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Assessment of Farmers' Health Risk Due to Pesticide Uses in Winter Vegetables at Selected Areas of Bogura District, Bangladesh

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Abstract: Farmers are facing various kinds of health problems due to exposure of pesticides. This study was conducted to find out the use of pesticides and their related health hazards to vegetable farmers. Data was collected by using a structured questionnaire from seventy-five vegetable cultivators of three different villages at Shajahanpur Upazila under Bogura district Bangladesh, from November to December 2021. The findings showed that the utmost used pesticide was Benzol 5 EC (used by 40% interviewed farmers), followed by Hexaconazol 5%, Amamectin 1% + Acetamiprid 3%, Cloropairiphos 50% + Chypermethin 5%, Chypermethin 10%, Lamda chyhelothrin 2.5%, Mancozeb 80 %. Mascut 550 EC had been reported as mostly used pesticide for which the frequency was recorded as 28 times. Diefenaconazol 15% + Propiconazol 15% were the highest using dose (7.5 kg/ha) in vegetable farms. Around 35% of the farmers reported the increasing rate of pesticide application in last 5 years whereas 52% of respondents reported that the amount was the same. No health risk was found for most of the interviewed farmers (65%) during applying pesticide whereas 35 percent of the interviewed farmers claimed that they faced some negative health symptoms. Twenty percent of respondents reported that they experienced itching of eye, skin, and nose irritation while applying pesticide, 11 percent faced headache, 15 percent faced dry cough, 9 percent had a digestive problem, 11 percent faced difficulty in breathing, 5 percent had chest pain and 21 percent had no health problem. This study also specifies that the farmers of Bogura are not conscious of the proper use of pesticides and this kind of behavior results in serious health hazards. Alternative methods and programs especially Integrated Pest Management may be applied for environmentally friendly agricultural production in Bangladesh.

Keywords: Health hazards; Pesticides; Vegetables; Environmental impact.

INTRODUCTION

Bangladesh is a lower-middle-income country that relies heavily on agriculture for economic growth, food and nutrition security, and poverty reduction (Sarma, 2022). Agriculture and the environment have always had a symbiotic relationship. Currently, around 76% people living in rural areas depends of on agriculture for their livelihood, either directly or indirectly (Kabir and Rainis, 2012). Farmers across the country are planting high-yielding crop varieties to feed the country's rapidly growing population. Alarming concern is that most of these high-yielding varieties are very sensitive to pests and diseases are an important distinction. Therefore, pesticides have been used more frequently in recent decades to boost agricultural productivity (Rahman, 2013).

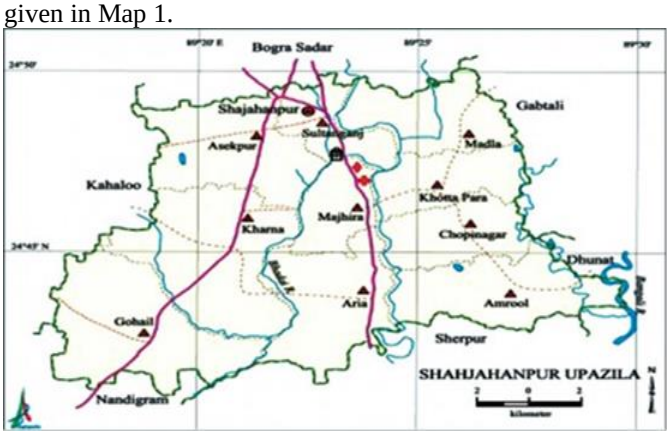
Bangladesh is one of South Asia's leading vegetable producers (Ali, 2000). This sector contributes a significant portion of Bangladesh's GDP, with 2 lac acres of cultivable land (6.73 percent) (BBS, 2017). Northern areas of Bangladesh are famous for vegetable cultivation, especially Bogura. For a long time, farmers in Bogura have been farming a wide range of vegetables and spices for commercial uses. Farmers earn by growing potatoes, tomatoes, pumpkins, cauliflower, carrots, and cabbages. According to DAE authorities, potato output in Bogura district grew from 0.914 million tons to 1.133 million tones (The Daily Star, 2011) in a year. Most farmers, especially in developing countries like Bangladesh, use pesticides without fully knowing their needs or efficacy, resulting in excessive pesticide application rates. Above 90% of Bangladeshi cultivators use pesticides inappropriately, intensively, and

unreasonably due to their ignorance and unconsciousness regarding pesticide usage (Miah et al., 2014). Although this is a serious issue for our aquatic environment as well as human health. Pesticides cause a variety of acute physiological health problems in humans, including reproductive inhibition, hormonal disorders, immune system disorders, and death. Even though several experiments have been conducted on the impact of pesticide use on field crops (Akter et al., 2018, Hasan et al., 2021) very limited published research is available for this region. This study was directed to investigate the knowledge, outlook and pattern of pesticide application on the vegetable crop as well as their impact on human health and the surrounding environment.

MATERIALS AND METHODS

Study area

Three villages (Rupiher, Kapashuri, and Kasahar) of Gohail union, Shajahanpur upzila in Bogura district were selected based on the recommendations of the Bogura District's Upazila Agricultural Officer and Agricultural Extension Officer. The study areas are well known for vegetable production. Location of the study area has been given in Map 1.



