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The Effective Factors on the Adoption of Biological Control in Farmers' Field School by Rice Producers: The Case of Babol Township

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The main purpose of this research is to determine the effective factors in adopting biological control in the Farmer Field School approach. The method used in this research is descriptive-correlation and comparative, which has been done by survey. The rice farmers of the township of Babol, Mazandaran, Iran were selected as the sample population of this research. The statistical sample of the research was 472 which included 92 rice farmers who attended the Farmer Field School and 380 people who did not participate in this course The designed questionnaire, after some modifications according to the corresponding experts' opinion, was distributed between the two groups of rice farmers. At last, 433 collected questionnaires were analyzed by SPSS software (81 of the rice farmers who participated and 352 of them that did not participate). The findings show that the independent variables of rice farmer's attitude toward to biological control, use of information sources and knowledge of biological control determine 85.5% of the changes in the dependent variable of adopting biological control. **[H, Moumeni Helali and A, Ahmadpour. The Effective Factors on the Adoption of Biological Control in Farmers' Field School by Rice Producers: The Case of Babol Township International Journal of Agricultural Science, Research and Technology, 2011; 1(4):201-206].**

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1. Introduction

The increasing needs to expand agricultural production and achieve a more appropriate level of food security lead to the uncontrolled use of chemical fertilizers and pesticides in 1950s. However, during the 1960s it became clear that the overuse of chemical pesticides not only has caused resistance in pests and the development of their new generations, but also has endangered the stability of the environment and human health. Therefore, using nonchemical control, like integrated pest management method, was gradually considered at the international level. And, for the first time in 1970, it was carried out in developing countries, But contrary to what was expected, the implementation of integrated pest management in developing countries was not successful. Researchers found the reason in the method of training the concepts of integrated pest management to the illiterate and less literate farmers of these areas. Because the methods which were used until then followed "Central" and "Top to Bottom" extension approach consequently due to lack of farmers' participation in the learning process the content of training courses in some cases was even and incomprehensible for farmer (Osko et al, 2007). Since human resource development and technology transfer and in line with it the change from the traditional methods of production to new methods based on scientific principles, one of the most important factors to achieve is Agricultural development that this will be obtained with researchers, extension agents and farmers' cooperation (Kalantari et al, 2005). One of the most suitable approaches in this case is the Farmer Field School approach that in 1998 the Food and Agriculture Organization and the office of comprehensive facilities of integrated pest management of this organization, the regional workshop of Biological control of plant pests in its summary in Near East, in Babolsar Township, Mazandaran, Iran, introduced the best way of public adoption of this innovation in the participation of all villagers in an educational environment without a wall, called Farmer Field School(Osko et al, 2007). originally the FFS were developed in Asia, where there are some 200 million rice farmers (Braun et al, 2000).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 (Dinpanah et al, 2010). That was developed in response to the Green Revolution. The aim was to re-educate farmers in agro-ecology and develop their critical thinking, based on the knowledge already available about rice ecosystems. (Braun et al, 2000). Farmer field schools are traditionally an adult education approach: a method to assist farmers to learn in a non formal setting within their own environment. FFS are "schools without walls" where groups of farmers meet weekly with facilitators. They are a participatory method of learning, technology development, and dissemination based on adult learning principles such as experiential learning (Davis et al, 2009). During the learning, all the stakeholders participate on an equal basis in field observations, discussions and in applying their previous experiences and new information from outside the community to reach management decisions on the appropriate action to take for increased production. Through farmer field schools, farmers learn about, and investigate for themselves, the costs and benefits of alternative management practices for sustaining and enhancing farm productivity (Onduru et al, 2002). In general, Farmer Field Schools (FFS) consist of groups of people with a common interest, who get together on a regular basis to study the "how and why" of a particular topic (Gallagher, 2003).

