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USE OF PESTICIDE BY THE VEGETABLES FARMERS AND OCCUPATIONAL HEALTH HAZARDS POSED BY PESTICIDE APPLICATION IN MYMENSINGH DISTRICT

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A B S T R A C T

In Bangladesh, the use of different types of pesticides has increased in crop protection purposes. These pesticides may affect farmers' health and contaminate the aquatic environment. The objectives of the current study were to assess the use of pesticide by the vegetable farmers and their associated health hazards caused by pesticide application. A structured questionnaire was used to collect data from fifty vegetable farmers of three different villages at Mymensingh Sadar Upazila during February and March of 2019. Results showed that the mostly used pesticide was Mefonexam (used by 40% interviewed farmers), followed by Thiamethoxam + Chlorantraniliprole (24%), Profenofos + Cypermethrin (20%), and Propineb (10%). The highest application frequency was reported as 30 times for Ebamectin. The present study recorded Chlorpyrifos as the highest using dose (7.5 kg/ha) in vegetable farms. Approximately 42% of the farmers were reported to increase the amount of applying pesticide in the last 5 years where 46% continued same. More than half of the respondents (56%) were reported to use at least one protective measure during pesticide application. Most of the interviewed farmers (56%) reported no health risk while applying pesticides. Sixty percent of the interviewed farmers were claimed to have faced some negative health symptoms. Respondents were reported to face headache (31%), eye irritation (27%), vomiting (20%), dizziness (12%), and skin irritation (7%). The study indicates that the farmers of Mymensingh are not conscious about the proper use of pesticide, thus this kind of injudicious use of pesticide causes serious occupational health hazards.

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INTRODUCTION

Bangladesh has an agrarian economy and agriculture is the main sector contributing to its' national economy (Gumma et al., 2014). About 80% of the total population resides in the rural areas and somehow engaged in agricultural activities either directly or indirectly (Bhattacharjee et al., 2012). Bangladesh is blessed with fertile soils and suitable climatic condition for crop production. Due to land scarcity and to meet the food needs of rapidly increasing population, intensification of agriculture through multiple crops in a year in the same land has become a common practice in Bangladesh (Dasgupta et al., 2007). In addition to these, crop production of this country faces severe agro climatic conditions like sudden and flash flood, drought and salinity intrusion and imposes further distress in meeting the increasing food demands (Sikdar and Xiaoying, 2014). To fulfill the ever increasing food demand, farmers are intended to cultivate high yielding varieties (Hasanuzzaman et al., 2017). But these high yielding varieties are highly susceptible to pests and diseases (Ali et al., 2018). Hence, in Bangladesh, like many other developing countries a large amount of pesticides are being used extensively to protect the crops (Shahjahan et al., 2017). Besides, the Government of Bangladesh promotes the pesticide use to expand production (Dasgupta et al., 2007; Sumon et al., 2018).

In Bangladesh, the use of pesticides was started in 1951 but their use was limited until 1960s (Ara et al., 2014). A dramatic increase in use was observed from 7350 metric ton active ingredients in 1992 to 45,172 metric ton in 2010 (Rahman, 2013). Nowadays about 84 active ingredients having different formulations and 242 trade names of pesticides have been registered for use in Bangladesh and are extensively used in crop protection (Chowdhury et al., 2012; Ara et al., 2014). Pesticides are considered as having potential environmental and public health hazards besides their beneficial effects in crop protection. Improper use of pesticides can cause direct human poisoning, accumulates as residues in food and the environment and can develop resistant strain of pests. These problems are caused either by misuse of pesticides or over reliance on them, particularly if the farmers are unaware of these potential problems.

