Determinants of Farmers' Level Awareness on Pesticide Use at Dumki Upazila under Patuakhali District

ABSTRACT

The major aims of this study were mainly to determine and describe the extent of farmers' level of awareness on pesticide use in the study area and also explore the relationship between the 10 selected characteristics of the farmers with their level of awareness on pesticide use. The study was designed with a mixed-method approach where both qualitative and quantitative analyses are blended in a rational way to have a deeper understanding of research problems. The study was conducted in Dumki Upazilla under Patuakhali district, Bangladesh. Simple random sampling technique was used to select 110 farmers except landless engaged in crop production using various types of pesticides. Data were collected by face to face interview using a pretested interview schedule during the period from March 10 to April 15, 2020. Data were analyzed using descriptive statistical measures and computer software like SPSS. Pearson's Product Moment coefficient of correlation results showed that out of 10 independent variables, the correlation coefficients of 6 variables had a positive and significant relationship with their level of level of awareness on pesticide use. The stepwise multiple regression analyses stated that only 4 variables such as communication exposure, knowledge on pesticide use, risk orientation and training experience had a significant contribution to the farmers' level awareness on pesticide use and also accounted for 54.5 per cent of the total variation in awareness index.

INTRODUCTION:

Bangladesh is predominantly an agricultural country where agriculture sector plays a major role in accelerating economic growth. About 13.31% of Gross Domestic Product and around 40%(LFS 16-17) of the total labour force of the country comes from agriculture sector [1]. It is therefore important to have a profitable, sustainable and environment-friendly agricultural system to ensure long-term food security for its large, dense ever-growing population [2]. Although, productivity in agricultural sectors is very important for Bangladesh perspectives but various social, economic, and psychological factors hinder the productivity. Among the factors scarcity of cultivable land is very crucial. The total cultivable land in Bangladesh is estimated to be 8.52 million hectares with an average cropping intensity of 191 [3]. The performance of this sector is very low and affects overall economic growth. According to Food and Agriculture Organization (FAO) projections, the global agricultural land area is expected to expand from 5.1 billion ha to 5.4 billion ha in 2030 [4]. Due to scarcity of cultivable land, farmers have to use small piece of land repeatedly for increased production using excessive agro-chemicals. Most of the farmers without awareness use a wide range of pesticides to prevent crop loss from pest attack and diseases. A study conducted in Bangladesh on rice, potato, mango and sugar cane farmers where the authors found that 47 percent of farmers were overusing pesticides, and only 13 percent of them use protective measures while applying pesticides [5]. Most of the farmers involved in the handling of pesticides, are at a high risk of exposure to pesticides through contact with its residues on treated crops, unsafe and inappropriate handling, storage and disposal practices, poor maintenance of spraying instruments, and the lack of protective equipment or failure to use it properly [6,7]. In some similar studies, the results predict that a great majority of the farmers (>90%) considered pesticides to be harmful to human health, but less than 20% of them used masks, impermeable clothes or gloves during the application of pesticide [8]. Despite the presence of rules and regulations, it has

been observed that pesticides are not used in an appropriate manner which in the long turn creates numerous hazards on human health and environment.

As for example a number of researchers mentioned that despite positive effects of pesticides in agriculture and human wellbeing, their use also causes several risks to human health, non-target organisms, environment as a whole [9,10]. Approximately five (5) billion kg of pesticides are applied per year in the world, which can have serious effects on non-target organisms, food chain and biodiversity, pretense high risks to human health and to the environment [11,12,13]. According to World Health Organization (WHO), each year about 3,000,000 cases of pesticide poisoning and about 220, 000 deaths are reported in the developing countries [14]. It is estimated that about 1,000 people die every year in Tanzania state from pesticide poisoning [15]. Several acute effects of pesticide poisoning include blurred vision, vomiting, nausea, dizziness, cramp, numbness, and muscle weakness [16,17].

