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ADOPTION OF COMMONLY USED INTEGRATED PEST MANAGEMENT (IPM) PRACTICES BY THE BORO RICE GROWERS

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ABSTRACT

Integrated Pest Management (IPM) practices are considered tools of eco-friendly rice cultivation. This study determines the adoption of commonly used IPM practices by the boro rice growers and explores the relationships between the adoption of commonly used IPM practices in boro rice cultivation and each of the twelve selected characteristics of the boro rice growers. Data were collected from 130 randomly selected respondents of the Baliadangi upazila under Thakurgaon district of Bangladesh. Data were collected by using an interview schedule from the respondents during 21 April to 6 May 2015. Adoption of commonly used IPM practices was measured on the basis of multiple technologies adoption quotient method. The highest proportion (57.69%) of the respondents had medium adoption, while 42.31 percent had low adoption of commonly used IPM practices in boro rice cultivation. Pearson's Product Moment Correlation co-efficient (r) results showed that training exposure, attitude towards harmful effects of chemical pesticide and contact with IPM club and FFS of the respondents had significant positive relationships with their adoption of commonly used IPM practices in boro rice cultivation. On the other hand, age, family agriculture workforce, annual family income, education, farm size, knowledge on pesticide application, awareness about environmental pollution, contact with pesticide dealers and cost of pesticide had non-significant relationship with the adoption of commonly used IPM practices in boro rice cultivation. Season long training and activation of IPM clubs are pre-requisite to increase adoption of commonly used IPM practices by the boro rice growers in a satisfactory level.

Keywords: Adoption, Pest, Integrated Pest Management (IPM) Practices, Boro rice growers

INTRODUCTION

Agriculture is the main source of livelihood for the most of the people of Bangladesh.Out of total GDP agriculture constitutes 15.35 percent (BBS, 2017). Rural economy of Bangladesh is mainly rice based. At present, rice covers about 11,800,000 ha of the cultivated land in Bangladesh (Abdullah, 2012) which is almost 75.0 % of total land. Boro rice production constitutes 54.56% of total rice production in 2015-16 (Year book of Agricultural statistics-2016).According to an estimate, annual yield loss due to insect pest alone is 16% for rice (Ahmed et al, 2001). The word 'pest' refers to organisms such as insects, rodents and birds that cause damage or annoyance to man, his animals, crops or possessions. In Bangladesh, chemical control has been the principal method of pest control.211 trade names of pesticides have been registered in Bangladesh (Islam, 2005). Pesticide consumption increased to 9.8 kg per ha in 2009 in Bangladesh which was 0.7 kg per ha in the year 2000 (Abdullah, 2012).In the year of 2007, 37,712.20 m. tons of pesticide sold in Bangladesh at different trade name and among them 22,118 m. tons which is nearly 86.81% was used in rice production (Rahman, 2011). Although pesticides may provide temporary relief from pest problems, long-term dependency on pesticides is not desirable.It is now widely accepted that indiscriminate use of pesticides not only creates serious environmental and human health problems but also promotes development of pest resistance to insecticides, destroys beneficial insect, upsets the balance between the pests and their natural enemies leading to the increase in the population of the target pests and even the creation of new pest problems.To avoid such consequences and at the same time to increase the crop production on a sustainable basis, a viable alternative to sole dependence on chemical pesticides is Integrated Pest Management (IPM). IPM has no standard definition, but comprises approaches that

range from carefully-targeted used of chemical pesticides to biological techniques that use natural parasites and predators to control pests (Sorby et al, 2003).

FAO first introduced IPM in Bangladesh for rice cultivation in 1981, but its gained popularity in 1987. Next in 1995 with the finance of UNDP, Department of Agricultural Extension (DAE)took five years project named DAE-UNDP IPM Project. In 1997 with the finance by Danish Government, DAE started an IPM project named DAE-DANIDA SPPS Project.Government formulated National IPM policy in 2002. Later on IPM project is being implemented phase by phase as different names with the finance of Bangladesh government. At present IPM activities cover almost all districts and upazilas of Bangladesh. Among all other agricultural practices IPM is the best practice to increase the crop production by effecting the human health and environment as less as possible. Some farmers realized the benefits of the practices and responded positively to adopt this practice. Some farmers in contrast, showed totally reverse attitude.Now the question came how far rice growers adopt IPM practices. Extent of adoption of IPM practices by the growers will determine the success and failure of IPM projects and help to readdress the projects in future. But there was no rice specific study has been conducted earlier. The researcher attempted the present study to seek research questions like what are the characteristics of the boro rice growers, what is the extent of adoption of commonly used IPM practices by the farmers in boro rice cultivation with their preferences and finally what relationship exists between the farmers selected characteristics with their extent of adoption of commonly used IPM practices in boro rice cultivation?:

