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# Adoption of Commonly Used Integrated Pest Management (IPM) Practices by the Boro Rice Growers in Sylhet District

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***Abstract:*** ***The focus of the present study was to determine the adoption of commonly used integrated pest management (IPM) practices by the Boro rice growers and to explore the relationships between the adoption of commonly used IPM practices in Boro rice cultivation and the eleven selected characteristics of the Boro rice growers. Data were collected from 100 randomly selected respondents of the six selected villages of Baraikandi union under South Surma Upazila of Sylhet district using an interview schedule from the respondents during December 15, 2017 to March 26, 2018. The result indicates that highest proportion 46 percent of the respondents had medium adoption, while 43 percent had low adoption and 11 percent had high adoption of commonly used IPM practices in Boro rice cultivation. The correlation analysis found that, annual income, farm size, attitude towards harmful effects of chemical pesticide, contact with pesticide dealer and contact with IPM club/FFS had significant positive relationship with the adoption of commonly used IPM practices in Boro rice cultivation. However, age, education, family agriculture workforce, training exposure, knowledge on pesticide application and awareness about environmental pollution showed non-significant relationship with the adoption of commonly used IPM practices in Boro rice cultivation.***

***Keywords: Adoption, IPM, Boro Rice, Sylhet***

## 1. INTRODUCTION

Bangladesh is an economically agriculture based developing country. Agriculture is the main source of livelihood for the most of the people of Bangladesh. Out of total GDP agriculture constitutes 16.33 percent (BBS, 2014). About 47.5 percent of the total population of this country is directly or indirectly involved in agricultural activities (BBS, 2010). 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.

On the basis of land area compared to other countries in the world, Bangladesh is a small country but its population density is probably the highest in the world. To meet up the food consuming demand for the ever increasing population, it is imperative to increase crop production. One of the main problems to increase crop production is the pest. The word 'pest' refers to organisms such as insects, rodents and birds that cause damage or annoyance to man, his animals, crops or possessions. According to an estimate, annual yield loss due to insect pest alone is 16% for rice (Ahmed et al, 2001)

In Bangladesh, chemical control has been the principal method of pest control. Although pesticides may provide temporary relief from pest problems, long term dependency on pesticides is not desirable. Pesticide consumption increased to 9.8 kg per ha in 2009 in Bangladesh which is 0.7 kg per ha in the year 2000 (Statistical Data Book for Agricultural Research and Development in SAARC Countries 2012).In the year of 2007, a total of 37,712.20 tons of pesticide sold in Bangladesh at different trade name and 22,118 tons which is nearly 86.81% is used in rice (Pesticide information of SAARC Countries, SAARC Agricultural center).

Many studies have examined the effects of pesticide exposure on the risk of cancer. Associations have been found with: leukemia, lymphoma, brain, kidney, breast, prostate, pancreas, liver, lung, and skin cancers. This increased risk occurs with both residential and occupational exposures. Increased rates of cancer have been found among farm workers who apply these chemicals. A mother's occupational exposure to pesticides during pregnancy is associated with an increase in her child's risk of leukemia, Wilms' tumor, and brain cancer. Application of pesticides to crops that are in bloom can kill honeybees, which act as pollinators .Fish and other aquatic biota may be harmed by pesticide-contaminated water (Helfrich) .To avoid such consequences Integrated Pest Management (IPM) is the best alternative strategy. Integrated Pest Management (IPM) is a broad ecological approach to pest control using various pest control tactics in a compatible manner.

Integrated Pest Management (IPM) is a broad ecological approach to pest control using various pest control tactics in a compatible manner. 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). In the contemporary usage, IPM is not limited to dealing with pesticides and pest management, in fact, IPM has holistic approaches to crop production based on sound ecological understanding. FAO first introduce IPM in Bangladesh in the year of 1981 in rice cultivation, but it gains its popularity in the year 1987. Government establishes National IPM policy in 2002. Next in 1995 with the finance of UNDP, DAE take five years project named DAE-UNDP IPM Project. In 1997 with the finance by Danish Government, DAE started a project named DAEDANIDA SPPS Project. Second phase of this project started in 2002 of this consequence Bangladesh Government took 3 years project from 2006 to 2009. It was started in 58 district of 244 Upazila.