So, the importance of awareness of the risk of pesticides used in the agricultural sector has drawn the attention of many countries. The levels of knowledge and risk awareness and the practices of farmers and retailers are essential elements for increasing the efficiency of devising to protect these stakeholders [18]. A study indicated that farmers' knowledge and awareness of pesticide risk plays an important role in determining the use of Personal Protection Equipment (PPE) [19]. The threat of pesticide residues is not only depends on the quality and specificity of pesticides, but also on farmers' awareness of pesticide residues and their applying behaviour pattern [20,21,22]. Also a study showed that due to the lack of awareness of farmers, the misuse of pesticides has become a serious problem in agricultural production [23].

Given the importance of farmers' level awareness on pesticide use, the present study had been undertaken. Now a day, a large number of people in Patuakhali district are involved in agricultural activities and used a huge amount of pesticide for crop production. This study is undertaken to determine the level of awareness among the farmers' and its major determinants in this region. By considering all these reasons this study had been conducted. The objectives of this study were as follows:

1. To determine and describe the level of awareness of farmers on the study area
2. To know the socio-economic conditions of the farmers and their farming characteristics,
3. To explore the relationship between selected characteristics and level of awareness of farmers, and
4. To describe the contribution of factors for level of awareness of farmers

The change of climate and its adverse effect on agriculture is considered as the worst resulting in temperature rise, abnormal rainfalls, sea-level rise, cyclone and storm surges in high frequency and cover more areas by salinity, further aggravation of drought. As a result sometimes the productivity loss occurs due to weather and pest, growing of unfamiliar crop or varieties involve more uncertainty. To minimize losses farmers use uncontrolled amount of pesticide without considering its impact in long run. Proper farming practices and awareness about various crop productions can save lives and resources. So, increasing farmers' level awareness on pesticide use is one of the coping mechanisms of food security.

MATERIALS AND METHODS:

The study was conducted in Dumki upazilla under Patuakhali district. All the farmers involve in crop production activities except landless using more or less amount of pesticide constituted the population for these study. For this purpose an upto- date list of the farmers was prepared with the help of respective union parishad personnel, sub-assistant agricultural officer, local leaders and also dealer or retailer. There were a total 1102 such farmers who are not landless and involved in agricultural activities using pesticide for crop production, which constitute the population of the study. A sample population was obtained by taking 10

percent of the estimated population of two randomly selected villages under one union namely Sreerampur. Thus 110 farmers constituted sample of the study. Besides, a reserve list of 10 percent of the sample size was also prepared to replace any respondent who could not be made available during data collection despite all attempts.

Socio-economic characteristics: These included variables their age, education, training experience, farming experience, farm size, land ownership, annual income, communication exposure, knowledge on pesticide use and risk orientation etc.

Awareness level of farmers on pesticide use, the dependent variable was used to measure farmer's awareness level score on 16 selected statements related to farmer's awareness level on pesticide use.

Statistical software SPSS 16 was used for data analysis. Descriptive statistical measures such as (frequency, range, mean, percentage distribution, standard deviation, rank order, categories etc.) were used to describe and interpret the data.

Effect of selected factors on farmers' level awareness on pesticide use was determined by using regression co-efficient. In order to estimate the respondent's awareness level on pesticide use the following multiple regression equation was used.

$$Y_i = \alpha + \beta X_i + \varepsilon_i$$

Where,
Y = Farmers' level awareness on pesticide use (obtained score)
X_1 = Age of the farmers (year)
X_2 = Education of farmers (year of schooling)
X_3 = Farming experience (year)
X_4 = Training experience (no. of days)
X_5 = Farm size (hectare)
X_6 = Land ownership (in percentage)
X_7 = Annual income (Tk.)
X_8 = Communication exposure (frequency of contact)
X_9 = Knowledge on pesticide use (obtained score)
X_{10} = Risk orientation (obtained score)

$\varepsilon_i s$ are random components which are independently and normally distributed with mean zero and variance σ^2. To find out the relationships between farmers' level crop productivity and selected characteristics of the farmers Pearson's product Moment Correlation (r) was used. Five percent level of significance was used to accept or reject any null hypothesis.