Many researchers like Gotland et al. (2004), Ooi and Kenmore (2005), Anandajayaskeram et al. (2007), Bunyatta et al. (2006) have proved investigation of farmer's field school (FFS) effect on difference variables. There are some researches like Mancini et al. (2007), Dinpanah and alavi (2008), Dolly (2009), Bunyatta et al. (2006), Rustam (2010), Erbaugh et al. (2007), Dinpanah et al. (2010), Bunyatta et al. (2005), Witt et al. (2006), Erbaugh et al. (2010) that have studied on adoption of technologies and innovations. Some variables in the research were selected from previous studies and some others from interviews with some experts in the field of agricultural extension and education. Many studies have identified important variables dealing with an FFS method. In Table 1, some of these studies are summarized.

This study is taken into consideration from this direction that rice is as a staple food of people after wheat in the world, and since in the production of this crop different pesticides are used to fight pests, which causes chronic diseases such as cancer, therefore this research aimed to determine factors in the direction of a better adoption of biological control to reduce the use of chemical pesticides in fighting against pests such as chilo suppresallias.

Table 1. Related references about the factors influencing the adoption of technologies and innovations in the FFS

Author	Variables or factors
Gotland et al (2004)	Knowledge.
Osko et al (2007)	Knowledge, attitude, age, educational level, rice farming experience, land size, cost.
Dinpanah et al (2010)	rice-cultivated land acreage, farm acreage, mechanization level, number of farming pieces, extent to used insecticides, attitudes towards biological control, social participation, use of mass media, use of information sources, yield, income, educational level, rice farming experience, knowledge of biological control, Effect of extension courses, number of contacts with extension agent.
Ooi and Kenmore (2005)	Knowledge, income.
Kalantari et al (2005)	Numbers of contacts with extension agent, number of participate in training classes, yield.
Witt et al (2006)	Sex, age, area under cultivation, ownership system, social altitude.
Davis et al (2009)	yield.
Anandajayaskeram et al (2007)	Income.
Erbaugh et al (2010)	Pesticide sprays, sex, age, years of education, household size, farm size, acres in crops, income, knowledge, distance to source of input.
Erbaugh et al (2007)	Age, educational level, knowledge of IPM.
Mancini et al (2007)	Age, educational level, extent to used pesticide, knowledge.
Bunyatta et al (2006)	Knowledge.
Reddy and Suryamani,M (2005)	Knowledge.
Rustam (2010)	Knowledge.

2. Materials and methods

This is a quantitative research with applied goal. Since controlling variables is a descriptive and correlational research, it was done by survey research. The rice farmers of the city of Babol, Mazandaran, Iran were selected as the statistical population of this study. 92 rice farmers participating in the farmer field school using the census and also according to Krejcie and Morgan's (1970) sampling table 380 rice farmers who did not participate in Farmer Field School using simple random sampling were chosen as the statistical sample. by the use

previous studies and some experts' opinion who hold the FFS courses the questionnaire was designed and developed. The validity was confirmed by corresponding specialist Masters. Reliability of the questionnaire was determined also by doing a pilot testing on 30 rice farmers out of samples and Cronbach's alpha coefficient was calculated at an average of 0.87 and confirmed. The questionnaires were distributed between two groups of rice farmers (92 farmers who participated in FFS and 380 farmers who did not participate in FFS). And finally, the 433 collected questionnaires were analyzed (81 of them for farmers who participated in FFS and 352 of them for the farmers who did not participate in the FFS). All the data were analyzed by SPSS software version 16. Meanwhile, in order to determine the effective factors in adopting the biological control first a correlation test was used. The independent variables which had a significant correlation with dependent variables were put into regression test and the effective factors in adopting biological control were determined by stepwise method.

3. Results and discussion

Farmer's individual and professional and agricultural and social and communication characteristics in the tow group (participation and non-participation in FFS):

According to table 2, the average education level of farmers who participated in the FFS is higher than those who did not participate in this course. Also, according to mechanization or the use of agricultural machinery in the rice farming, the findings show that the average use of agricultural machinery by the rice farmers who participated in the FFS is higher in comparison to those who did not participate in this course.