METHODOLOGY

Two villages namely Nagesharbari and ChoutakiinDhantola union of BaliadangiUpazilla under Thakurgaondistrict of Bangladersh were purposively selected as the locale of the study. IPM clubs and Farmer Field Schools (FFSs) are being operated here by the DAE. The total number of the bororice growers (615) in the study area was considered as the population of the study. According to Yamane's (1967) formula, sample size was determined as 130. In calculating sample size from the formula, 10% precision level, 50% degree of variability and value of Z= 2.57 at 99% confidence level were chosen. Data were collected through face-to-face interview by using structured interview schedule from the selected respondents of the study area during April 21 to May 6, 2015. The methodology followed for measuring the dependent and independent variables are described below:

Measurement of independent variables

The characteristics of the farmers such as age, education, family agriculture workforce, training exposure, farm size, annual income, cost of pesticide, knowledge of pesticide application, awareness about environmental pollution, attitude towards harmful effects of chemical pesticide, contact with pesticide dealer, contact with IPM club and FFS were independent variables. Age of a respondent was measured in terms of actual years from his birth to the time of interview.Education of a respondent was measured in terms of years of schooling completed by an individual in an educational institute.Family agriculture workforce was estimated by computing the total number of member of a respondent's family, who engaged actively in farming activities.Farm size was measured as the size of the respondent's farm on which he/she continued his/her farming operations during the period of study.

Annual income of a respondent was measured in thousand taka on the basis of last year total earnings from rice cultivation and other sources like agriculture, poultry rearing, domestic animal, fish, service, business and others in which the respondent as well as his family members were involved.Training exposure of a respondent was measured on the basis of number of days of training received from different sources in the last five years.Knowledge on Integrated Pest Management (IPM) practices of a respondent was measured by using 16 different kinds of questions in relation to IPM practices.Awareness aboutenvironmental pollution was measured by asking fifteen questions on various aspects of environmental pollution.Farmers' attitude towards harmful effects of chemical pesticide has been measured by constructing 5-point Likert scale.Contact with pesticide dealers was measured on the basis of extent of visit for10 selected purposesby using four points (0-3) rating scale.Cost of pesticide was measured in taka on the basis of the cost of used insecticide, fungicide & weedicide in the last boro season. Contact with IPM club and FFSwas measured on the basis of extent of visit for10 selected purposes by using four points (0-3) rating scale.

Measurement of dependent variable:

Adoption of commonly used integrated pest management (IPM) practices by the boro rice growers was the dependent variable of the study. The commonly used IPM practices were determined from literatures, discussion with IPM experts and concerned boro rice growers. The selected practices were: use of light trap, use trap to capture rat, use of healthy and disease free seeds, use of crop rotation, use of water management, use of weed management, use of sweeping net, destroy the crop residues, use of perching in the field to sit the birds, use of pesticide as a last method of pest control. Adoption can be measured in various ways. But in this study multiple technologies adoption quotient method (Ray, 1998; Bhuiyan, 2012) was used to determine adoption of commonly used IPM practices in Boro rice cultivation. Adoption of commonly used IPM practices was measured by the

summation of mean($\bar{x}$) adoption of different practices for particular time period divided by the number of practices. It was expressed in percentage resulting mean area coverage. Thus, the formula would be:

Multiple practices adoption quotient =$\frac{\sum \bar{x}}{No.\ of practices}$ X 100

Mean ($\bar{x}$)adoption of a practice was measured by calculating summation of proportions of area coverage with dividing time period. In this study, three Boro seasons of consecutive years were considered for calculating adoption. Proportion of area coverage means land allotted for particular practice (l) out of potential land (L) for that particular practice.So, the mean adoption of ten IPM practices was calculated and summed up. Then, average adoption of ten IPM practices for a respondent were determined which could range from 0 to 100% where 0% indicating no adoption at all and 100% indicating fully adoption of commonly used IPM practices.

