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Research Article

SOCIO-ECONOMIC FACTORS ON ADOPTION OF BIOLOGICAL CONTROL IN IRAN

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ABSTRACT
One of the key elements for pesticide usage reduction is live organisms against pests which are called Bio-control. This new approach affects by many socio-economic factors in farmers. The main instrument for collecting data was a questionnaire which prepared for target populations of farmers in *Guilan and Khuzestan* regions, Iran. Results showed that age, rice culture activity experience, distance between home and field, social corporation amount, rate of leadership in biological control, cultivated field in recent year, average yield of rice per year, behavior of extension agents in biological agent promotion were regarded as the main effective factors on biological control adoption.

Keywords: *Biological Control, Adoption, Parasitoid, farmers, Iran*

INTRODUCTION
Currently, due to increasing population, agriculture must meet the food needs of the people in the next century. Rice, being the staple food of many people, mainly in Asia, the second largest consumptions food of Iranian households and the most rice growing provinces are *Guilan*, *Mazandaran*, *Golestan*, *Khuzestan* and *Fars* regions. In recent years, many agricultural programs increased the quality and quantity of paddy rice yield, but some factors such as pests causing a decline in the quality and quantity of rice in some area. Major pest of rice in the *Guilan* province is rice stem borer (*Chilo suppresalis*) which causes damage to paddy encompasses every year. Recent decades in many countries, under different titles, programs to reduce and prevent pollution caused by pesticides have been implemented (Jervis, 2005). Today, the policy goal of reducing pesticide programs and alternative pest management practices, particularly in the organic world, the prevention of such hazardous materials in all aspects of environmental risks have emerged.
The agriculture sector and organization which can reduce the use of pesticide in rice farmers' decisions identify carried out experimental researches in different countries that showed a wide range of social-economic factors can influence farmer's decisions on pesticides use (Jetter, 2005). Some researchers in the world studied effective factors on new technology adoption including biological control adoption by farmers (Abeydeera, 1994; Monfared, 1995; Salami and Khaledi, 2001; Hosseini *et al*., 2010; Singh *et al*., 2008; Gullen *et al*., 2008; Niyaki *et al*., 2010, Mahdavi and Fahimi, 2001; Dinpanah *et al*., 2009; Hosseini and Niknami, 2001; Pezeshki-Rad *et al*., 2006). Abeydeera (1994) reported that the biological control application decreases total control cost more than where no biological agent is used. Several studies carried out in our country were in line with these studies. Monfared (1995) quoted the findings of regression analysis and indicated that access to inputs, credit, farm size, and contact with extension agent, listening to radio programs, membership organizations, cooperatives in the village and nearby roads have a significant relationship with the adoption of new technologies and fragmentation of paddy field is one of the inhibiting factors in technology adoption. Salami and Khaledi (2001) concluded that the biological approach taken by rice adopter farmers decreased pesticides application against rice stem borer to 17.4 kg/h compared with other non-adopter farmers 31.14 kg/h. However, it is evident that there is a need for use of new technologies in the agricultural sector more than any time (Hosseini *et al*., 2010). The adoption of new ideas and practices is affected by at least five factors: 1) the type of decision involved in

adoption; 2) perceived attributes of the innovation; 3) communication channels used; 4) nature of the client system, and 5) the extent of the practitioner's effort (Lamble, 1984). A major function of extension practitioners is to facilitate the adoption of new ideas and practices or to influence the rate of diffusion and adoption of innovations by their clients. To enhance their effectiveness as change agents, extension practitioners must understand the unique characteristics that describe their clientele system. Two decades ago Rogers and Shoemaker (1971) conducted research on adopter features to enable diffusion agencies (i.e. Cooperative Extension) to appropriately categorize and address adopter audiences. They analyzed publications and reviewed hundreds of empirical diffusion research that either supported or did not support more than four dozen generalizations about technology adoption. Their findings related various independent variables to innovativeness (dependent variable) that was then grouped into three categories of generalizations: 1) socioeconomic status; 2) personality variables; and 3) communication performance. For example, a socioeconomic generalization states that earlier adopters are no different from later adopters in age; a character generalization states that earlier adopters have greater empathy than later adopters; and the information behavior of an earlier adopter includes more contact with change agents than that of a later adopter. The goal of this investigation is the determination of effective socio-economical factors on adoption of biological control methods in Iran.