Table 1. Description of variables used in the regression model

Variables Name	Variables description and unit of measurement
i.Dependent variable Farmers' level awareness on pesticide use	Level of awareness of farmers on pesticide use, 5 point Likert type scale.
(ii) Independent variables	

1. Age	Age of the farmers in years.
2.Education	Year of schooling.
3.Farming Experience	Completed years on farming activities.
4. Training Experience	Number of days training received.
5.Farm Size	Total farm size of the household in hectare.
6.Land Ownership	Area of land in hectare inherited from family from total farm size. Expressed in percentage.
7.Annual Income	Farmer's total income in taka in "ooo"taka/year.
8. Communication Exposure	No. of contact to selected information source.
9. Knowledge on Pesticide use	Scores obtained when asked related questions.
10. Risk Orientation	Measured by a scale of 10 statement where five positive and five negative. Score obtained from those statements and weighed.

3. RESULTS AND DISCUSSION:
3.1 General Characteristics of Respondents:

The majority, 52.72 percent and 34.55 percent of the farmers were old and middle-aged categories. Thus, most (87.27 percent) of the farmers have belonged to middle age to old age categories. This seems logical because heads of farm households were selected as respondents and the old people hold the position of family heads for their income generating activities. It was found that a high proportion of the farmers 44.55 percent had primary level of education. This might be due to the highly educated person in those villages are involved in diversified activities. Among the farmers, 65.45 percent had medium farming experience. This might be due to their medium level of knowledge, skill and practice on crop production in agricultural sectors. Majority of the farmers, 65.45 percent had short training experience on pesticide uses. Training experience on pesticide use is very low due to lower level of opportunities but an important factor, which enhance the demand for knowledge and improve skill on awareness level for pesticide use to increase crop production. Among farmers 65.45 percent had small and 32.73 percent had medium farm size. The reason behind this was as they had low land and had to lease land for agricultural cultivation. Most of the farmers 55.45 percent had 76-100% land ownership. Among farmers, 80.91 percent had low annual income. This may be due to as they have a few lands of their own or low training experience and medium knowledge etc.. Majority 47.27 percent had low communication exposure. The probable reason behind this might be a lower level of the medium of contact with various extension media. Among farmers, 41.82 percent had moderate knowledge on pesticide use and management. This may be due to their low training and lower communication with various agents for using of different types of pesticide. 41.82 percent farmers belonged to moderate risk orientation. Higher risk-oriented farmers can encounter risk and uncertainty with new ideas.

The observed farmers' level awareness on pesticide use scores ranged from 24.00 to 76.00 with an average of 50.89 and a standard deviation of 12.73. Based on their level of awareness on pesticide use scores, the farmers were classified into three categories. The categories were "Low (24.00- 41.00)", "Medium (42.00-59.00)", and High (60.00-76.00)". The majority (45.45 percent) of the farmers in the study area belonged to medium awareness level category compared to 26.36 percent farmers had high awareness level on pesticide use and 28.19 percent farmers had low awareness level and it is not satisfactory. So, the concerned authority should come forward and take effective steps to aware the farmers about increasing farmers' level awareness on pesticide use for crop production.

3.2 Correlation Analysis among Farmers Level Awareness on Pesticide use and Selected Variables

The findings of Table **4** reveal that variables such as training experience, land ownership, annual income, communication exposure, knowledge on pesticide use and risk orientation had a positive and significant relationship with farmers' level awareness on pesticide use. This indicates that with the increase of training

experience, land ownership, annual income, communication exposure, knowledge on crop production, and risk orientation the farmers' level awareness on pesticide use was also increased. Dessart, et al. **[24]** demonstrated that the behavioral factors enrich economic analyses of farmer decision-making, and can lead to more realistic and effective agro-environmental policies. Among them, four variables like age, education, farming experience and farm size had a positive and non-significant relationship with the farmers' level awareness on pesticide use which indicates that these variables are not an important factor towards farmers' level awareness for the using of pesticide.