Pesticide application in agricultural crops contaminate the aquatic environment in and around them by several routes including spray drift, surface runoff, and groundwater leaching, careless disposal of empty containers after pesticide application (Van den Brink, 2013, Hossain et al., 2015., Sumon et al., 2016, 2017). These pesticides may potentially cause toxicological effects on both non-target aquatic organisms like primary producers (Malev et al., 2012; Liu et al; 2013; Kumer et al., 2014; Daam et.al., 2008) and fish (Tillit et al., 2010; Marimuthu et al., 2013; Ali et al., 2018; Sumon et al., 2017, 2019). Furthermore, farmers having poor knowledge on safe pesticide use and management could result in human health hazards like skin disease, gastrointestinal disease, urinary and reproductive dysfunctions (Sumon et al., 2016). Exposure to pesticides during application may affect the health conditions of farmers including acute intoxication and/or other diseases e.g. dermatological, gastrointestinal, neurological, carcinogenic, reproductive effects. Furthermore, accidental exposure to pesticides may result in death (Boccolini et al., 2017).

Several studies monitored the pattern of pesticides use in different agricultural crops of Bangladesh (Dasgupta et al., 2005; Meisner, 2004). Few studies investigated the potential risks of pesticides in different water bodies in Bangladesh (Sumon et al., 2016, 2018) but the use of the pesticide has not received much attention in Mymensingh district. To the best of our knowledge, no studies have investigated the use of pesticide by the vegetable farmers and different health issues caused by pesticide application in Mymensingh district, Bangladesh. Hence, the objectives of the present study were to assess the use of pesticide by vegetable farmers and occupational health hazards posed by pesticide application.

MATERIALS AND METHODS

Selection of the Study Area

Three villages (Kustiapara, Bartipara and Mridhapara) of Borar Char union of Mymensingh District, Bangladesh were selected for the study where a plenty of vegetables were grown (Figure 1). The study area was selected based on the suggestions made by Upazila Agriculture Officer of Mymensingh Sadar.

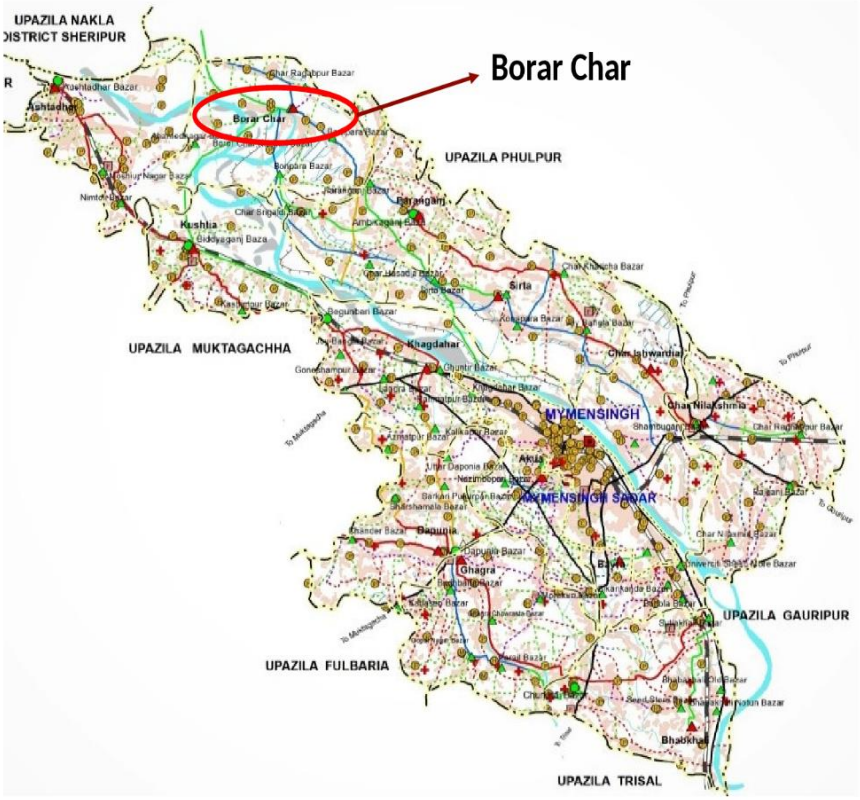

Figure 1. Map of the study area

Questionnaire Preparation and Data Collection

Considering the objective of the study a questionnaire was prepared for the selected community. The questionnaire was used to elicit the type of pesticide use, and the deleterious effects of pesticides on human health. Data were collected through the questionnaire survey (structured questionnaire) from vegetable cultivators in the selected areas during February and March 2019. In the present study, a face-to-face interview method was used to collect the data.