MATERIALS AND METHODS

***Study area**:* The area of study is the 2 province in Iran including *Guilan* region (*Astaneh Ashrafieh*, *Rezvanshahr* and *Roudsar* cities) and *Khuzestan* region.

Data Collection: The main instrument for collecting data was a questionnaire. Target populations were farmers of *Guilan* and *Khuzestan* provinces. Respondents selected from the rural area were categorized into adopters and non adopters of pest's biological control.

***Variables**:* In this study, the dependent variable was adoption of pest's biological control among farmers. The dependent variable was dichotomized with a value 1 if a farmer were an adopter of biological control and 0 if non-adopter. The independent variables in this study are 20 socio-economic factors.

Sample size: The sample population was 364 farmers who were selected by random sample According to Table Bartlett (2001). It includes 198 adopters and 166 non-adopters (Table 1).

Table 1: Sample size

	Frequency	Frequency Percent
Non-Adopters	166	45.6
Adopters	198	54.4
Total	364	100.0

Data analysis: Logistic regression was used for data analysis, using SPSS ver. 18 software. The socio-economic variables for the two groups were examined using logistic regression model. The dependent variable was dichotomized with a value 1 if a farmer was an adopter of biological control and 0 if non-adopter. The model was specified as follows

RESULTS AND DISCUSSION

The results of the Logit likelihood regression model indicated that the overall predictive power of the model (82.5%) is quite high, while the significant Chi square ($p<0.05$) is indicative of strength of the joint effect of the covariates on probability of adoption among farmers in the zone. The results also showed that the decision on application of pests biological control is determined by age (Age), rice culture activity experience (RCE), distance home from field (HFD), social corporation amount (SC), rate of Thought Leadership in biological control (BCL), cultivated field in recent year (CF), average yield of rice per year (RY), behavior of extension agents in biological agent promotion (EAB) which have significant influence. Also, the Wald indicating the relative contribution of individual variable to probability of adoption of pest's biological control showed that BCL (22.980) was the one most important factor determining choice of application of biological control agent among the farmers (Table 3).

Table 2: Definition of variables included in the regression model

Dependent variable	
Adoption (Y)	Adopters = 1, Non adopters = 0
Independent variable	
Age (Age)	Age of the farmer, measured in year
Family Size (FS)	Number of family members
Agricultural activities experience (AAE)	Year farming experience, measured in year
Rice culture activity experience (RCE)	Year farming experience, measured in year
Distance home from field (HFD)	Meter
Rate of Communication with the City (CR)	Very mach = 5, Much = 4, Intermediate = 3, Little = 2, Very little = 1
Associated with agricultural service center (ASR)	Very mach = 5, Much = 4, Intermediate = 3, Little = 2, Very little = 1
Social corporation amount (SC)	Very mach = 5, Much = 4, Intermediate = 3, Little = 2, Very little = 1
Rate of Leadership in biological control (BCL)	Very mach = 5, Much = 4, Intermediate = 3, Little = 2, Very little = 1
Rate of participation in educational -extensional activities (RR)	Very mach = 5, Much = 4, Intermediate = 3, Little = 2, Very little = 1
The total area of land owned (OFW)	Farm area (ha)
Number of owned farm patches (OFN)	Number of patches
Number of domesticated cattle (DCN)	Number of animal
Cultivated field in recent year (CF)	Farm area (ha)
Average yield of rice per year (RY)	Ton/ha
Family help in agricultural activities (FH)	Very mach = 5, Much = 4, Intermediate = 3, Little = 2, Very little = 1
Accessibility to agriculture input (fertilizers, pesticides, machinery equipments (AIA)	Very mach = 5, Much = 4, Intermediate = 3, Little = 2, Very little = 1
Accessibility to financial resources/credits/investment (FRA)	Very mach = 5, Much = 4, Intermediate = 3, Little = 2, Very little = 1
Pesticide usage amount (PU)	Very mach = 5, Much = 4, Intermediate = 3, Little = 2, Very little = 1
Behavior of extension agents in biological agent promotion (EAB)	Very good = 5, Good = 4, Intermediate = 3, Bad = 2, Very bad = 1

