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PATTERNS OF INSECTICIDES APPLICATION ON T. AMAN RICE BY THE SELECTED FARMER'S AND ITS IMPACT ON HEALTH

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ABSTRACT

The study was conducted in four districts viz., Jessore, Mymensingh, Natore and Tangail to know the insecticide application pattern in T. Aman rice during July to November 2020. Data were collected from randomly selected 30 farmers of each district through a structured questionnaire. Farmers collected information mostly from extension people (40.0%) while insecticide doses from expert (57.5%) about insect pests control. They applied insecticides once/twice a season (85.8%) without reading the labelled information before spraying (80.0%) with hand operated sprayer (95.0%) before noon (63.3%). The respondents used partial protective measures, long pant/trouser, long sleeve shirts and took shower after handling insecticides at the rate of 70.0, 88.3, 80.0 and 58.3%, respectively during insecticide application. Of the respondents, 56.6% stored insecticides bottle/ packets in their living room while 69.1% left open after application. Health risks of the respondents were found to suffer from problem of skin, eye, gastrointestinal, urine and sexual, chronic diseases, physical weakness and breathing, and dizziness at the rate of 86.6, 130.7, 53.2, 11.6, 6.6, 70.0 28.3 and 3.3%, respectively. The study revealed that the farmers of Bangladesh are in at high risk of health hazards due to pesticide poisoning.

Keywords: Survey, disposal, safety measures, insecticides.

INTRODUCTION

Bangladesh is a predominantly agricultural country. Rice dominates the cropping pattern with nearly 90% of the population relying on it. Rice provides caloric intake on average over 63% of urban consumers and over 71% of rural consumers. Besides, it employs nearly 48% of rural residents. Furthermore, the rice sector accounts for half of Bangladesh's agricultural GDP and one-sixth of the country's

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national income (Alam 2013). There are three rice-growing seasons in Bangladesh: Aus, Aman, and Boro. In Bangladesh, The Aman rice covers approximately 50% of the total cultivable land (BBS 2010).

From the time of sowing until harvesting, rice plants are vulnerable to insect feeding. In Bangladesh rice ecosystems, 267 insect pest species, 185 parasitoids and 192 predators have been identified (Ali *et al*. 2021). Crop protection products particularly the use of insecticides against insect pests is viewed as an economic, labor-saving and efficient tool for pest management and for increasing crop production (Damalas and Eleftherohorinos 2011).

During 2011 and 2012, about 20 to 24 thousand tons of formulated (active ingredient, 1900-2400 tons) insecticide were used in Bangladesh (BCPA 2013). More than half of the amount of those insecticides was applied against rice pests. Per year approximately five (5) billion kg of pesticides are applied 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 (Calliera *et al*. 2013, Miller 2004, Verger and Boobis 2013).

While mixing, loading, or applying pesticides or through contact with treated crops during field application, human and environmental exposure to pesticides can occur (Damalas and Eleftherohorinos 2011, Remoundou *et al*. 2015). Both acute and chronic health effects can occur due to exposure to pesticides. Farmers in developing countries usually have too little knowledge on the proper handling of pesticides, and as a result, do not normally handle the products according to best agricultural practices (Houbraken *et al*. 2016, Ntow *et al*. 2006, Wumbei *et al*. 2019). Researchers have shown the annual incidence rates of acute pesticide poisoning among agricultural workers to be as much as 18 per 100,000 full time workers and 7 per million among school-children (Thundiyil *et al*. 2008), and also chronic effect such as cancer in agricultural workers (Markel *et al*. 2015). As many as 25 million farmers and farm workers suffer from mild poisoning and three million farmers and farm workers suffer annually from serious pesticide poisoning, and resulting in approximately 180,000 fatalities among agricultural workers annually in rural areas of developing countries (Miller 2004, Zhang *et al*. 2011), because of erroneous perceptions, lack of knowledge and education, regulation, unintentional application errors, for example, careless handling of pesticides, low level of knowledge and education among farmers and farm workers (Damalas and Hashemi 2010, Hashemi *et al*. 2012a, Hashemi *et al*. 2012b, Lekei *et al*. 2014, Khan *et al*. 2015).

Pesticide use in crop production has been suspected of being a major contribution to environmental pollution. There are widespread and growing concerns of pesticide over-use, relating to a number of dimensions such as contamination of ground water, surface water, soils and food, and the consequent impacts on wildlife and human health (McLaughlin and Mineau 1996). Farmers often spray hazardous insecticides like organophosphates and organochlorine up to five to six times in one cropping season through only two applications may be sufficient.

