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Analysis of Effect of Farmer Field School Approach on Adoption of Biological Control on Rice Producer' Producer' Characteristics in Iran

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Abstract : The purpose of this study was to determine the effect of farmer field school (FFS) approach on rice producer's characteristics and adoption of biological control. The research population consisted of 72 farmers who participated in FFS program and 346 farmers who had not participated in this program. Target population selected through randomized sampling method. The methodological approach of this study was twofold: descriptive-correlative and causal-comparative. The results of the multiple regression analysis (stepwise method) revealed that the variables of knowledge of biological control, relative advantage, mechanization level, rice producers experiences, social participation, number of contacts with extension agents, the extent to which farmers used mass media and information sources described a variation of 75.9% of the adoption of biological control by rice producers who had participated in FFS program. Also the results of the multiple regression analysis (stepwise method) revealed that the variable of knowledge of biological control described a variation of 83.1% of the adoption of biological control by rice producers who had not participated in FFS program.

Key words: Farmer field school · Adoption of biological control · Rice producers

INTRODUCTION

Agricultural research is vital to addressing the challenges of food production in Iran . Also one of the main challenges that extension and research is currently confronted is the transfer of agricultural technology from the research stations to the farm lands. By taking into account the rapid technological and scientific growth, the problem gets even more complicated and intricate. Farmer Field School served as one of the most effective extension education approach ever developed. The Farmer Field School extension method was introduced in Central Java in Indonesia at 1989, under the assistance provided by Food and Agriculture Organization (FAO) of the United Nations to Indonesia Pest Management (IPM) program on rice production [1-4]. The Farmer Field School is basically a school without walls. It is a school where: a) Participatory training techniques are used to achieve learning objectives; b) Learning objectives are not limited to those of the work domain alone, but also include interactive and empowerment domains; c) The approach is integrated and organized so that participants are not the objects of training but are able to use their experience as the subject of training; d) Participants share in the control of decision making [1,3,5]. A Farmer Field School can be described as a community-based practically oriented field study program, involving a group of farmers, facilitated by extension staff (public or private) or, increasingly, by other farmers. The FFS provide an opportunity for farmers to learn together and test and adapt practices, using practical, hands-on methods of discovery learning that emphasize observation, discussion, analysis and collective decision making. Discussion and analysis are important ways to combine local indigenous knowledge with new concepts and bring both into decision making. The process aims to build self-confidence, encourage group control of the process and improve group and community skills [6]. A " Farmer Field School " approach

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is an empowering process to enhance the decision-making capabilities of farmers. Through the process, farmers can relate to the technology that the extension worker is trying to introduce. This approach requires that farmers be recognized as experts in their own ponds [7]. The aim of the FFS is to build the capacity of farmers to analyze their production systems, identify problems, test possible solutions and eventually adopt the practices that is most suitable to their farming system. The knowledge acquired during the learning process enables farmers to adapt their existing technologies to be more productive, profitable and responsive to changing conditions, or to test and adopt new technologies. Training in FFS seeks to assist farmers to develop their ability to make critical and informed decisions that will render their crop production systems more productive, profitable and sustainable [6]. Van den Berg *et al*.[8] showed that, 23% increase in yield and 41% increase in profit are due to FFS activities that insecticide use was reduced by 81 % (from 2.2 to 0.4 sprays season). Godtland *et al.* [9] indicated that farmers who participate in the FFS program have significantly more knowledge about IPM practices than those in the non-participant comparison group. Also they find found that improved knowledge about IPM practices has a significant impact on productivity in potato production. Godrick and Richard [10] showed Respondents respondents overwhelmingly felt that the FFS had increased their skills, profits and yields and had reduced risks. Rola *et al.*[11] indicated that FFS farmers had significantly higher scores on agricultural and pest management knowledge than non-FFS farmers, indicating an effect of training. There was no significant difference in knowledge scores between exposed and non-FFS farmers. Likewise, no difference was found between those who had received knowledge from FFS farmers and those who had not. The results of a study in Sri Lanka combined with review of the literature provide evidence that Farmer Field Schools (FFS) can contribute to increasing farmers' skills and lowering Insecticide insecticide use in rice [2]. Mancini *et al.* [12] revealed that FFS program effect on natural capital (natural resource stocks from which resource flows are derived including land, water, biodiversity, landscapes etc.); Social capital (social assets, such as networks, memberships in groups, relationships and the wider institutions of society); Human capital (assets such as skills, knowledge, ability to work, good health, creativity etc) and Financial financial capital (financial assets). Bunyatta *et al.* [13] indicated FFS participants had significantly better adoption of biological control than the non- FFS farmer.