To compare adoption of different IPM practices by the Boro rice growers, Individual Practice Adoption Index (IPAI) was calculated on the basis of summation of proportion of area coverage. Summation of proportion of area coverage score of a practice for 3 years could range from 0 to 3. Thus, Individual Practice Adoption Index (IPAI) for an IPM practice could range from 0 to 390 by summing up all score of 130 respondents.

RESULTS AND DISCUSSION

Selected characteristics of the farmers

In this section, the findings on the farmers' selected characteristics have been discussed and a summary profile of these characteristics is presented in Table 1, which indicates an overwhelming majority (73.08%) of the respondents belonged to middle and young aged categories except a few (26.92%), among which 72.31% had education ranged from primary to secondary, far above the national average. The findings of the study revealed that an overwhelming majority (77.69 %) of the farmers had medium to large agriculture workforce size while majority (92.08 %) of the boro rice growers had small to medium farm size. Table 1 show that 90.77 percent of the farmers had low to medium annual income. Most of the (88.46% %) respondents fell in no training exposure to low training exposure group.Highest proportion (88.46%) of the respondents had the medium to high knowledge on pesticide application while majorities (90.76 %) of the farmers in the study area were low to medium awareness about environmental pollution. Highest proportion (86.93 %) of the respondents had low to moderate unfavorable attitude towards harmful effects of chemical pesticide. 91.50 percent of the respondents had low to medium contact with pesticide dealers. Majority of the respondent (73.08 %) belonged to low tomedium pesticide cost groupin the last boro season.Majority (96.92 %) of the farmers had no to very low connection with IPM club and FFS.

Adoption of commonly used IPM practices in boro rice cultivation

Percentage of adoption of commonly used IPM practices of the Boro rice growers ranged from 30 to 71 against the possible range from 0 to 100 percent with an average of 40.85 and standard deviation of 8.40. On the basis of percentage of adoption of commonly used IPM practices in boro rice cultivation, the respondents were classified into two categories as shown in Table 2.

Data in the Table 2 show that the more than half (57.69 %) of the respondents had medium adoption and 42.31 percent had low adoption of commonly used IPM practices in boro rice cultivation. Sardar (2002) also found almost similar findings in his study. The findings of the present study reveal that adoption of commonly used IPM practices by the boro rice growers was not satisfactory. Cent percent of the boro rice growers had low to medium adoption of commonly used IPM practices. The reasons may be most of the boro rice growers had no training (80.0 %) and no connections with IPM clubs and FFS (88.0 %).

Preferences of adoption of the different IPM practices by the boro rice growers

To compare the adoption of commonly used IPM practices in boro rice cultivation, Individual Practice Adoption Index (IPAI) was calculated. An Individual Practice Adoption Index (IPAI) for each of the practices could range from 0 to 390. The ten commonly used IPM practices have arranged in rank order in Table 3 on the basis of their IPAI. The observed IPAI ranged from 12.8 to 383.6.

On the basis of computed IPAI, it was observed that the use of healthy and disease free seeds were adopted by the farmers to the highest extent (383.6) and it was closely followed by the use of weed management (381.5) and use of water management (378). On the other hand, practices like use of pesticide as a last method of pest control (32.5), use of light trap (23.3), use of trap to capture rat (13.1) and use of sweeping net (12.8) were adopted by the farmers to the lowest extent.

The findings indicate that seeds are one of the basic inputs of agricultural production. To increase production there is no alternative of using quality seed. Almost all of the farmers in the study area collect healthy and disease free seed from local seed dealers of BADC. That is why farmers adopt these practices to the highest extent. Weeding is an age-old practice used by the farmers in all areas. Farmers adopt this practice because it is very easy to handle and little technical knowledge is needed. Underground water and surface water are easily available in the locality. Very little technical knowledge is needed to supply irrigation in the field. For this reason, this practice ranked 3rd among the ten practices.