It is critical to understand the current use of pesticides among small-scale farmers in order to promote appropriate pesticide use. Until now, there have been no complete published reports regarding the actual scenario of usage of insecticide against insect pests of rice and on farmers' health hazards. Under this circumstances, complete information about pattern of insecticides application on rice and types of protective measure have taken by farmers during insecticides application and the most importantly the impacts of using insecticides on their health are barely needed.

MATERIALS AND METHODS

The study was conducted during July to November 2020 in Jessore, Mymensingh, Natore and Tangail district. The researcher selected these districts deliberately because these are the major rice growing areas of Bangladesh. One hundred twenty farmers i.e., thirty from each district were selected as sample respondents following simple random sampling technique. Pre-designed and pre-tested interview schedule was used for data collection. The questions were explained and clarified whenever any respondent felt difficulty in understanding them properly. The demographic data like age, education, family size, farm size, monthly income and farming experience of the respondents were included as additional information. The collected data were coded, compiled, tabulated and analyzed for processing through tabular method using average, percentage, ratio etc. in accordance with the targeted objectives. The SPSS/PC+ computer program was used to perform the data analysis.

RESULTS AND DISCUSSION

Sources of information and insecticides application pattern: Table 1 represents general information on insecticide using pattern in T. Aman rice in the studied area. Among the respondents, mostly (40.0%) collected information from extension personnel followed by retailer shop (30.8%) while 10.0% from company people (12

respondents). A total of 57.5%, 26.7% and 19.2% farmers collected the information of pesticide doses from expert, by reading the label of packets/bottles and from other farmers, respectively. Most of the farmers (85.8%) applied the insecticides once/twice a season, whereas 14.1% depending on the number of pests. None of them were found to apply insecticides at every week or twice a week.

Present findings are in line with Mohiuddin *et al*. (2009). They cited that the farmers received advice on the selection of chemicals and their doses of application from the pesticide sellers (60%) followed by research workers (12%), neighbors (9%) and extension workers (8%). This indicated that the pesticide dealers and research workers are important source of selecting pesticide in the study areas. As a developing country, more than 90% farmers of Bangladesh indiscriminately used pesticides at a high concentration due to their ignorance and unconsciousness. A survey reported that farmers mostly relied exclusively on the use of different types of insecticides, where they sprayed their crop 150 times or more in a brinjal cropping season (BARI 2000). Akhter *et al*. (2016) found that only about 20% of applicators can able to read the label which are written on Bottles or Packets while 75% can't read the label of pesticide Bottles or Packets. They are dependent on pesticide seller's opinion. Generally, pesticide sellers are not properly trained and

Table 1. Sources of information on the application pattern of insecticides for T. Aman rice in the study areas

Application pattern of insecticides	No. of total respondents (120)	Per cent
A) Source of insect pest control information		
a) Extension personnel	48	40.0
b) Retail stores	37	30.8
c) Company personnel	12	10.0
d) From other farmers	23	19.2
B) Source for doses of insecticides		
a) Read the label on the packet/bottle	32	26.7
b) Expert people	69	57.5
c) From other farmers	23	19.2
C) Frequency of insecticide application		
a) Once/twice a season	103	85.8
b) Every week	0	0.0
c) Twice a week	0	0.0
d) Depend on pest number	17	14.1

(*Multiple-answer considered).

they learn about pesticide from the representative of the company orally. Moreover, farmers complained that block supervisors or agricultural officials are rarely seen and do not properly suggests about pesticides doses.

Application method of insecticides for T. Aman rice: Application methods of insecticides for T. Aman rice in the studied area is presented in Table 2. According to the opinion of respondents, 95.0% used hand operated sprayer for insecticide application, followed by 15% applied insecticide after mixing with fertilizer. Only 3.3% farmers applied insecticides through broadcasting. Prior to application, the label was read by only 18.3% farmers. But a major portion of respondents (80.0%) did not read the label. Protective measures like washing hand or taking shower after spraying were taken by 37.5% farmers, partial safety measures were taken by 70.0% of the respondents but 30.0% farmers did not take any protective measures. Again, 63.3% of the farmers applied insecticides before noon, followed by 32.5% applied insecticides in the afternoon. Around 19.1% farmers applied insecticides in the morning.