3.3 Stepwise Multiple Regression Analysis Explaining Contribution of Variables to the Farmer's Level Crop Productivity

To determine the contribution of factors influencing farmers' level awareness on pesticide use a step wise multiple regression analysis was carried out. The regression model includes all of the independent variables which had significant correlations with the farmers' level awareness on pesticide use. The dependent variable was the respondent's awareness level which was defined as their scores from sixteen statements obtained from five point likert type scale. There were 10 independent variables entered in the model, out of which only 4 variables had a significant influence at the 5% level of significance of farmer's level awareness on pesticide use. As shown in Table **5**, communication exposure, knowledge on pesticide use, risk orientation and training experience were found to have a positive influence on respondent's awareness level. The R^2 value was 0.545 and F value was 31.491, which were significant at 0.000 levels. The R2 value indicated that 54.5 percent of the total variation in the awareness level the farmers could be explained by these 4 variables.

The variable that had the greatest influence on farmers' level awareness on pesticide use was communication exposure with the $\beta_1=0.263$, implies that when communication exposure of the farmer increases by a unit then level of awareness on pesticide use increases by 0.263 units. Similarly, knowledge on pesticide use, $\beta_2=0.701$ implies that when knowledge on pesticide use of the farmer increases by a unit then their awareness level on pesticide use increase by 0.701 units. Similarly, risk orientation $\beta_3=0.690$, implies that when risk orientation of the farmer increases by a unit then their level of awareness on pesticide use of farmers increases by 0.690 units. However, training experience $\beta_4=0.545$, implies that when training experience of the farmer increases by a unit then their level of awareness increases by 0.545 units.

The unique contribution of the variables was also determined by taking the changes in R^2 value occurred for entry of a particular variable in the stepwise regression model. The results of Table **6** shows that communication exposure along could explain 36.7 percent of the total variation in the farmer's level awareness on pesticide use and other three variables namely knowledge on pesticide use, risk orientation and training experience could explain 8.1, 6.1 and 3.5 percent variation respectively in case of Level of awareness on pesticide use for farmers.

Table 2. Socio economic characteristics of farmers

Characteristics of the farmers	Range	Categories	Respondents		Mean	Standard deviation
	Observed		Number	Percent		
Age	25-75	Young aged (up to 35years)	14	12.73		
		Middle aged (36-50 years)	38	34.55	52.22	11.68
		Old aged (above 50 years)	58	52.72		
Education	0-12	Illiterate (0)	5	4.54		
		Can sign only (.5)	12	10.91		
		Primary education (1-5)	49	44.55		
		Secondary education (6-10)	42	38.18	5.06	2.87
		Above secondary education (above 10)	2	1.82		
Farming experience	10 to 65	Low experience (10-28)	30	27.27		
		Medium experience (29-47)	72	65.45	34.20	11.24
		High experience (above 48)	8	7.28		
Training experience	0 to 22	No experience (0)	9	8.18		
		Short experience (1-7)	72	65.45		
		Medium experience (8-15)	23	20.91	5.69	4.87
		High experience(above 16)	6	5.46		
Farm size	0.28 to 3.02	Landless (below 0.02ha)	00	00		
		Marginal (.02-0.20 ha)	00	00	0.99	0.59
		Small (.21-1.00 ha)	72	65.45		
		Medium (1.01-3.00 ha)	36	32.73		
		Large (above 3.00 ha)	2	1.82		
Land ownership	21.56-100	Below 25% land ownership	2	1.82		
		26-50% land ownership	17	15.46	76.73	24.08
		51-75% land ownership	30	27.27		
		76-100% land ownership	61	55.45		
Annual income	52.0 to 363.85	Low income (52-156)	89	80.91		
		Medium income (156.01-261)	19	17.27	114.33	54.22