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. This practice will help to increase the overall condition of the country. Some farmers realized the benefits of the practices and responded positively to adopt this practice. Some farmers in contrast, showed totally reverse attitude. Few researches have been conducted to measure the extent of adoption of IPM in rice cultivation and in Sylhet region such attempt yet has not been undertaken. Therefore the current study has been designed to achieve the following objectives:

1. To describe the selected personal and socio-economic characteristics of the Boro rice growers;

2. To determine the extent of adoption of commonly used IPM practices by the Boro rice growers;

3. To compare the preferences in adoption of different IPM practices by the Boro rice growers; and

4. To explore the relationship between the adoptions of commonly used IPM practices by the Boro rice growers and their selected characteristics.

## 2. MATERIALS AND METHODS

### *2.1 Study area*

South Surma Upazila under Sylhet district was purposively selected as the locale for the study. The study was conducted in six villages in Baraikandi union under South Surma Upazila of Sylhet district of the country. The selection was made on the basis suggestions made by Upazila Agriculture Officer (UAO), Agriculture Extension Officer(AEO),Sub Assistant Agriculture Officer(SAAO),Union Parisshad Member and Officials of South Surma Upazila. A map of Sylhet district and South Surma Upazila indicating the specific study area are shown in map 3.1 and 3.2 respectively.

### *2.2 Population and sample of the study*

The Researcher himself with the help of local leaders and concerned Sub-Assistant Agriculture Officer (SAAO) prepared an updated list of all the Boro rice growers of the selected villages. The total numbers of farm families (Boro rice growers) in this village was 401, which constituted the population of the study. Out of 401, 25% was randomly taken as sample size of the study. The sample size was determined as 100. However, data were collected from the sample rather population. 100 farmers were selected simple random sampling technique. A reserve list of 15 farmers was also prepared. Farmers in the reserve list were used only when a respondent in the original list was not available.

### *2.3 Data Collection*

A well-structured interview schedule was developed based on objectives of the study for collecting information with containing direct and simple questions in open form and close form. Appropriate scales were developed to measure the variables. A schedule was prepared in bangle for clear understanding of the respondents. The interview schedule was pre-tested with 15 women beneficiaries in actual situation before finalizing it for data collection. Necessary correction, additions, alternation, rearrangement and adjustments were made in the interview schedule based on pre-test experience.The researcher himself collected data from the sample farmers. Data collection was started in December 15, 2017 and completedin March 26, 2018.

### *2.4 Variables of the Study*

In the present study, the respondents' selected characteristics viz. 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 were independent variables and their adoption of commonly used IPM practices in Boro rice cultivation constituted dependent variable.

### *2.5 Measurement of dependent variable*

Ten commonly used IPM practices of the respondents such as use of healthy and disease free seeds, use of perching in the field to sit the birds, use of hand or machine for weed management, destroy the crop residues, use trap to capture rat, use of light trap, use of sweeping net, use of irrigation and drainage for pest management, use of crop rotation and use of sufficient amount of pesticide as a last method of pest control were selected under the dependent variable discussing with IPM experts & concerned Boro rice growers and exploring literatures to measure farmers' extent of adoption of these IPM practices. Adoption can be measured in various ways. Here we computed by considering two dimension of adoption namely: i)

area covered by particular practice (A) and ii) length of time taken to accept that practice after hearing about it (T). The computation method and assigning weight for each of the two dimensions are discussed as follows:

Area sub score (A): In computing area score, the following formula will be used (Muhammad, 1974 and Muttaleb, 1995):

$$\text{Area coverage} = \frac{\text{Area covered by particular practice}}{\text{Area suitable for particular practice}} \times 100$$

The proportion thus calculated was converted into area coverage score by assigning weights as follows:

**TABLE 2.1: The scale used for computing the area coverage score**

| Area coverage % | Weight |
|---|---|
| No coverage | 0 |
| 1-25 | 1 |
| 25.1-50 | 2 |
| 50.1-75 | 3 |
| 75.1-100 | 4 |

b) Time sub-score: Based on length of time taken to accept that practice after hearing about it, the following scoring system was adopted.