Results of the present study are comparable with Mohiuddin *et al*. (2009). They found that most of the farmers (80%) used sprayer in spraying insecticides, while only 20% used "piskari" which was locally made by bamboo. Brinjal, a crop in which the farmers applied insecticides to the highest frequency of 45 times in Patiya, 40 times in Satkania and 35 times in Hathazari.

In a study in Jhenidah district of Bangladesh, majority of farmers (77%) reported that they applied pesticide with hand drive spray machine. Few farmers (14%) used pesticides through injection process (Akhter *et al*. 2016). In Bangladesh

Table 2. Application methods of insecticides for T. Aman rice in the study areas

A) Methods of application	No. of respondents	B) Label information of insecticide used	No. of respondents
a) With hand operated sprayer	114 (95.0)	a) Read the label of packet/bottle	22 (18.3)
b) Mix with fertilizer	18 (15.0)	b) Don't read the label of packet/ bottle	96 (80.0)
c) Broadcasting	4 (3.3)	c) Understand the label of insecticide	6 (5.0)
C) Protective measures taken after using insecticide	No. of respondents	D) Time of insecticide application	No. of respondents
a) Partial safety measures	84 (70.0)	a) At morning (before 10 am)	23 (19.1)
b) No protective measures	36 (30.0)	b) Before noon (After 10 am to 3pm)	76 (63.3)
c) Washing hand or taking bath after spraying	45 (37.5)	c) At Afternoon (After 3 pm)	39 (32.5)

(*Multiple-answer considered, value in the parenthesis denotes the percent respondents).

many farmers spray pesticides without taking any safety measures (not even wearing masks, gloves and other proper clothes) in the crop field that are highly vulnerable to suffer from various diseases because they absorb the toxic chemical unaware in different ways, including inhalation, dermal irritation etc. (Gain 1998).

Storage and disposal of insecticide packets/bottles by farmers: Storage and disposal of insecticide packets/bottles by the respondents in the study area is presented in Table 3. Among the respondents, 56.6% stored their packets/bottles of insecticides in their living room while 48.2% didn't store. The packets/bottles of insecticides were stored with other inputs by 25.0% farmers and 8.3% in kitchen while 69.1% respondents threw the packets/bottles to the open field. But 19.1% farmers carried those in home and 11.6% burnt it. Nevertheless, none of them returned the insecticide packets/bottles to the distributer.

Parallel results were also cited by Akhter *et al*. (2016) who reported that about 80% of the farmers throw the bottles or packets in their agricultural field after use while 20% brought pesticide bottles to their home for further use. They have no idea about the consequence; as a result they threw it here and there thought it has a negative impact on health and environment. In a similar study, Islam (2021) reported that the most farmers (48.3%) stored their packets/bottles of insecticides with other agricultural inputs. The packets/bottles of insecticides were stored in kitchen by 41.6% farmers while 25.0% in living room. In case of disposal of packets/bottles of insecticide, 96.6% farmers threw the packets/bottles to the open field while 23.3% carried those in home and only 8.3% burnt them. There was none who returned the insecticide packets/bottles to the distributor.

Table 3. Storage and disposal of insecticides by farmers of T. Aman rice in the study areas

Storage of insecticide (packet or bottle)	No. of total respondents (120)	Dispose of insecticide (packet or bottle)	No. of total respondents (120)
a) No storage	58 (48.2)	a) Returned to the distributor	0 (0.0)
b) Living room	68 (56.6)	b) Throw it to the open field	83 (69.1)
c) Kitchen	10 (8.3)	c) Burnt	14 (11.6)
d) With other inputs	30 (25.0)	d) Carry at home	23 (19.1)

(*Multiple-answer considered).

Protective measure taken during application of insecticides by farmers: Protective measure taken during application of insecticides in T. Aman rice by farmers in the study area is presented in Table 4. Among the respondents the highest (88.3%) wore trouser/ long pant while 80.0% wore long sleeve shirts during insecticide application. Conversely, the lowest (1.6%) number of farmers ate rice or other food during insecticide application. A total of 58.3% respondents took shower after handling of insecticides, 31.6% smoke cigarettes and 26.6% used face mask. A total of 21.6% used their hands during mixing, 19.1% considered the direction of wind flow during application. Moreover, about 10.0% farmers used to drink water, 8.3% used sunglasses, 6.6% used boots and hats. Only 1.6% used hand gloves.