Sampling Technique

For collecting raw data, farmers were selected on the basis of ownership of their own land and directly involved in vegetable cultivation. Data were collected from 50 farmers: firstly from Kustiapara (20 farmers), followed by Bartipara (15 farmers) and Mridhapara (15 farmers). The farmers were selected with the help of Sub-Assistant Agricultural Officer (SAAO) of Mymensingh District.

Analyses of Data

Data were checked and cross checked before transferring to the master table sheets. For this study, the collected data were coded, compiled, tabulated and analyzed in accordance with the objective. Qualitative data were converted into quantitative by means of suitable scoring technique wherever applicable. Statistical measurements such as number and percent distribution of the variables were conducted with Microsoft Office Excel 2010.

RESULTS

The present study found that the highest cultivated crop in the selected areas was chili (25.77%), followed by tomato while the lowest cultivated crop was potato (Table 1). In the current investigation, 10 insecticides and 6 fungicides having 16 different active ingredients were reported to use in different vegetables. Among them, Profenofos 40% + Cypermethrin 2.5% (Shobicron) insecticide were reported to be used in maximum. The highest application interval was found for Mefenoxam 45.3% and Carbofuran 5% pesticide with an average number of applications of 25 days (Table 2).

This study revealed that the highly used fungicide was Indofil M-45 (Mancozeb a.i 80%) which was used 9 to 10 times in a cropping period. The maximum number of application was found 28-30 times in a cropping period (Table 1). This study found Vertimec (Ebamectin 1.8%) and Shobicron (Profenofos 40% + Cypermethrin 2.5%) were the mostly used insecticide in Chili in respect to the amount of active ingredient and frequency of application. In our study, the mostlyused fungicide was Companion (Mancozeb 63% +Carbendazim 12%) where the most commonly used insecticide was found to be Nitro (Chlorpyrifos 50% +Cypermathrin 5%). A significant number of pesticides were being used in brinjal cultivation. The mostly used pesticide in brinjal protection was Karate (Lambda Cyhalothrin) and Actara (Thiamethoxam 25%) (Table 1). Sunfuran (Carbofuran 5%), Vertimec (Ebamectin 1.8%) and Virtako (Thiamethoxam 20% + Cloran-traniliprole 20%) insecticides were reported as common insecticides used in Okra cultivation (Table 1). The mostly used fungicide in cucumber was Ridomil Gold (Mefenoxam 45.3%). Besides Amister Top (Azoxistrobin 20% + Diphenoconazol 12.5%) and Cabrio Top (Pyraclostrobin (5%) +Metiram (55%)) fungicide was reported in a considerable amount (Table 1).

The study revealed that the highest proportion of respondents (66%) belonged to the small size farm, while 34% of them belonged to the large size. Thus the study indicates that most of the farmers were poor and they had a small amount cultivable area for crop production (Table 3). It was found that the most of the farmers (36%) were associated with farming for more than 15 years and a very few of them (10%) were associated with farming for 1 to 5 years (Table 3). Most of the respondents were totally attached and relied on vegetable farming from their early age of life.

From the study it was observed that 56% of the total respondents thought that pesticide has no health risk at all while 10% thought it has a small amount of risk and 2% thought it has a large amount of risk and no one thought that it is fatal or dangerous. Among the respondents, 27 (54 %) of them reported that there were no short-term effects on pesticide and 13 reported that there were little side effects. Seven respondents informed some effects. From the present study it was found that 28 respondents (56%) think there are no long term effects of pesticide. Thirteen respondents reported it has some little effects and 5 respondents reported it has some effects where 1 respondent reported it has long term fatal effect and 3 respondents did not know about this issue (Table 3).