**TABLE 2.2: The scale used for computing the duration taken to accept score**

| Duration taken to accept | Weight |
|---|---|
| Accept after 0-1 year of hearing | 5 |
| Accept after 2-3 year of hearing | 4 |
| Accept after 4-5 year of hearing | 3 |
| Accept after 6-7 year of hearing | 2 |
| Accept after 8 year of hearing | 1 |

In this way, the highest possible scores for each practice was A x T = 5 x 4= 20 and the lowest score 0. The scores as computed against each of the 10 practices were added together to have the total adoption score of an individual farmer. In this scoring system the maximum adoption score for a total number of selected practices could be (20 x numbers of selected practices) = 200 and the minimum is 0.

### *2.6 Data Analysis*

Data collected from the respondents were complied, coded, tabulated and analysed in accordance with the objectives of the study. Various statistical measures such as number and percentage distribution, range, mean, standard deviation and rank order were used in describing data. SPSS (version 20) computer program were used for analysing the data. To find out the relationships between adoption of commonly used IPM practices in Boro rice cultivation and the selected characteristics of the Boro rice growers, the Pearson's Product Moment Correlation coefficient (r) was computed.

## 3. RESULTS AND DISCUSSIONS

### *3.1 Socio-economic characteristics of the farmers*

Age of the farmers ranged from 22 to 75 years, with an average of 48.16. Among 100 respondents, 50 percent were middle aged, 30 percent were old and 20 percent were young aged. Education scores of the farmers ranged from 0 to 8, with an average of 2.74. Among the 100 respondents, the highest proportion 40 had sign only, 24 percent had primary education, 16 percent was illiterate, and 0 percent had above secondary education and 20 percent secondary education. Family agriculture workforce size of the respondents ranged from 2 to 17. Among the 100 respondents, the average family agriculture workforce size of the respondents was 6.68. The highest proportion 76% of the respondents had medium families compared to 14 percent had small agriculture workforce and 10 percent had large agriculture workforce. The annual income of the farmers ranged from Tk. 11.6 to 300 thousands, the average being of Tk. 51.81 thousands. Among the 100 respondents, 49 percent had very low, 30percent had low, 18 percent had medium and 3 percent had high annual family income. The farm size scores of the respondents ranged from 0.13 hectares to 14.75 hectares with an average of 1.81 hectares. Among the 100 respondents, 1 percent had marginal farm size, 43 percent had small farm size, 40 had medium and 16 percent had large farm size. Training exposure of the farmers ranged from 0 to 1, with an average being of 0.33. Among the 100 respondents, the highest proportion (67%) had no training compared to 33 percent had low training exposure. The knowledge on pesticides scores ranged from 2 to 10, and the average being 5.72. Among the 100 respondents, 64 percent had medium knowledge, 13 percent had low knowledge and 23 percent had high knowledge on pesticides application.

**TABLE 1: Selected socio-economic characteristics of the respondents**

| Socio-economic factor | Frequency | Percent | Socio-economic factor | Frequency | Percent |
|---|---|---|---|---|---|
| Age (years) | | | | | 0 |
| Young (up to 35) | 20 | 20 | Low contact (above 10) | 0 | |
| Middle age (36-50 years) | 50 | 50 | Mean | 0.19 | |
| Old (above 50 years) | 30 | 30 | Standard Deviation | 0.39 | |