Characteristics of the farmers	Range	Categories	Respondents		Mean	Standard deviation
			High income (above 261) 2 1.82			
	Observed		**Number**	**Percent**		
Communication exposure	17 to 52	Low exposure (17-28)	52	47.27		
		Medium exposure (29-40)	47	42.73	29.81	7.73
		High exposure (above 40) (above 10)	11	10.00		
Knowledge on pesticide use	14 to 37	Low knowledge (14-21)	28	25.45		
		Medium Knowledge (22-29)	46	41.82	25.90	5.43
		High (above 29)	36	32.73		
Risk orientation	23 to 45	Low risk orientation (23-30)	27	24.54		
		Moderate risk orientation (31-38)	46	41.82	34.80	5.60
		High risk orientation (39-450	37	33.64		

Table 3. Classification of farmers according to their level of awareness on pesticide use

Categories	Farmers		Mean	Standard deviation
	Number	Percent		
Lower level of awareness	31	28.19		
Medium level of awareness	50	45.45	50.89	12.73
High level of awareness	29	26.36		

Table 4. Correlation Analysis among Farmers Level Awareness on pesticide use and Selected Variables

Dependent variable	Independent variable	Coefficient of
	(Farmers characteristics)	correlation (r)
	1. Age	$.012^{NS}$
	2. Education	$.164^{NS}$
	3. Farming experience	$.046^{NS}$
	4. Training experience	$.452^{**}$
Farmers' Level Awareness on	5. Farm size	$.143^{NS}$
Pesticide use	6. Land ownership	$.233^{*}$
	7. Annual income	$.514^{**}$
	8. Communication exposure	$.606^{**}$
	9. Knowledge on crop production	$.598^{**}$
	10. Risk orientation	$.578^{**}$

**=Significant at .01 level, NS=Not significant, *=Significant at .05 level
Source: Author's own calculation using SPSS from field survey data, 2016.

Table 5. Results of multiple regression analysis

Predictor variables	B	Standard error	β	T	p
Constant	-2.218	5.697		-.389	.698
Communication exposure	.263	.158	.160	1.664	.099
Knowledge on pesticide use	.701	.198	.229	3.537	.001
Risk orientation	.690	.183	.304	3.762	.000
Training experience	.545	.191	.209	2.855	.005

$R^2=0.545, F=31.49$ and $P=0.000$

Table 6. Change in multiple R2 for entry of the said variable into the stepwise multiple regression models

Model	Variables	R^2	Adjusted R square	Std. Error of the Estimate	R square change	Variance explained (%)	Sig. F Change
1	Communication Exposure	.367	.362	10.17	.367	36.7	.000
2	Knowledge on pesticide use	.449	.439	9.53	.081	8.1	.000
3	Risk Orientation	.510	.496	9.03	.061	6.1	.000
4	Training Experience	.545	.528	8.74	.035	3.5	.005

4. CONCLUSIONS AND RECOMMENDATIONS

Farmers' level awareness on pesticide use is an important consideration that ensures food security and it also has an impact on income and livelihood status as well as sustainable environment for the farmers. But findings of the study revealed that the majority (73.64 percent) of the farmers have low to medium level of awareness for the using of various kind of pesticide. So it can be said that the tendency or trend of farmers' level awareness on pesticide use is not satisfactory in the study area. The result showed that training experience, land ownership, annual income, communication exposure, knowledge on pesticide use and risk orientation had positive and significant relationship with farmers' level awareness on pesticide use. In addition, multiple regression analysis showed that communication exposure, knowledge on pesticide use, risk orientation and training experience were found to have a positive influence on respondent's awareness level. Therefore, the implementing agencies need to keep this in view for its dissemination. Therefore, it may also be concluded that unless proper steps are taken to increase the farmers' level awareness on pesticide use, the national goal of increasing crop productivity considering safe health and balanced environment will continue to suffer seriously.

CONSENT
As per international standard or university standard, farmers' written consent has been collected and preserved by the author(s).

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