Rico Agricultural Extension Service

Years	F	%
1-5	8	18
6-10	12	27
11-15	10	23
16-20	8	18
21-25	4	9
26 or more	2	4
Total	44	99

Gender of County Extension Agents

Table 10 represents findings on the gender of the County Extension agents. As illustrated in this table, 84% of the county Extension agents were male and 16% were female.

Table 10. Gender of respondents

Gender	F	%
Male	37	84
Female	7	16
Total	44	100

Extension Region

Table 11 presents the three participant regions almost equally divided regarding number of participants in the study. The obtained frequencies were 34%, 34%, and 32% for the regions of Arecibo, Mayagüez, and San Juan, respectively.

Table 11. Extension Region

Region	F	%
Arecibo	15	34
Mayagüez	15	34
San Juan	14	32
Total	44	100

CONCLUSIONS AND RECOMMENDATIONS

- The typical Extension agent for the regions of Arecibo, Mayagüez, and San Juan held either a Bachelor degree or a Master degree, had an specialization in agronomy or animal science, a tenure between 6 and 15 years, and is a male.

- Regarding the meaning of sustainable agriculture, participants dot not visualize the term as something awkward that intends to replace progressive farming, or as amethod of farming confined to the underdeveloped third world countries, or envision an image of obsolete technology.

- Therefore, training efforts should not focus just in convincing participants that sustainable agriculture is a progressive way to farm.

- In reference to the availability of information on sustainable agriculture, participants agreed that both Extension agents and researchers must get involved in sustainable agriculture. Extension agents must communicate findings, and researchers must investigate on the topic. On the other hand, participants feel that sustainable agriculture innovations are not readily available, and they do not know where to get information on sustainable agriculture.

  Thus, for this to happens, Extension agents and researchers must be trained on sustainable agriculture. An appropriate linkage between researchers and Extension agents need to take place. In other words, both groups needs to be familiar with local conditions. Representation from the farmer sector should be incorporated into the system as well. A guide on alternative sustainable agriculture practices suited for local conditions, need developed as soon as possible.

- In allusion to the attitudes toward sustainable agriculture, Extension agents recognized that the importance of sustainable agriculture cannot be overemphasized. Extension agents also believe that they should be expected to provide sustainable agriculture information to farmers. On the other hand, participants say that not much information on sustainable agriculture is being provided , and Extension agents acknowledged that they do not know enough about the subject to inform others.

  Based on the previous information, Extension agents feel they should get involved in sustainable agriculture. In order for this to take place, Extension agents must be trained, and information on sustainable practices suited for local conditions must be available.

- In regard to the way Extension agents associate the concept of sustainable agriculture, respondents largely link it with environment protection and health and safety. On the other hand, extensionists do not relate the concept as a profitable way to farm and they do not see sustainable agriculture as a system confined to small scale agriculture.

In the positive side, Extension agents associate sustainable agriculture with environment protection and health and safety, which is not limited to small scale farming. However, participants still do not perceive the concept as cost effective for the farmers. Consequently, future training must emphasize the economic aspect.

- Concerning people who influence decision making on sustainable agriculture, Extension agents believe that sustainable farmers are the one who influence the most, followed by the availability of markets for organic products.

  Therefore, farmers need to be included in the training process soon. Emphasis on marketing needs to be included in the training on sustainable agriculture. In the less influential side, chemical companies and peer groups are visualized by respondents as the less influential groups in sustainable agriculture. This mean sustainable agriculture ought to be taken to the most influential farmer groups in order for the dissemination to be successful. This strategy ought to be accompanied by the availability of markets for the farm products.

- In regard to training needs, integrated pest management, nonchemical weed control, and training on education, communication, and extension in sustainable agriculture0 were conceived as the areas most mentioned.

  Thus, respondents understand their need for fluency on sustainable agricultural practices. Additionally, they recognized the importance of methods and technics of dissemination. Therefore, in addition to subject matter technical practices, extension agents must be trained on technics and methods for technology dissemination and diffusion.

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