| Socio-economic factor | Frequency | Percent | Socio-economic factor | Frequency | Percent |
|---|---|---|---|---|---|
| Mean | 48.16 | | Farm size | | |
| Standard Deviation | 12.69 | | Marginal (<0.2 ha) | 1 | 1 |
| Education | | | Small (0.20 - < 1 ha) | 43 | 43 |
| Illiterate (0) | 16 | 16 | Medium (1-3 ha) | 40 | 40 |
| Can sign only (0.5) | 40 | 40 | Large (> 3.00) | 16 | 16 |
| Primary education (1-5) | 24 | 24 | Mean | 1.81 | |
| Secondary education (6-10) | 20 | 20 | Standard Deviation | 2.07 | |
| Above secondary (above 10) | 0 | 0 | Knowledge on pesticide application (score) | 23 | 23 |
| Mean | 2.74 | | Low knowledge (up to 4) | 13 | 13 |
| Standard Deviation | 1.51 | | Medium knowledge (5-7) | 64 | 64 |
| Family agriculture workforce (number) | | | High knowledge (above 7) | 23 | 23 |
| Small workforce (1-4) | 14 | 14 | Mean | 5.72 | |
| Medium workforce (5-9) | 76 | 76 | Standard Deviation | 2.05 | |
| Large workforce (above 9) | 10 | 10 | Awareness | 20 | 20 |
| Mean | 6.68 | | Low awareness (0-3) | 17 | 17 |
| Standard Deviation | 2.65 | | Medium awareness (4-7) | 64 | 64 |
| Annual family income | | 33.0 | High awareness (> 7) | 19 | 19 |
| Very Low income (up to 30000) | 49 | 49 | Mean | 5.19 | |
| Low income (31000-55000) | 30 | 30 | Standard Deviation | 2.57 | |
| Medium income (56000-150000) | 18 | 18 | Attitude | | |
| High income (above 150000) | 3 | 3 | Low unfavorable attitude (0-25) | 24 | 24 |
| Mean | 51807 | | Moderate unfavorable attitude (26-35) | 64 | 64 |
| Standard Deviation | 52381.73 | | High unfavorable attitude (> 35) | 12 | 12 |
| Training exposure | | | Mean | 15.55 | |
| No training exposure(0 days) | 67 | 67 | Standard Deviation | 3.67 | |
| Low training exposure (1-3 days) | 33 | 33 | Contact with pesticide dealers | | |
| Medium training exposure(>3days) | 0 | 0 | Very Low contact (up to 10) | 22 | 22 |
| Mean | 0.33 | | Low contact (11-17) | 67 | 67 |
| Standard Deviation | 0.47 | | Medium contact (18-21) | 8 | 8 |
| Contact with IPM club/FFS | | | High contact (above 21) | 3 | 3 |
| No contact (0) | 81 | 81 | Mean | 13.25 | |
| Very low contact (up to 10) | 19 | 19 | Standard Deviation | 3.49 | |

The awareness about environmental pollution scores ranged from 0 to 10, the average being of 5.19. The highest proportion of respondents had 64 % medium awareness about environmental pollution, while 17 percent had low awareness and 19 percent had high awareness about environmental pollution. The attitude towards harmful effects of chemical pesticides scores ranged from 8 to 24, average of 15.55.The highest proportion of respondents had 64% moderate unfavorable attitude, while 24 percent had low unfavorable attitude and 12 percent had high unfavorable attitude towards harmful effects of chemical pesticides. The contact with pesticide dealers' scores ranged from 7 to 27, the average being of 13.25.The highest proportion of the respondent had 67% low contact, while 8 percent had medium contact and 22 percent

had very low contact and 3 percent had high contact with pesticide dealers. The contact with IPM club scores ranged from 0 to 21, the average being of 0.19. The highest proportion of the respondent had 81 % no contact with IPM club, while percent had very low contact and 0 percent had low contact with IPM club/FFS.

In order to quantify the adoption of the farmers, scores were computed on the basis of time spend to accept a new practice after hearing about it and area coverage by that selected practice. Percentage of adoption of commonly used IPM practices by the Boro rice growers ranged from 3 to 18 against the possible range from 0 to 20 percent with an average of 7.99.

### *3.2 Adoption of commonly used IPM practices in Boro rice cultivation*

**TABLE 2: Distribution of the Boro rice growers according to their adoption of commonly used IPM practices in Boro rice cultivation**

| Sl. No. | Name of practices | Possible highest score range | Observed mean | Rank order |
|---|---|---|---|---|
| 1 | Use of healthy and disease free seeds | 20 | 1.4 | 2 |
| 2 | Use of perching | 20 | 1.09 | 4 |
| 3 | Use of hand or machine for weed management | 20 | 1.45 | 1 |
| 4 | Destroy the crop residues | 20 | 0.43 | 7 |
| 5 | Use trap to capture Rat | 20 | 1.14 | 3 |
| 6 | Use of light trap | 20 | 0.22 | 8 |
| 7 | Use of sweeping net | 20 | 1.08 | 5 |
| 8 | Use of irrigation and drainage for pest management | 20 | 0.87 | 6 |
| 9 | Use of crop rotation | 20 | 0.13 | 10 |
| 10 | Use of sufficient amount of pesticide as a last method of pest control | 20 | 0.19 | 9 |
| Total | | | 8.00 | |

On the basis of percentage of adoption of commonly used IPM practices in Boro rice cultivation, the respondents were classified into three categories that were shown in table 2.