Approximately 32 respondents reported that they faced some problems related to health issues while applying pesticide. From the present study it was found that 31% respondents reported to experience headache while applying pesticide, followed by eye irritation (27% respondents), vomiting (20% respondents), dizziness (12% respondents), skin irritation (7% respondents) and some others problems (3% respondents). About 41% respondents reported that they were very sure that these symptoms were caused by applying pesticide, 28% respondents were not sure that it was caused by pesticide (Table 3). This study revealed that 44% of the farmers did not use any protective measures while applying pesticides. Approximately 19 respondents (44.18 %) used mask, 18 respondents were reported to use protective cloths, 3 respondents used glass during pesticide application and only 3 respondents used gloves (Table 3). It was found that 13 respondents (20%) among 50 were trained from a government or non-government organization but the rest of them were not trained about pesticide usage (Table 3).

In the present study, 27 of the respondents understood the label and rest of them did not understand. Ninety percent respondents did not know about the banned pesticides (Table 3). It was reported that 46% respondents remained same quantity which was prescribed by Upazila Agricultural Officer, whereas 12% respondents reduced the prescribed amount while applying the pesticide and 42% respondents increased the quantity. About 3 respondents out of 50 reported that they knew about the alternative to pesticide application (Table 3).

Table 1. Pesticides used in different vegetables in the study area

Name of the vegetables	Trade Name	Active Ingredients	Mode of Application	Using Dose (kg/ha)	Application Interval (days)	Total No. of Application
Tomato	Virtako	Thiamethoxam 20% + Cloran-traniliprole 20%	Spray	0.075	15-20	3-4
	Indofil M-45	Mancozeb a.i 80%	Spray	0.32	7-10	9-10
	Dursban	Chlorpyriphos 20%	Spray	7.5	7-10	9-10
	Ridomil Gold	Mefenoxam 45.3%	Spray	2.5	20-30	3-4
	Shobicron	Profenofos 40% + Cypermethrin 2.5%	Spray	0.98	7-8	8-9
Chili	Ridomil Gold	Mefenoxam45.3%	Spray	2.5	20-30	4-5
	Vertimec	Ebamectin 1.8%	Spray	0.6	7-10	28-30
	Shobicron	Profenofos 40% + Cypermethrin 2.5%	Spray	0.98	7-8	25-28
	Companion	Mancozeb (63%) +Carbendazim(12%)	Spray	0.32	15-20	6-8
Cauliflower	Thiovit	Sulfur 80%	Broadcast	2.5	10-14	4-6
	Tracer	Spinosad 45%	Spray	0.175	8-10	5-6
	Nitro	Chlorpyrifos (50%) +Cypermathrin (5%)	Spray	0.067	12-15	3-4
	Companion	Mancozeb (63%) +Carbendazim (12%)	Spray	0.32	15-20	14-15
Brinjal	Vertimec	Ebamectin 1.8%	Spray	1.2	7-10	9-10
	Nitro	Chlorpyrifos (50%) +Cypermathrin (5%)	Spray	0.067	7-10	9-10
	Karate	Lambda Cyhalothrin	Spray	0.75	5-7	18-20
	Shobicron	Profenofos 40% + Cypermethrin 2.5%	Spray	0.98	7-8	12-15
	Actara	Thiamethoxam 25%	Spray	0.61	5-7	18-20
	Diazinon 60EC	Diazinon	Spray	1.2	7-8	12-15
	Indofil M-45	Mancozeb a.i 80%	Spray	0.64	10-12	5-6
Okra	Sunfuran	Carbofuran 5%	Spray	30	25-30	1-2
	Vertimec	Ebamectin 1.8%	Spray	1.2	7-10	4-5
	Shobicron	Profenofos 40% + Cypermethrin 2.5%	Spray	0.98	7-8	3-4
	Jazz	Mancozeb 80%	Spray	0.65	10-14	3-4
	Ridomil Gold	Mefenoxam 45.3%	Spray	2.5	20-30	1-2
	Virtako	Thiamethoxam 20% + Cloran-traniliprole 20%	Spray	0.075	15-20	5-6
Cucumber	Thiovit	Sulfur 80%	Spray	4.47	25-30	1-2
	Ridomil Gold	Mefenoxam 45.3%	Spray	2.5	20-30	1-2
	Relux	Mancozeb (63%) +Carbendazim (12%)	Spray	0.60	14-15	2-3
	Amister Top	Azoxistrobin 20% + Diphenoconazol 12.5%	Spray	0.5	10-14	3-4
	Cabrio Top	Pyraclostrobin (5%) +Metiram (55%)	Spray	1	24-30	1-2