STUDY SITES AND METHODS

The research population consisted of 72 farmers who participated in FFS programs and 346 farmers who had not participated in FFS programs, which were selected by using randomized sampling method. The methodological approach of this study was twofold: descriptive-correlative and causal-comparative. The independent variables of the study were divided in seven groups: personal characteristics (age, education level, rice producer experiences and farming experiences), agricultural characteristics (agricultural system, land ownership, type of seeds, rice cultivation method, rice-cultivated land acreage, farm acreage, mechanization level, number of farming pieces, ecological situation and the extent to which farmer used insecticides), social characteristics (rice producers' attitudes towards biological control, rice producers' social influence and the extent of their social participation), communication characteristics (the extent to which farmer used mass media and the extent to which they used information sources), extension- knowledge characteristics (effect of extension courses, knowledge of biological control and the number of their contact with extension agent), economical characteristics (yield, income and cost-benefit) and innovation characteristics (relative advantage, adaptability, complexity, friability and visibility of biological control techniques). The dependant variable of the study was adoption of biological control. Face validity of the instrument was established by a panel of experts consisting of senior faculty members in agricultural extension and education department and research committee advisors. Reliability analysis was conducted by using and Cronbach alpha formula and result was 82. Data were collected with using a questionnaire developed by the researchers. The questionnaire was designed to gather data on the 15 principle factors influencing on using six-point Liker type scale.

Analysis of Data: All data were analyzed by using SPSS/PC+ (the Statistical Package for the Social Sciences, Personal Computer Version). Appropriate statistical procedures for description and inference were used. The alpha level was set priori at .05.

RESULTS AND DISCUSSION

Effect of Ffs on Rice Producer's Personal Characteristics: Rice Producers producers who participated in the study ranged in age from 30 to 77 years old. The mean of age of participation in FFS was 51.1 years. All rice producers were male. Rice producers were asked to report their level of education: 9.8% were illiterate, 46.5% of them had an elementary education; 23.4% had secondary education and 20.2% had high school diploma. Rice producers were asked to indicate the number of years of farming experience they possessed, farming experience ranged from 5 to 60 years (M=29.9; SD=14.7). Among averages variables of education level and rice farming experience, a significant differences were found when participating and non-participating farmers were compared (Table 1). Significant difference of age between two groups of rice producers have been approved by Mancini *et al.* [12], Bunyatta *et al.* [13], 12; 13; by Khalid [14] , Witt *et al.* [15] and Erbaugh *et al.* [16]. Significant difference of education level between two groups of rice producers have been approved by Khalid [14], Erbaugh *et al.* [16] and Palis [17].

Effect of Ffs on Rice Producers' Farming Characteristics: The average rice-cultivated land acreage was 2.3 hectare. The level of mechanization ranged from 21 to 54 (M=34.8; SD=9.1). The ecological situation ranged from 0 to 35 (M=15.7; SD=3.1). The number of farming pieces ranged from 1 to 5 (M=2.3; SD=0.8). The extent to which farmer used insecticides ranged from 1 to 42 liter per hectare per year (M=26.4; SD=9.8). Among the averages of the variables of rice-cultivated land acreage, farm acreage, mechanization level, number of farming pieces and the extent to which farmer used insecticides, significant differences were found when participating and non-participating farmers were compared (Table 2). Significant difference of farm acreage between two groups of rice farmers have been approved by Tripp *et al* [2] Khalid [14], Witt *et al.* [15] and Erbaugh *et al* [18]. Significant difference of ecological situation between two groups of rice producers have been approved by Van den berg [8] and Kimani and Mafa [19]. Significant difference of extent to used insecticides between two groups of rice producers have been approved by Kimani and Mafa [19], Haiyang [20], Larsen *et al.* [21] and Praneetvatakul and Waibel [22].

