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A Logistic Regression Analysis: Agro-Technical Factors Impressible from Fish Farming in Rice Fields, North of Iran

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Abstract

This study was carried out to identify Technical-Agronomic Factors Impressible from Fish Farming in Rice Fields. This investigation carried out by descriptive survey during July-August 2009. Studied cities including Talesh, Rezvanshahr and Masal set in Tavalesh region near to Caspian Sea, North of Iran. The questionnaire validity and reliability were determined to enhance the dependability of the results. Data were collected from 184 respondents (61 adopters and 123 non-adopters) randomly sampled from selected villages and analyzed using logistic regression analysis. Results showed that there was a significant positive relationship ($p<0.05$) between biological control of pests in rice fields and the fish farming in rice fields. Also, there was a significant negative relationship ($p<0.10$) between the fish farming in rice fields and variables of quantity using pesticide of Diazinon in rice fields and number of plows in rice fields.

Keywords:
Rice-Fish Farming, Technical-Agronomic Factors, Pest, Weed, Plow, Fertilizer

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INTRODUCTION

The earliest records of fish culture in rice-fields originate from China, circa 2000 years ago, followed by India, 1500 years ago. Other countries with a recorded history of rice-fish culture are Indonesia, Malaysia, Thailand, Japan, Madagascar, Italy, Russia, Vietnam (Rothuis, 1998), Egypt, Philippines, Bangladesh, Cambodia, Korea and other countries (Saikia and Das, 2008; Frei and Becker, 2005; Halwart, 1998). Also in northern Iran rice-fish farming is a new farming system (Karami *et al.,* 2006; Noorhosseini and Allahyari, 2010). Integrated rice-fish farming offers a solution to economic problem of farmers by contributing to food, income and nutrition. Not only the adequate supply of carbohydrate, but also the supply of animal protein is significant through rice-fish farming. Fish, particularly small fish, are rich in micronutrients and vitamins, and thus human nutrition can be greatly improved through fish consumption (Larsen *et al.,* 2000; Ahmed and Garnett, 2011; Noorhosseini and Mohammadi, 2010). Many reports suggest that integrated rice-fish farming is ecologically sound because fish improve soil fertility by increasing the availability of nitrogen and phosphorus (Giap *et al.,* 2005; Dugan *et al.,* 2006; Noorhosseini, 2012).The feeding behavior of fish in rice fields causes aeration of the water. Integrated rice-fish farming is also being regarded as an important element of integrated pest management (IPM) in rice crops (Berg, 2001; Hilbrands and Yzerman, 2004). At the farm level rice-fish integration reduces use of fertilizer, pesticides and herbicides in the field. Such reduction of costs lowers farmer's economic load and increases their additional income from fish sale (Noorhosseini, 2010; Noorhosseini and Radjabi, 2010). Also, integrated rice-fish farming gave higher rice yields and fetched higher gross margin than sole rice cropping system (Das *et al.,* 2002; Hossain *et al.,* 2005). Ahmed and Garnett (2011) Reported that higher yields can be achieved by increasing inputs in the integrated farming system. Integrated rice-fish farming also provides various socioeconomic and environmental benefits. Nevertheless, only a small number of farmers are involved in integrated rice-fish farming due to a lack of technical knowledge, and an aversion to the risks associated with flood and drought. In addition, Ahmed *et al.,* (2011) Reported that rice-fish farming is as production efficient as rice monoculture and that integrated performs better in terms of cost and technical efficiency compared with alternate rice-fish farming. However, a lack of technical knowledge of farmers, high production costs and risks associated with flood and drought are inhibiting more widespread adoption of the practice. Our objective was to identify technical-agronomic factors impressible from fish farming in rice fields in north of Iran.

MATERIALS AND METHODS

Studied Location and Survey: This study was carried out by survey during July and August 2009. Studied area including Talesh, Rezvanshahr and Masal set in Tavalesh region of Guilan province near to Caspian Sea, north of Iran (Figure 1). Respondents were selected from rural area and categorized into adopters and non-adopters of integrated rice-fish farming. Totally 184 farmers were selected by stratified random sampling technique using the table for determining the sample from given population developed by Bartlett *et al.,* (2001) that including 61 (33.15%) adopters and 123 (66.85%) non-adopters (Table 1). This survey was conducted in using a questionnaire with open-ended questions. The questionnaire was pre-tested by in-

Table 1: Total sample size used in the study area

	Talesh	Masal	Rezvanshahr	Total
IRFF Adopters Population	31	31	17	17
IRFF Adopters Sample Size	19	28	14	14
IRFF Non-adopters Sample Size	38	56	29	29

Source: Survey Results, 2009

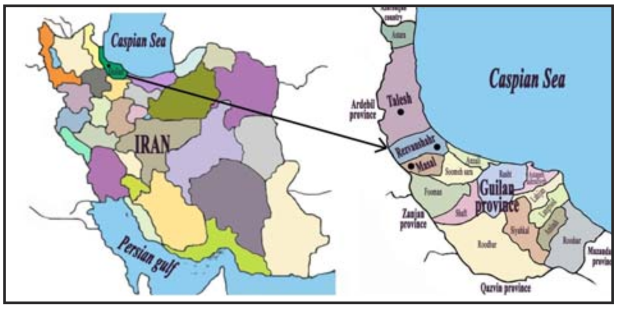

Figure 1: Site of study

terviewing three farmers (not included in the study). After some modifications, it was tested again with 10 other respondents.