Table 2. Active ingredients of pesticides with their number of applications and application intervals applied in vegetable production in the study area

Pesticide type (% of total number in use)	Active ingredients	Application intervals (Mean ± SD)	Total number of application (Mean ± SD)
Insecticides (60%)	Thiamethoxam 20% +Cloran-traniliprole 20%	17.5±2.5	4.5±1.5
	Chlorpyriphos 20%	8.5±1.5	11±2
	Profenofos 40% + Cypermethrin 2.5%	7.5±0.5	18±10
	Ebamectin 1.8%	8.5±1.5	17±13
	Spinosad 45%	12±2	5±1
	Chlorpyrifos (50%) +Cypermathrin (5%)	11±4	6.5±3.5
	Lambda Cyhalothrin	6±1	19±1
	Thiamethoxam 25%	6±1	19±1
	Diazinon	7.5±0.5	13.5±1.5
	Carbofuran 5%	27.5±2.5	1.5±0.5
Fungicides (40%)	Mancozeb 80%	9.5±2.5	10.5±5.5
	Mefenoxam 45.3%	25±5	3±2
	Mancozeb (63%) +Carbendazim (12%)	12.5±2.5	10±5
	Sulfur 80%	20±10	5±1
	Azoxistrobin 20%+ Diphenoconazol 12.5%	12±1	3.5±0.5
	Pyraclostrobin (5%) +Metiram (55%)	27±3	2.5±1.5
Herbicides	Pretilachlor 50%	0	1.5±0.5

Table 3. Distribution patterns of pesticide use, and occupational health hazards of vegetable farmers (N = 50)

Variables	Total respondents	
	Number	Percentage (%)
Farm size		
Land size <100 decimal	33	66
Land size ≥100 decimal	17	34
Farming period (year)		
1 to 5	5	10
6 to 10	13	26
11 to 15	14	28
More than 15	18	36
Cultivated Crop.		
Tomato	24	24.74
Chilly	25	25.77
Cauliflower	10	10.30
Brinjal	13	13.40
Okra	6	6.18
Cucumber	8	8.24
Bitter gourd	6	6.18
Potato	5	5.15
Understanding the Pesticide label of the container		
Respondents understand the label of pesticide	27	54
Respondents could not understand the label	23	46
Changing the dose of Prescribed Pesticide		
Kept same quantity of pesticide application	23	46
Increased the application quantity	21	42
Reduced the quantity	6	12

Table 3. Distribution patterns of pesticide use, and occupational health hazards of vegetable farmers (N=50) (contd.)