Effect of Ffs on Rice Producers' Social Characteristics: The rice producers ' attitudes towards biological control ranged from 0 to 40(M=25.5; SD=3.3). The rice producers ' social influence ranged from 0 to 20(M=11.4; SD=3.5). The rice producers ' social participation ranged from 0 to 30(M=18.9; SD=5.3). Among the averages of the variables of rice farmers' attitudes towards biological control and the extent of their social participation, significant differences were found when participant and non-participant farmers were compared (Table 3). Significant difference of attitudes between two groups of rice producers have been approved by Anandajayasekeram *et al.* [1], Tripp *et al.* [2], Khalid [14], Palis [17] and Huan *et al* [30]. Significant difference of social participation and social influence between two groups of rice producers have been approved by Witt *et al* [15], Minjauw *et al* [23] and Pontius [24].

Table 1: Compare personal characteristics of rice producers in two groups (Participated and non participated in FFS)

	FFS (n=72)		NON-FFS (n=346)			
Variables	M	SD	M	SD	t	p
Age	51.1	11.9	51.5	11.9	0.252	0.801
Educational level	7.9	4.7	5.9	3.9	3.39**	0.001
Farming experience	30.3	13.2	29.9	14.7	0.257	0.797
Rice farming experience	28.4	13.5	21.2	10.1	4.28**	0.000

** $p<0.01$

Table 2: Compare farming characteristics of rice producers in two groups (Participant and non- participant in FFS programs)

	FFS (n=72)		NONFFS (n=346)			
Variables	M	SD	M	SD	t	p
rice-cultivated land acreage	2.5	1.3	1.6	0.9	5.5**	0.000
Farm acreage	2.8	2.1	2.2	1.5	2.5**	0.013
Number of farming pieces	3.8	1.9	2.3	0.8	6.7**	0.000
Mechanization level	41.5	9.1	34.8	9.1	5.7**	0.000
Extent to used insecticides	17.4	11.9	26.4	9.8	5.9**	0.000
Ecological situation	15	3.6	15.7	3.1	1.6	0.119

** $p<0.01$

Table 3: Compare social characteristics of rice farmers in two groups (Participated and non- participated in FFS)

	FFS (n=72)		NONFFS (n=346)			
Variables	M	SD	M	SD	t	p
Attitudes towards biological control	25.5	3.3	23.2	2.5	5.5**	0.000
Social influence	11.4	3.5	11.5	2.6	0.131	0.896
Social participation	18.9	5.3	16.8	3.6	3.3**	0.001

** p<0.01

Table 4: Compare communication characteristics of rice producers in two groups (Participated and non- participated in FFS)

	FFS (n) =72		NONFFS (n=346)			
Variables	M	SD	M	SD	t	p
Use of mass media	20.3	8.6	8.2	3.5	11.8**	0.000
Use of information sources	27.5	7.1	15.3	6.2	14.7**	0.000

** p<0.01

Effect of Ffs on Rice Producers' Communication Characteristics: The extent to which farmer used mass media in month ranged from 0 to 46 hours (M=20.3; SD=8.6). The extent to which they used information sources ranged from 0 to 60 (M=27.5; SD=7.1). Among the averages of the variables use of mass media and use of information sources, significant differences were found when participant and non-participant farmers compared (Table 4). Significant differences of use of mass media and information sources between two groups of rice producers have been approved by Minjauw *et al* [23] and Hofisi [25].