On the other hand, sweeping net is not a realistic practice for large area though it is suggested for primary infestation. Sweeping net may damage crops during capturing insect. So, it was the least practice. Rodenticides are easily available in the village area and which are sold at cheaper rate. Meanwhile technical knowledge is needed to make the trap to capture rat. Light trap is a combined practice which should be use all the farmers in the locality at a time, otherwise farmers will not be benefitted by this practice. Farmers were habituated to use of pesticide. Mechanical and biological methods of pest control are time consuming. So they adopt use of pesticides as the last method of pest control to the lower extent.

Table 1. The characteristics profile of the sample farmers

Characteristics	Measuring unit	Range		Categories	Respondents		Mean	SD
		Possible	Observed		Number (N=130)	Percent (%)		
Age	Actual Years	Unknown	24-78	Young aged (≤ 35)	33	25.38	44.94	11.62
				Middle aged (36-50)	62	47.70		
				Old aged(> 50)	35	26.92		
Education	Year of schooling	Unknown	0-15	Illiterate (0-0.5)	27	20.77	5.87	3.94
				Primary education (1-5)	44	33.85		
				Secondary education (6-10)	50	38.46		
				Above secondary education (>10)	9	6.92		
Family agriculture workforce	Number of members	Unknown	2-12	Small workforce (≤ 3)	29	22.31	4.65	1.78
				Medium workforce (4-5)	71	54.61		
				Large workforce (>5)	30	23.08		
Farm size	Actual (in ha)	Unknown	0.1- 4.8	Marginal (<0.2 ha)	4	3.07	1.03	0.95
				Small (0.20 - < 1 ha)	68	52.31		
				Medium (1-3 ha)	53	40.77		
				Large (> 3.00)	5	3.85		
Annual family income	Taka ('000)	Unknown	10-348	Low income (<60)	74	56.92	74.877	60.50
				Medium income (60-150)	44	33.85		
				High income (>150)	12	9.23		
Training exposure	Days obtained	Unknown	0-20	No training exposure (0 days)	104	80	1.88	4.95
				Low training exposure (1-2 days)	11	8.46		
				Medium training exposure(>2days)	15	11.54		
Knowledge on pesticide application	Scores	0-16	8-15	Low knowledge (<10)	15	11.54	11.13	1.38
				Medium knowledge (10-12)	98	75.38		
				High knowledge (>12)	17	13.08		
Awareness about environmental pollution	Scores	0-15	6-14	Low awareness (< 8)	14	10.76	9.12	1.61
				Medium awareness (8-11)	104	80		
				High awareness (> 11)	12	9.24		
Attitude towards harmful effects of chemical pesticide	Scores	12 -60	31-51	Low unfavorable attitude (<37)	20	15.39	41.04	4.19
				Moderateunfavorable attitude (37-45)	93	71.54		
				High unfavorable attitude (>45)	17	13.07		
Contact with pesticide dealer	Scores	0-36	4-19	Very Low contact (<10)	11	8.46	12.82	2.42
				Low contact (10-14)	87	66.92		
				Medium contact (>14)	32	24.62		
Cost of pesticide	Actual (in Taka)	Unknown	300-15000	Low pesticide cost (<2000 Tk)	59	45.39	3596.92	3425.12
				Medium pesticide cost (2000-5000 Tk)	36	27.69		
				High pesticide cost (>5000 Tk)	35	26.92		
Contact with IPM club and FFS	Scores	0-30	0-14	No contact (0)	114	87.69	1.05	2.96
				Very low contact (≤10)	12	9.23		
				Low contact (>10)	4	3.07		

Table 2. Distribution of the boro rice growers according to their adoption of commonly used IPM practices in boro rice cultivation

Categories	Respondents		Mean	Standard deviation
	Number	Percent		
Low adoption (<40 %)	55	42.31		
Medium adoption (≥40 %)	75	57.69	40.85	8.40
Total	130	100		

Table 3. Rank order of the adoption of different IPM practices by the boro rice growers

Sl no.	Name of commonly used IPM practices	IPAI	Rank order
1	Use of healthy and disease free seeds	383.6	1
2	Use of weed management	381.5	2
3	Use of water management	378.0	3
4	Destroy the crop residues	130.0	4
5	Use of crop rotation	124.7	5
6	Use of perching	111.7	6
7	Use of pesticide as a last method of pest control	32.5	7
8	Use of light trap	23.3	8
9	Use of trap to capture rat	13.1	9
10	Use of sweeping net	12.8	10

Relationship between individual characteristics of the boro rice growers and their adoption of commonly used IPM practices in boro rice cultivation

An attempt was made to find out the relationship between the selected characteristics of the respondents and their adoption of commonly used IPM practices in boro rice cultivationwhich is shown Table 4.