Also, the results of the descriptive statistics show that the mean scores of rice farmers participating farmer field school compared to those who did not participate in terms of the use of information resources and extension methods in finding information about biological control, and also attitude toward biological control, biological knowledge, social participation and social influence is in a higher level. In a way that in terms of the use of information resources the mean scores of rice farmers who participated in the FFS is 27.4583 but the mean scores of those who did not participate in the FFS is 19.3708. Also, in terms of the use of extension method the mean scores of rice farmers who participated in the FFS is 11.4444 but the mean scores of those who did not participate in the FFS is 6.5147. The mean scores of rice farmers who participated in the FFS are 26.6667 but the mean scores of those who did not participate in the FFS are 20.6581 in terms of their attitude toward the biological control. The mean scores of rice farmers who participated in the FFS in terms of Knowledge of biological control are 47.9522 but the mean scores of those who did not participate in the FFS are 28.9140. The mean scores of rice farmers who participated in the FFS in terms of social participation are 11.7778 but the mean scores of those who did not participate in the FFS are 9.4599. The mean scores of rice farmers who participated in the FFS in terms of social influence are 13.5556 but the mean scores of those who did not participate in the FFS are 8.1440.

Comparing rice farmers participated and not participated at FFS in terms of their adoption of the biological control:

According to table 3, there is a significant difference at the level of 1% (confidence of 99%) between two groups of rice farmers participating and not participating in the FFS course in terms of adopting biological control.

Investigating correlation between the independent variables and adoption of biological control:

According to table 4, there is a positive and significant correlation between the dependent variable as adopting biological control by rice farmers and the independent variables including: use of information sources, attitude toward biological control, knowledge of biological control of rice farmers. Therefore, in order to determine the effective factors on the adoption of biological control by rice farmers participating in the FFS these variables and regression test were used.

Determining the influential factors in the adoption of biological control:

The multiple linear regression analysis with the step by step method was used to determine the influential factors in the adoption of biological control in farmers' field school participatory approach by rice producers.

The result as of Table 6 shows attitude toward to biological control, use of information sources and knowledge of biological control predicts about 85.5% of the variances of the dependent variable.

According to the Table 5, regression Equation is:

$$Y= -8.292+ 0.341(X1) + 0.265(X2) – 0.127(X3)$$

Table 2. Farmer's individual and professional and agricultural and social and communication characteristics in the tow group (participation and non-participation in FFS)

Variable	FFS		NON-FFS	
	Mean	SD	Mean	SD
Age	44.62	9.592	46.97	11.066
Educational level	4.12	1.278	1.90	1.624
Number of family members	4.0	0.872	4.62	1.731
Rice cultivation experience (year)	26.0	12.705	25.98	13.049
rice-cultivated land size (ha)	1.428	0.722	1.6277	1.833
Mechanization level	0.942	0.960	0.6559	1.120
Use of information sources				
Very low	0.0		37.2%	
Low	33.3%		35.5%	
Moderate	66.7%		22.1%	
Much	0.0		5.2%	
Very much	0.0		0.0	
Average	27.4583		19.3708	
Standard Deviation	5.90193		11.08249	
Use of extension methods				
Very low	22.2		59.7%	
Low	11.1		25.8%	
Moderate	55.6		9.6%	
Much	11.1		2.9%	
Very much	0.0		2.0%	
Mean	11.4444		6.5147	
Standard Deviation	4.83994		6.36205	
Attitude toward biological control				
Very low	0.0		8.6%	
Low	0.0		19.4%	
Moderate	22.2%		28.6%	
Much	55.6%		18.3%	
Very much	22.2%		25.1%	
Mean	26.6667		20.6581	
Standard Deviation	4.18927		9.48404	
Knowledge of biological control				
Very low	0.0		6.5%	
Low	11.1%		48.5%	
Moderate	33.3%		32.7%	
Much	44.4%		11.7%	
Very much	11.2%		0.6%	
Mean	47.9522		28.9140	
Standard Deviation	9.87750		10.41922	
Social participation				
Very low	22.2%		35.1%	
Low	55.6%		35.6%	
Moderate	0.0		20.7%	
Much	11.1%		6.9%	
Very much	11.1%		1.7%	
Mean	11.7778		9.4599	
Standard Deviation	7.01605		6.18507	
Social influence				
Very low	0.0		31.8%	
Low	0.0		38.6%	
Moderate	77.8%		21.0%	
Much	11.1%		8.0%	
Very much	11.1%		0.6%	
Mean	13.5556		8.1440	
Standard Deviation	4.35029		4.78841	