Effect of Ffs on Rice Producers' Extension- Knowledge Characteristics : The knowledge of biological control ranged from 0 to 32 (M=22.4; SD=4.2). The effect of extension courses ranged from 0 to 100 (M=58.4; SD=11.2). The number of rice producers' contact with extension agent in month ranged from 0 to 4 (M=2.9; SD=1.5). Among the averages of the variables of the number of contacts with extension agent, effect of extension courses and knowledge of biological control, significant differences were found when participant and non- participant farmers were compared (Table 5). A significant difference in knowledge between two groups of rice producers have been approved by Tripp *et al.* [2], Mancini *et al.* [12], Bunyatta *et al.* [13], Khalid [14], Erbaugh *et al.* [16], Palis [17], Erbaugh *et al.* [18], Kimani and Mafa [19], Haiyang [20], Larsen *et al.* [21], Praneetvatakul and Waibel [22] 19, 20, 21, 22, Minjauw *et al.* [23], Ooi and Kenmore [26] and Reddy and Suryamani [27].

Effect of Ffs on Rice Farmers' Economic Characteristics: The average rice yield per hectare was 2.9 Ton. The average income of rice farmers was 4000$ in year. The cost-benefit of rice farmers' ranged from 2 to 4 (M=2.3; SD=0.6). Among the averages of the variables of yield, income and cost-benefit, significant differences were found when participating and non-participating farmers were compared (Table 6). Significant differences of yield, income and cost-benefit between two groups of rice farmers have been approved by Van den berg [8], Erbaugh *et al.* [18], Haiyang [20], Larsen *et al.* [21], Ooi and Kenmore [26], FAO [28] and Wu *et al*. [29].

Effect of Ffs Programs on Rice Producers' Innovation Characteristics: The relative advantage of biological control techniques ranged from 0 to 20 (M=13.4; SD=3.2). The adaptability of biological control techniques ranged from 0 to 20 (M=12.8; SD=3.4). The triability of biological control techniques ranged from 0 to 10 (M=5.8; SD=1.3). The visibility of biological control techniques ranged from 0 to 20 (M=13.8; SD=2.9). The complexity of biological control techniques ranged from 0 to 20 (M=10.2; SD=1.8). Among averages of the variables of relative advantage, adaptability, complexity, triability and visibility of biological control techniques, significant differences were found when participant and non- participant farmers were compared (Table 7). A significant difference of biological control techniques between two groups of rice producers have been approved by Minjauw *et al.* [23], Pontius [24] and Hofisi [25].

Effect of Ffs on Rice Producers' Adoption of Biological Control: The results showed that 63.9 percent of farmers who had participated in FFS adopt the techniques much and very much and only 13.3 percent of those who had not participated in FFS adopted the techniques much. The adoption of biological control ranged from 0 to 40 (M=25.9; SD=5.7). Among the averages of the variable of adoption of biological control, significant differences were

Table 5: Compare extension- knowledge characteristics of rice farmers in two groups (Participated and non participated in FFS)

	FFS (n=72)		NONFFS (n=346)			
Variables	M	SD	M	SD	t	p
Knowledge of biological control	22.4	4.2	19.6	4.2	5.2**	0.000
Effect of extension courses	58.4	11.2	34.3	12.8	16.2**	0.000
Number of contacts with extension agent	2.9	1.5	0.93	0.8	10.8**	0.000

** $p<0.01$

Table 6: Compare economic characteristics of rice farmers in two groups (Participated and non participated in FFS)

	FFS (n=72)		NONFFS (n=346)			
Variables	M	SD	M	SD	t	p
Yield	2.9	0.7	2.2	0.7	7.2**	0.000
Income	5.3	4.1	2.1	1.5	8.7**	0.000
Cost-benefit	3.9	1.2	2.4	0.6	10.5**	0.000

** $p<0.01$

Table 7: Compare innovation characteristics of rice producers in two groups (Participated and non participated in FFS)

	FFS (n=72)		NONFFS (n=346)			
Variables	M	SD	M	SD	t	p
Relative advantage	13.4	3.2	10.2	3.6	7.8**	0.000
Adaptability	12.8	3.4	6.4	3.1	15.9**	0.000
Triability	5.8	1.3	2.9	1.4	16.6**	0.000
Visibility	13.8	2.9	6.7	3.8	17.5**	0.000
Complexity	10.2	1.8	9.7	1.1	2.4**	0.02

** $p<0.01$

Table 8: Compare adoption of biological control of rice Producers in two group (Participated and non participated in FFS)