Table 4 shows that among the 12 selected characteristics of the boro rice growers, only three, namely training exposure, attitude towards harmful effects of chemical pesticide and Contact with IPM club and FFS had significant positive relationships with their adoption of commonly used IPM practices in boro rice cultivation which are explained below:

Training exposure and adoption of commonly used IPM practices by the boro rice growers:Training exposure had highly significant positive relationship with the adoption of commonly used IPM practices by the boro rice growers. Training increases courage and enable the farmers to do new or complicated farming activities. As the first use of integrated pest management practices may be complicated to the farming community, the finding of the study revealed the truth that training exposure is a significant attribute for adoption of commonly used IPM practices by the boro rice growers. Rahman (2010) and Rahman (2001) also found similar findings in their studies.

Table 4. Relationship between adoption of commonly used IPM practices by the Boro rice growers and their selected characteristics

Dependent variable	Independent variables	Computed value of co-efficient of correlation 'r'	Tabulated value at 128df	
			0.05 level	0.01 level
Adoption of commonly used IPM practices by the boro rice growers	Age	-0.009 NS	0.172	0.225
	Education	0.167 NS		
	Family agriculture workforce	-0.113 NS		
	Training exposure	0.329**		
	Annual income	-0.034 NS		
	Farm size	0.026 NS		
	Cost of pesticide	-0.012 NS		
	Knowledge on pesticide application	0.066 NS		
	Awareness about environmental pollution	0.145 NS		
	Attitude towards harmful effects of chemical pesticide	0.203*		
	Contact with pesticide dealer	0.139 NS		
	Contact with IPM club and FFS	0.324**		

** Significant at the 0.01 level, * Significant at the 0.05 level, NSNot significant

Attitude towards harmful effects of chemical pesticide and adoption of commonly used IPM practices by the boro rice growers: Attitude towards harmful effects of chemical pesticide of the farmers had significant relationship with the adoption of commonly used IPM practices by the boro rice growers. Farmers' unfavourable attitude towards chemical pesticide indicates that, they know the harmful effects of chemical pesticides. To reduce harmful effect of chemical pesticide they adopt IPM practices.

Contact with IPM Club and FFSand adoption of commonly used IPM practices by the boro rice growers: Contact with IPM club had highly significant positive relationship with the adoption of commonly used IPM practices by the boro rice growers. The farmers who have contact with IPM club will aware of the benefit of IPM practices. They know the elaborate use of IPM technology. So, the farmers who had contact with IPM club will adopt more IPM practices.

CONCLUSION

All of the respondents had low to medium adoption of commonly used IPM practices in boro rice cultivation.This fact leads to the conclusion that overall adoption of commonly used IPM practices by the boro rice growers was not satisfactory. There is huge scope for increasing the extent of adoption of commonly used IPM practices in boro rice cultivation.DAE and other rural advisory service providers should take effective steps for strengthening extension services in order to increaseadoption of commonly used IPM practices in boro rice cultivation. Overwhelming majority (88.46%) of the respondents had 'no' to 'low' training exposure, low to moderate unfavorable attitude towards harmful effects of chemical pesticide(86.93%) andno to very low connection with IPM club and FFS (96.92 %). Therefore, it may be concluded that more training program on IPM should be organized by DAE.On the other hand, training exposure,attitude towards harmful effects of chemical pesticide and contact with IPM club and FFS of the farmers had significant positive relationships withadoption of commonly used IPM practices in boro rice cultivation. Therefore, it may concluded thatany arrangement made to increase training exposure, attitude towards harmful effect ofchemical pesticide andcontact with IPM club and FFS of the farmers would ultimately increase theiradoption of commonly used IPM practices in boro rice cultivation.

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