Variables	Total respondents	
	Number	Percentage %
Causes of changing the pesticide dose		
Suggestion from others	2	4
Insect does not die	3.5	71
Make sure that it may work	7	13
Supplier said so	6	12
Knowledge about banned pesticide		
Know the banned pesticide	5	10
Does not know the banned pesticide	45	90
H. Training received		
Trained	13	26
Non trained	37	74
Farmers' perception on the health risk while applying pesticide		
No risk	28	56
Small amount of risk	14	28
Medium amount of risk	5	10
Large amount of risk	1	2
Dangerous / fatal	0	0
I don't know	2	4
Farmer's perception on short term negative effects of pesticide		
No effects	27	54
Little effects	13	26
Some effects	7	14
Fatal effects	0	0
I don't know	3	6
Negative effects of pesticide		
No effects	28	56
Little effects	13	26
Some effects	5	10
Fatal effects	1	2
I don`t know	3	6
Using the protective measure		
Using protective measure	28	56
Don't use	22	44
Types of protective measure taken by respondent		
Mask	19	44.18
Proper cloths	18	41.86
Glass	3	6.97
Gloves	3	6.97
Pesticide related problem or symptoms		
Faced problem	32	64
Did not face problem	18	36
Occupational health hazards during pesticide application		
Eye irritation	14	27
Headache	15	31
Dizziness	6	12
Vomiting	10	20
Skin irritation	4	7
Others	1	2

DISCUSSION

Pest and diseases are the two major problems in vegetable cultivation. The farmers tend to use pesticides to protect their crops from the damage caused by them. This study found that all respondents in the present survey were reported to spray their crops with pesticides. Almost similar results (87% of interviewed farmers) were reported to use pesticides in rice fields in a study in Khulna region (Sumon et al., 2016). Slight variations in percentage in use of the pesticides might be due to the type of cultivated crops since vegetables are more susceptible to pests and disease than rice. The present study found that 16 active ingredients including insecticide (60%) and fungicides (40%) with different formulations were being used by the farmers in the surveyed area. Fifty different active ingredients with a total of 161 formulations of pesticides were reported to use in a study including 821 farmers among 11 districts in Bangladesh (Dasgupta et al., 2007). The present study found that highest average application intervals of 25 times for Mefenoxam 45.3% and Carbofuran 5% pesticide. Dasgupta et al. (2007) reported that the number of pesticide applications in a single season ranges from 1 and 16, with an average of four applications.

In the present study, the majority of the interviewed farmers (56%) were reported to think that pesticides having no occupational health hazards at all. Sumon et al. (2016) reported that 94% of the interviewed farmers thought pesticides to have short/long term health effects. This could be explained by the fact that 64% of the farmers in the present study faced health problem after applying pesticides however, among them 41% reported to be very confident that these symptoms had been caused by the pesticides. The results of this study is in line with the finding of a study reported that 49% of the interviewed farmers experienced acute pesticide poisoning such as eye irritation, headache, dizziness, vomiting and skin diseases (Dasgupta et al., 2007). The present interview revealed that the mostly reported health problems were headache (31%), followed by eye irritation (27%) and vomiting (20%). Dasgupta et al. (2007) found almost similar occupational health hazard symptoms e.g. headaches (27%), eye irritation, (26%) and vomiting (9%).

Present investigation found that 44% of the interviewed farmers did not take any protective measures while dealing with pesticides. An earlier study by Dasgupta et al. (2007) reported that 87% of the farmers did not take any protective measures during pesticide handing. In the present study, only 26% of the total respondents were reported having training on safe pesticides use from government and non-government organizations. Another study covering 11 districts of Bangladesh and 821farmers on pesticide use reported 4% of the farmers received basic training on pesticide use practices (Dasgupta et al., 2007).

CONCLUSION

The present study investigated the current use pesticides by vegetables farmers, and their associated health hazards posed by the pesticide application. The study revealed that the mostly used (20 respondents) pesticide was Mefenoxam 45.3%. Maximum application interval (25-30 days) was found for Sulfur 80% and Chlorpyrifos 20% was reported as the highest using dose (7.5 kg/ha). In our study, only 20 percent of the interviewed farmers were trained on pesticide use. The present study revealed several health hazard symptoms including eye irritation, headache, dizziness, vomiting and skin irritation, indicating that the farmers of Borar Char Union are not more conscious about the proper use of pesticide. Hence, we recommend to enhance proper training facilities by any means of government and/or non-government organizations to educate the farmers on the use of recommended dose of pesticides in their vegetables and on suitable protective measures during pesticide application.

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COMPETING INTERESTS

The authors have declared that no competing interest exist

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