	FFS (n=72)		NONFFS (n=346)			
Variables	M	SD	M	SD	t	p
Adoption of biological control	25.9	5.7	17.6	5.7	11.2**	0.000

** $p<0.01$

Table 9: Stepwise Regression Analysis of influence variables in adoption of biological control in rice farmers who participated in FFS (N=72)

Step	Variable	R	R^2
1	Knowledge of biological control	0.59	0.348
2	Relative advantage of biological control techniques	0.703	0.495
3	Mechanization level	0.73	0.578
4	Rice farming experience	0.82	0.673
5	Social participation	0835	0.698
6	Umber of contacts with extension agent	0.848	0.718
7	Use of mass media	0.858	0.736
8	Use of information sources	0.871	0.759

$Y=6.51+0.705X_1 +0.592X_2 +0.167X_3 -0.106X_4 +0.193X_5 +0.567X_6 +0.234X_7 + 0.138X_8$

found when participant and non- participant farmers were compared (Table 8). Significant difference of adoption of biological control between two groups of rice producers have been approved by Tripp *et al.* [2], Khisa and Heinemann [6], Bunyatta *et al.* [13], Khalid [14], Erbaugh *et al.* [13,14,16], Kimani and Mafa [19], Ooi and Kenmore [26] , Reddy and Suryamani [27] and Huan *et al*. [30].

Effect of Rice Producers' Characteristics on Adoption of Biological Control: The results of the multiple regression analysis (stepwise method) revealed that the variables of biological control knowledge, relative advantage, mechanization level, rice farming experience, social participation, the number of contacts with extension agent, the extent to which farmers used mass media and information sources explained 75.9% of the adoption of biological control by rice producers who had participated in FFS (Table 9). Also the results of the multiple regression analysis (stepwise method) revealed that the variable of knowledge of biological control explained 83.1% of the adoption of biological control by rice producers who had not participated in FFS

CONCLUSION AND RECOMMENDATIONS

Based on finding of this study, the following conclusion was drawn and recommendations are given. Based on the preset definition of success, the FFS approach reduces reliance on chemical insecticides in rice while increasing yield, income and productivity and improving knowledge and adoption biological control. The Farmer Field School changed pest management behavior of farmers, resulting in better-informed decision-making and a clear overall reduction in the use of insecticides. In addition, increased awareness about the role of rats prompted trained farmers to spend more on control rate. This study experienced by farmers indicate that the benefits of FFS training are not restricted to only IPM but the learning approach potentially sets in motion the development of local programs which may affect all assets (natural, human, social and financial) of rural livelihoods. The stories by farmers express a dynamism, creativity and collegiality ? In comparing the two groups of rice producers (Participant and non-participant in FFS and non participated in FFS), it was found that Participated farmers were more literate, had more farming experience, had higher yield and productivity, used machineries in their farming practices. On the other hand non-participated farmers they were less involved in social participations, used less mass Medias such as radio and television as a source of learning and felt no need to participating in FFS activities in future. Therefore must be increased farmers' knowledge, accepted biological control techniques culturally and economically, promote interaction between farmers, extension agents and researchers and using more media and information resources. Also educational approach needed, because biological control in tropical small holder farms is highly dependent on local context, it often calls for farmers analytical skills and expertise. Improving farmer expertise requires hands-on education, such as provided by the Farmer Field School , for which there is no shortcut alternative.

Further and concrete studies are needed because of complexity of the impact evaluation; it is necessarily to combine studies using different perspectives in order to increase the scope and rigor of results. If studies are coordinated (e.g. by targeting the same population or time period), cross-verification of data sources can be enhanced.

Developmental Impacts Emphasize: Because of the trigger function of the IPM Farmer Field School (i.e. triggering empowerment and collective action), future impact studies, in particular those looking at long-term effects, should give increased emphasis to developmental impacts through participatory approaches and qualitative methods.

Broaden Institutional Basis of the FFS: Because of its multiple impacts, the IPM Farmer Field School should be given a broader basis, for example by involving sectors of education, environmental protection and public health.

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