Y = f (Age, FS, AAE, RCE, HFD, CR, ASR, SC, BCL, BCL, RR, OFW, OFN, DCN, CF, RY, FH, AIA, FRA, PU, EAB)

In totally, the analysis has shown that there was a positive relationship between the probability of adoption of biological control and variables of rice culture activity experience ($p<0.01$), distance home from field ($p<0.05$), social corporation amount ($p<0.01$), rate of leadership in biological control ($p<0.01$), cultivated field in recent year ($p<0.05$), average yield of rice per year ($p<0.01$), behavior of extension agents in biological agent promotion ($p<0.05$). But, the analysis has shown that there was a negative relationship ($p<0.01$) between the probability of adoption of biological control and age (Table 3).

Table 3: Logistic regression coefficients of the factors affecting adoption of biological control

Variables	*B*	*S.E.*	*Wald*	*Sig.*
Age	-0.111	0.034	10.586	0.001***
FS	-0.115	0.110	1.075	0.300
AAE	0.051	0.040	1.617	0.204
RCE	0.082	0.033	6.000	0.014***
HFD	0.001	0.001	5.347	0.021**
CR	-0.251	0.230	1.187	0.276
ASR	0.212	0.276	0.591	0.442
SC	0.777	0.208	13.979	0.000***
BCL	1.278	0.267	22.890	0.000***
RR	0.093	0.218	0.182	0.670
OFW	-0.066	0.048	1.867	0.172
OFN	0.004	0.014	0.086	0.770
DCN	-0.064	0.043	2.201	0.138
CF	0.118	0.054	4.797	0.029**
RY	0.174	0.063	7.500	0.006***
FH	-0.053	0.183	0.083	0.774
AIA	-0.118	0.232	0.258	0.611
FRA	0.175	0.216	0.652	0.419
PU	-0.333	0.258	1.668	0.196
EAB	0.404	0.206	3.855	0.050**
Constant	-3.435	2.030	2.863	0.091*

****, ** and *, Significant at $P < 0.01$, $P < 0.05$, and $P < 0.10$, respectively. B, Parameter estimate; SE, Standard error. -2log likelihood is 168.473;Chi square statistic is 196.119***; Overall correct prediction is 82.5%*

In order to do any kinds of pest control including agricultural, chemical and biological, proper understanding on basic components of pest life stages is important during program. The present study showed that this is not so much of a high recognition on rice paddy programming, and then knowledge raise on this issue is essential elements of the promotional activities for new technology introduction. The use of chemical pesticides in agriculture has always been faced with numerous problems and limitations. Since most of the farmers had low literacy level must be involved in the promotion of effective learning strategies. In this respect, continuous learning and scientific effectiveness play the key role on biological control adoption. The great problem that has threatened the agricultural sector (or rather farmers) is lack of proper education and low literacy of farmers traditionally.