Results of the present study are comparable with Mohiuddin *et al*. (2009). They found that very few farmers used protective clothing or other safety measures during insecticide application. A proportion of 39% of the farmers did not use any safety measures at all. Only 8% covered their faces with cloth during application, while nearly 32% of them covered their body and wore shirts at the time of insecticide application. Akhter *et al*. (2016) in another survey reported that only 21% respondents covered both their faces and bodies. No farmer used glasses or other form of protective devices to protect their eyes during pesticide application. Majority of respondents has taken cigarette (80%) during the period of pesticide application which makes them more vulnerable in health risks (Akhter *et al*. 2016).

Table 4. Protective measures and other activities taken during application of insecticides by the respondents

Item	No. of item respondents		No. of respondents
a) Use of face mask	32 (26.6)	g) Use of trouser/long pant	106 (88.3)
b) Use of goggles	10 (8.3)	h) Taking a shower after handling	70 (58.3)
c) Use of Hand gloves	2 (1.6)	i) Use hand during mixing	26 (21.6)
d) Taking wind condition into account	23 (19.1)	j) Smoke cigarette	38 (31.6)
e) Use of boots and hats	8 (6.6)	k) Drink water	12 (10.0)
f) Long sleeve shirts	96 (80.0)	l) Take rice and other foods	2 (1.6)

(*Multiple-answer considered, value in the parenthesis denotes the percent of total respondents).

Impacts of insecticide on farmer's health: Table 5 depicted the impacts of insecticide on farmer's health in the studied area. According to the opinion of respondents, the highest (50.0%) of the farmers suffered from skin diseases followed by 33.3% of rashes, while 3.3% from irritation and itching. The highest (65.8%) of them suffered from eye irritation followed by 41.6% suffered from eye pain and 23.3% suffered from little vision. Considering the opinion of the respondents regarding gastro-intestinal diseases, the highest (30.0%) of farmers went through the loss of appetite, followed by 16.6% faced digestion problem and 6.6% used to feel vomiting tendency during insecticide application. In case of urine and sexual diseases, 11.6% suffered from urine control problem but none of them have kidney problem and reduction of sexual urge. In case of chronic impacts on farmer's health, the highest (6.6%) suffered from asthma but none of them have cancer and birth defect. A total of 70.0% suffered from physical weakness, followed by 28.3% suffered from dizziness and 3.3% suffered from breathing problem.

In a similar type of study, Islam (2021) reported that according to the opinion of respondents, 28.3% of farmers suffered from body itching, followed by 20.0% suffered from irritation and rashes. But 38.3% of farmers suffered from eye irritation followed by 31.6% and 20.0% suffered from eye pain and little vision, respectively.

Table 5. Impacts of insecticides on farmer's health

Diseases pattern	No. of respondents	Diseases pattern	No. of respondents
A) Skin diseases		**D) Urine and sexual diseases**	
a) Body itching	4 (3.3)	a) Kidney problem	0 (0.0)
b) Body irritation	40 (33.3)	b) Urine control problem	14 (11.6)
c) rashes	60 (50.0)	c) Reduction of sexual urge	0 (0.0)
B) Eye diseases		**E) Chronic impact**	
a) Eye pain	50 (41.6)	a) Cancer	0 (0.0)
c) Eye irritation	79 (65.8)	b) Birth defect	0 (0.0)
b) Little vision	28 (23.3)	c) Asthma	8 (6.6)
C) Gastro- intestinal diseases		**F) Other diseases**	
a) Digestion problem	20 (16.6)	a) Physical weakness	84 (70.0)
b) Loss of appetite	36 (30.0)	b) Dizziness	34 (28.3)
c) Vomiting	8 (6.6)	c) Breathing problem	4 (3.3)

(*Multiple-answer considered, value in the parenthesis denotes the percent of total respondents).

The rate of dermal absorption of pesticide residues varies with the parts of body such as scalp (3.7%), forehead (4.2%), ear canal (5.4%), abdomen (2.1%), forearm (1.0%), palm (1.3%), genital area (11.8%) and ball of foot (1.6%). For these reason they are suffered from various types of health problems such as abdominal pain, dizziness, headaches, nausea, vomiting, as well as skin and eye problems (Rahman *et al*. 2012).

CONCLUSION

This study has presented a relatively current scenario of inappropriate insecticide use in T. Aman rice by farmers in Bangladesh. Findings of this study, clearly suggest that it is necessary to reduce possible health and environmental risks associated with insecticide application by documenting risk perceptions and developing ways to address these problems. This study points to the need for a comprehensive intervention and awareness among farmers on environmental issues including health impacts due to usage of insecticides in Bangladesh.

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