### *3.3. Relationship between individual characteristics of the Boro rice growers and their adoption of commonly used IPM practices in Boro rice cultivation*

Pearson's Product Moment Correlation Co-efficient (r) was computed in order to find out the extent of relationship between adoption of commonly used of integrated pest management practices by the Boro rice growers and their selected characteristics. To reject or accept the null hypothesis 1% & 5% level of probability was used. As mentioned earlier, the eleven selected characteristics of the farmers were the independent variables of the study. The variables were age, education, family agriculture workforce, annual income, farm size, training exposure, knowledge on pesticide application, awareness about environmental pollution, attitude towards harmful effects of chemical pesticide, contact with pesticide dealers and contact with IPM club/FFS, while the adoption of commonly used IPM practices in Boro rice cultivation was dependent variable of the study. The result of correlation test is shown in Table 4.

**TABLE 4: Relationship between adoption of commonly used IPM practices by the Boro rice growers and their selected characteristics**

| | Selected characteristics of the women beneficiaries | Value of co-efficient correlation | Tabulated value | |
|---|---|---|---|---|
| | | | 0.05 level | 0.01 level |
| Adoption of commonly used IPM practices by the Boro rice growers | Age | $.054^{NS}$ | 0.196 | 0.256 |
| | Education | $-.033^{NS}$ | | |
| | Family agriculture workforce | $-.063^{NS}$ | | |
| | Annual income | $.821^{**}$ | | |
| | Farm size | $.236^{*}$ | | |

| | Selected characteristics of the women beneficiaries | Value of co-efficient correlation | Tabulated value | |
|---|---|---|---|---|
| | | | 0.05 level | 0.01 level |
| | Training exposure | .102$^{NS}$ | | |
| | Knowledge on pesticide application | .057$^{NS}$ | | |
| | Awareness about environmental pollution | .139$^{NS}$ | | |
| | Attitude towards harmful effects of chemical pesticide | .702$^{**}$ | | |
| | Contact with pesticide dealer | .562$^{**}$ | | |
| | Contact with IPM club/FFS | .307$^{**}$ | | |

** Significant at the 0.01 level * Significant at the 0.05 level $^{NS}$ Not significant

Pearson Product Moment Correlation Co-efficient variable revealed that annual income, farm size, attitude towards harmful effects of chemical pesticide, contact with pesticide dealer and contact with IPM club/FFS had significant positive relationship with the adoption of commonly used IPM practices by the Boro rice growers. This represents that the above mentioned characteristics of the respondents were the important factors in adoption of commonly used IPM practices and with the increases of these qualification of the respondent's adoption of commonly used IPM practices will increases. Age, family agriculture workforce, training exposure, knowledge on pesticide application and awareness about environmental pollution had non-significant positive relationship with the adoption of commonly used IPM practices in Boro rice cultivation which indicate that these characteristics of the rice growerswere not the important factors in adoption of commonly used IPM practicesbut with the increases of these attributes of the respondent's the adoption of commonly used IPM practicesalso increases. However, Education and family agriculture workforce had nonsignificant negative relationship and it can be concluded that education is not an important factor in adoption of IPM practices but with the increases of the respondent's adoption of IPM practices also decreases.

## 4. CONCLUSIONS AND RECOMMENDATIONS

The findings indicate that 46% of the respondents had medium adoption of commonly used IPM practices, while 43% of the respondent had low adoption and 11% of the respondent had high 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. High training exposure, high unfavorable attitude towards harmful effects of chemical pesticides and contact with IPM club/FFS of the farmers' helped to increase their adoption of commonly used IPM practices in Boro rice cultivation. Environment friendly IPM practices like use of perching, use of pesticide as a last method of pest control, use of light trap, use of capture rat and use of sweeping net were least used IPM practices by the Boro rice growers. Therefore, it may be concluded that unless or until these environment friendly practices are not popularize among the Boro rice growers, the overall adoption of commonly used IPM practices would not be increased. The major recommendations are: the Department of Agricultural Extension (DAE) should take effective steps for strengthening extension services, conducting more training programs, campaign and massive result and method demonstration programs, and opening more IPM club.

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