Muthuraman and Sain (2002) found that the lack of knowledge about pest management strategies and lack of community actions was among the major barriers in the adoption of IPM technologies by farmers. Palis *et al.* (2002) found that kin networks, neighborhoods, membership in a farmer's association cause adoption of IPM technologies. Therefore, with efforts to increase the education levels of farmers, they will be familiar with the benefits of modern methods of biological control. In general, the use of *Trichogramma* requires a high risk compared with pesticides application while most of the farmers have not other work. Second job is causing farmers to rely on less income and operate with simple control method with no insert to the development of biological methods. Gullen *et al*., (2008) noted that farmers must perceive biological pest control innovations to have economic advantages at an acceptable level of risk when compared to the relatively simple conventional agrochemical control methods. Singh *et al.* (2008) showed that technology knowledge through formal crop-specific IPM training provided by farmers' field schools is extremely important for wider adoption of IPM in the study area. Hence, investment in IPM education through these programs will have long-term beneficial impact. Local language should be used. It seems that all dimensional outcome measures are needed in growing levels of field combat as biological control. The results of this study and the reviewed experiences of other countries have showed that the most important factor influencing the success of biological control programs using support in all stages of present IPM program. In this way, a convenient tool for grower's education and participation in organized programs of integrated pest "farmer field schools" are suggested. According to Niyaki *et al.* (2010), the main important factors of adoption of biological control include education level, family size, experience in rice culture, rate of participation in educational-extensional activities. Ferguson and Yee (1995) found that the participation of farmers in IPM activities affected adoption of not chemical methods and IPM technologies. The executives also revised the traditional methods, the organization of participatory approaches to training them to pay in the form of paddy. To achieve this requires providing the necessary facilities, changing the attitudes of managers and executives, and the introduction of and training on how to implement these programs. Surveys of tree fruit and small grains producers were undertaken to assist the Utah IPM Program with more effectively targeting its outreach efforts. Some differences in responses of the two grower groups can be explained by grower experience and past intensity of Extension IPM outreach efforts. The survey revealed that greater consideration should be given to grower background (part-time versus full-time, farm size, market destination), perceptions of pest problems, current use of IPM, and preferences for educational formats (Alston and Greding, 1998).

Bonabana-Wabbi (2002) indicated that the membership in farmers' association had the positive effect on the level of adoption of IPM practices. Luther *et al*. (2005) found the significant difference between farmers who participated in extension activities and farmer's field schools (FFS) for IPM adoption compared to those who did not participate in these activities. Barrera *et al.* (2005) found that information sources had a positive impact on the adoption of IPM technologies. FFS program was the main determinant in IPM adoption. Other factors were field days, pamphlets, and exposure to FFS participants. Asghari and Hadi (2009) found that social participation of farmers, membership in rural associations, participation in extension activities, and communication with extension experts had the significant correlation with the adoption of biological control by farmers. Erbaugh *et al.* (2010) found that the participation of farmers in farmer field schools programs influenced increasing IPM knowledge of farmers significantly. Also, IPM knowledge was a major factor in the adoption of IPM technologies among farmers. In General, farmers' awareness on pest life cycle associated with social participation in agricultural cooperative with education of paddy rice farmer can lead to better yield in biological control adoption.

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REFERENCES

Abeydeera WM (1994). Impact of intervention: integrated pest management in rice_based farming system . Third Asia farming systems symposium (Agris Abstract).

Alston DG and Greding ME (1998). Factors influencing adoption and educational outreach of integrated pest management. Available: http://www.joe.org/ joe/ 1998 june/a 3.html.

Asghari S and Hadi F (2009). The study of extension effects on adoption of biological control in soybean farmer at Moghan (Ardebil province, Iran). *1st National New Technology in Agriculture and Natural Resources*, *Rasht* 982-996.

Barrera V, Norton GW, Alwang JR and Mauceri M (2005). Adoption of Integrated Pest Management Technologies: A Case Study of Potato Farmers in Carchi, Ecuador. *American Agricultural Economics Association Annual meeting*.

Bonabana-Wabbi J (2002). Assessing Factors Affecting Adoption of Agricultural Technologies: The Case of Integrated Pest Management (IPM) in Kumi District, Eastern Uganda. MS thesis, Virginia Polytechnic Institute and State University.