Source: Research findings

Table 3. Mann–Whitney U adoption of biological control of rice Producers in two groups (Participated and non participated in FFS)

	T	Mean	SD	Sig
Adoption of biological control	-6.214	FFS participant= 2.0 NON-FFS participant= 0.9	1.50 1.03	0.000

Table 4. The result of Correlation coefficient between the independent variables and adoption of biological control

Variable	Correlation	r	Sig.
Use of information sources	spearman	0.599**	0.000
Use of extension methods	spearman	-0.009	0.936
Attitude to biological control	spearman	0.720**	0.000
Knowledge biological control	spearman	0.375**	0.001
Social participation	spearman	-0.108	0.336
Social influence	spearman	0.121	0.282

Table 5. Stepwise Regression Analysis of influence variables in adoption of biological control by rice farmers who participated in FFS (N=81)

Variables	R	R^2	B	Beta	T	Sig.
Attitude to biological control (x_1)	0.770	0.593	0.341	0.952	18.957	0.000
Use of information sources (x_2)	0.845	0.714	0.265	1.045	11.428	0.000
Knowledge of biological control (x_3)	0.925	0.855	-0.127	-0.836	-8.655	0.000
Constant	-	-	-8.292	-	-	-

Source: Research findings.

According to result of Comparing rice farmers participated and not participated at FFS in terms of their adoption of the biological control, there is a significant difference at the level of 1% (confidence of 99%) between two groups of rice farmers participating and not participating in the FFS course in terms of adopting biological control. In other words rice farmers that attended the Farmer Field School approach are using more of the biological control than rice farmers that did not attend this course. That is in the same direction with the findings of Mancini et al. (2007), Dinpanah and alavi (2008), Dolly (2009), Bunyatta et al. (2006), Rustam (2010), Erbaugh et al. (2007), Dinpanah et al. (2010), Bunyatta et al. (2005), Witt et al. (2006), Erbaugh et al. (2010) research. Since this course has been effective in increasing farmers' adoption of biological control, it is suggested that this training-extension course be held for farmers especially rice farmers in different regions to finally see the use of biological control by all rice farmers instead of chemical pesticides to reduce pest populations such as chilo suppresallias. According to result of Investigating correlation between the independent variables and adoption of biological control, there is a positive and

significant correlation between the dependent variable as adopting biological control by rice farmers and the independent variables including: use of information sources, attitude toward biological control, knowledge of biological control and social influence of rice farmers. In other words, the more information sources rice farmers use the more biological control they use. The more believe they have in biological control the more they use it. The more knowledge rice farmers have about biological control the more they use it. Also, the higher influence and social prestige rice farmers have, the more biological control they use. The result as of regression shows attitude toward to biological control, use of information sources and knowledge of biological control predicts about 85.5% of the variances of the dependent variable.

4. Conclusion and Recommendations

Farmer Field School approach is a collaborative method in which the farmers gather together weekly for a special crop on its one-period growth and every session one particular issue is discussed to finally achieve a complete knowledge of that particular issue, and eventually they themselves be the expert of their farms. One of the objectives of holding this course is the implementation of the integrated pest management and the adoption of biological control. Hence the present study investigated the factors affecting the adoption of biological control. The findings of the study show that there is a significant difference at between two groups of rice farmers participating and not participating in the FFS course in terms of adopting biological control. In other words rice farmers that attended the Farmer Field School approach are using more of the biological control than rice farmers that did not attend this course. Also, in investigating the effective factors on adopting biological control the research results indicate that the variables of attitude toward to biological control, use of information sources and knowledge of biological control are the important factors in adopting biological control, that paying attention to these factors seems to be important in holding the FFS courses for farmers, especially rice farmers.

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