Statistical Analysis: The technical-agronomic variables for the two groups were examined using logistic regression model. The dependent variable was the adoption of rice-fish farming. The dependent variable was dichotomized with a value 1 if a farmer was an adopter of integrated rice-fish farming and 0 if non-adopter. The definitions and measurement of variables are present in Table 2. AF, AH, MW, AP, BP and WI were entered in the model as dummy variables. The other variables namely QF, QD and NP were entered as continuous variables. Data analysis was conducted with Statistical Package for Social Sciences (SPSS 18).

The model was specified as follows;

$$Y = f\,(AF, QF, AH, MW, AP, BP, QD, NP, WI)$$

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 adoption of rice-fish farming is determined by biological control of pests in rice fields (BP), quantity using Diazinon in rice fields (QD) and number of plows in rice fields (NP) which have significant influence. Also, the Wald indicating the relative contribution of individual variable to probability of adoption of rice-fish farming showed that BP (4.538) was the most important factor determining choice of adoption of rice-fish farming among the rice farmers. Generally, the results of logistic regression show that there was a significant positive relationship ($p<0.05$) between biological control of pests in rice fields and the fish farming in rice fields (Table 3). These results were similar to Frei and Becker (2005) and Kathiresan (2007). In other words, fish farming in rice fields reduced the use of chemical control methods that is light reason of rice-fish farming system sustainability. Also, there was a significant negative relationship ($p<0.10$) between the fish farming in rice fields and quantity using Diazinon in rice fields (Table 3). These results are consistent with Saikia and Das (2008), Salehi and Momen Nia (2006). The use of chemical control methods reduced with adoption of rice-fish farming which is also

Table 2: Definition of variables included in the regression model

Dependent variable **Y = Adoption**	**Adopters = 1, Non adopters = 0**
Independent variable	Yes = 1, No = 0
AF = Application of Chemical Fertilizers	Kg/ha
QF = Quantity Using Chemical Fertilizers	Yes = 1, No = 0
AH = Application of Herbicides	Yes = 1, No = 0
MW = Mechanical Control of Weed	Yes = 1, No = 0
AP = Application of Pesticides	Yes = 1, No = 0
BP = Biological Control of Pests	Kg/ha
QD = Quantity Using Diazinon	Number in year
NP = Number of Plows	Very mach = 5, Much = 4, Intermediate = 3, Little = 2, Very
WI = Accessibility to Water Supply for Irrigation	little = 1

RESULTS AND DISCUSSION

The results of the Logit likelihood regression model indicated that the overall predictive power of the model (70.1%) is quite high, while the significant Chi square ($p<0.01$) is indicative of

compatible with sustainable agriculture. Since many fish species feed partly on the aquatic fauna, it has been assumed that they can act as biological control agents in rice fields. Concurrent rice and fish culture decrease pesticides appli-

Table 3: Logistic regression coefficients of the technical-agronomic factors affecting adoption of rice-fish farming

	B	S.E.	Wald	Sig.
AF	-19.131	25320.477	0.000	0.999
QF	0.000	0.001	0.005	0.943
AH	-21.476	18858.287	0.000	0.999
MW	20.493	40192.879	0.000	1.000
AP	0.611	0.558	1.200	0.273
BP	0.996	0.468	4.538	0.033**
QD	-0.029	0.016	3.311	0.069*
NP	-0.717	0.396	3.273	0.070*
WI	0.112	0.167	0.450	0.502
Constant	20.822	51110.003	0.000	1.000

*** p<0.01, ** p<0.05 and * p<0.10
-2 log likelihood = 204.830
Chi square statistic = 28.943***
Overall Correct predictions = 70.1%

cation compare monoculture (Berg, 2002; Noorhosseini, 2011). In general, common carp, being an omnivorous feeder, seems to be the most promising species in controlling insects and snails [15]. In addition, there was a significant negative relationship (p<0.10) between fish farming in rice fields and number of plows in rice fields (Table 3). According to results, by adoption of rice-fish farming, number of plows was reduced. It seems that the decrease of tillage frequency among adopters, caused by farms occupied by fishes is the time dimension.

CONCLUSION

In general, our results suggest that biological control of pests in rice fields, quantity using Diazinon in rice fields, and numbers of plows in rice fields were the most important technical-agronomic factors impressible from fish farming in rice fields. In other words, adopters of rice-fish farming used less chemical materials in order to control pests and reduce the number of plows. Furthermore, society health and environment sustainability will be saved and they reach more profit that is economical. Also, since aquaculture requires resources such as pond, land, water and other inputs, poor farmers cannot afford the requirements. As a target to understand and meet their needs and to access the common water resources available in their rice-fields, rice-fish farming is the most appropriate technology in recent times.

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