Dinpanah GR, Mirdamadi SM, Chizari M and Alavi SV (2009). An Analysis of the Effect of Farmer Field School Approach on Adoption of Biological Control by Rice Farmers In Sari County, Iran. *Iranian Journal of Agricultural Economics and Development Research* **40**(1) 75-84.

Erbaugh JM, Donnermeyer J, Amujal M and Kidoido M (2010). Assessing the Impact of Farmer, Field, School Participation on IPM Adoption in Uganda. *Journal of International Agricultural and Extension Education* **17**(3) 5-17.

Ferguson W and Yee Y (1995). A Logic model of Cotton Producer Participation in Professional Scout Programs. *Journal of Sustainable Agriculture* **5**(3).

Hosseini JF, Dehyouri S, Mirdamadi M (2010). The perception of Agricultural Researchers about the Role of Nanotechnology in Achieving Food Security. *African Journal of Biotechnology* **9**(37) 6152-6157.

Hosseini SM and Niknami M (2001). Factors Affecting the Adoption of *Trichogramma* Application in Controlling *Chilo Suppressalis* by Rice Growers In Amol. *Journal of Agricultural Sciences* **7**(1) 95-110.

Jervis MA (2005). Insects as natural enemies: a practical perspective (Springer, New York).

Jetter K (2005). Economic framework for decision making in biological control. *Biological Control* **35** 348–357**.**

Lamble W (1984). Diffusion and adoption of innovations. In Donald J. Biackbum Ontario: University of Guelph 32-41.

Luther GC, Harris C, Sherwood S, Gallagher K, Mangan J and Gamby KT (2005). Development and Innovations in Farmer Field School and Training of Trainers. Globalizing IPM (Black Well Publishing) 275.

Mahdavi A and Fahimi GR (2001). Biological Control of *Chilo Suppressalis* in Rice Fields and Its Role in Pesticide Reduction in North of Iran. *Journal of Environmental Science and Technology* **9** 31-40.

Monfared N (1995). The study of effective parameters on innovation adoption in rice culture and its effects on woman in Mazandaran and Fars provinces, M.Sc thesis on agricultural education and extension, Agriculture College, Shiraz University.

Muthuraman P and Sain M (2002). Sociology of Integrated Pest Management in Rice. *Resources Management in Plant Protection during Twenty First Century, Hyderabad, India* **2** 14-15.

Noorhosseini-Niyaki SA, Radjabi R, Allahyari MS (2010). Social Factors Critical for Adoption of Biological Control Agents *Trichogramma* Spp. Egg Parasitoid of Rice Stem Borer *Chilo suppressalis* in North of Iran. *American-Eurasian Journal of Agriculture and Environmental Science* **9**(2) 133-139.

Palis FG, Morin S and Hossain M (2002). Social capital and diffusion of integrated pest Management technology: case study in Central luzon, Philippines. *Social Research Conference, CIAT, Cali, Columbia*.

Pezeshki-Rad Gh, Masaeli M and Yaghoubi J (2006) The study of effective social factors on adoption of integrated control of rice stem borer by farmers of Isfahan province. *Iranian Journal of Agricultural Sciences* **2**(1) 27-33 (In Persian with English Abstract).

Rogers EM and Shoemaker FF (1971). Communication of Innovations: A cross-cultural approach (The Free Press, New York) 167-169.

Salami HA and Khaledi M (2001). Impact of Biological Technology of *Chilo Suppressalis* Control on Pesticides Use: Case Study in Mazandaran Province. Eqtesad-E Keshavarzi Va Towse'e, **9**(1 (33)): 247-270 (In Persian with English Abstract).

Singh A, Vasishtb AK, Kumara R and Dasc DK (2008). Adoption of Integrated Pest Management Practices in Paddy and Cotton: A Case Study in Haryana and Punjab. *Agricultural Economics Research Review* **21** 221-226.