Map 1. Shajahanpur upazila of Bogura Districts

Survey designed and data collection

Farmers were selected based on certain criteria, such as having their land and being involved directly in vegetable cultivation. The farmers were chosen with the assistance of the Bogura district's Sub-Assistant Agricultural Officer. The data were collected from November to December 2021 from the key informants (vegetable farmers) through face-to-face interviews whereas the sample size for Rupiher was 30, Kapasuri was 25, and Kasahar was 20. Farmers were interviewed by using a standardized questionnaire about the study surveillance of the selected farmers about the use and the injurious effects of pesticides on the environment as well as human health. The clarity and correctness of the questions were evaluated as a result of these interviews, and the questionnaire was revised accordingly. Wherever possible, qualitative data were transformed into quantitative datausing an appropriate scoring method. Microsoft Office Excel 2013 was used to perform statistical calculations.

RESULTS AND DISCUSSIONS

Selected characteristics of the farmers and knowledge on pesticides

The characteristics of the farmers have been given in Table 1. Farmers in the study area had farms ranging in size from 0.4 hectares to over 1 hectare. Farmers are divided into three groups where most of the farmers had small and medium farms. Farming participation is divided into three categories. The highest percentage (61.33 percent) of farmers had been farming for over ten years and the lowest percentage (10.66 percent) were farming for one to five years (Table-1). Tomatoes, chillies, potatoes, brinjal, cabbage, radish, and carrot were the most commonly grown winter vegetables in the study areas. But the mostly cultivated crop was potato (43.2 percent) followed by brinjal and cabbage whereas carrot was the lowest cultivated crop (Table-1).

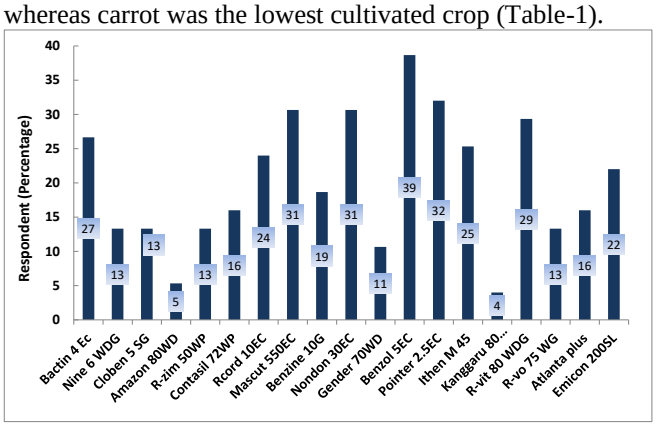


Figure 1. Pesticides used by the vegetable's farmer

Twenty-seven percent of the respondents had primary level education whereas 29 percent had secondary and above secondary level education. The rest of the 15 percent of respondents were illiterate. Sixty-one percent of respondents were associated with farming for more than 10 years. Respondents received pesticide-related information from various sources such as mass media, group contact, personal cosmopolite or local people. From the table, it is also revealed that 59 percent of respondents understood pesticide labels and 28 percent received various types of crop production related training from government and non-government organizations. Respondents were asked about banned pesticides as several pesticides were banned nationally and globally and 90 percent of the respondents were not aware about the banned pesticides. This paper also studied changing the dose of pesticides, causing the changing of application doses. Farmers tend to change the pesticide application dose. This may produce positive results in contrast to killing pests, but it may also harm the environment. Excessive pesticide use has negative effects on aquatic environments. According to a survey, 52 percent of respondents continued to use the same amount of pesticide.

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Table 1. Characteristics of respondents and perception on pesticides.

Characteristics	Categories	Number	Percent
Farm size	Large size (above 1 ha)	8	10.67
	Medium size (.04 to 1 ha)	33	44
	Small size (up to 0.4 ha)	34	45.33
	Total	75	
Participation of farming	Occasionally (6 to 10y)	21	28
	Rarely (1 to 5y)	8	10.67
	Regularly (above 10y)	46	61.33
	Total	75	
Cultivated crop	Brinjal	23	30.13
	Cabbage	23	30.13
	Chili	21	27.51
	Potato	33	43.23
	Tomato	19	24.89
	Radish	9	11.79
	Carrot	3	3.93
Pesticides information sources	Group contact	18	24
	Mass media	28	37.33
	Personal cosmopolite	11	14.67
	Personal locality	18	24
	Total	75	
Education level	Primary	20	26.67
	Secondary	22	29.33
	Above	22	29.33
	Illiterate	11	14.67
Knowledge on pesticide use	High	17	22.67
	Medium	32	42.67
	Low	26	34.67
Understanding pesticide label	Understand	44	59
	Don't understand	31	41
Training received	Trained	21	28
	Untrained	54	72
Types of protective measure	Long sleve shirt	17	22.67
	Long sleve shirt and gamcha	19	25.33
	Long sleve shirt, gamcha, cloth over mouth and nose	28	37.33
	Did not take any protective measure	11	14.67
Knowledge about banned pesticide	Know about banned pesticide		
	Don't know about banned pesticide		

Farmer's opinion on the health hazard while applying pesticide

Farmers must use protective equipment such as cloths, masks, hand gloves, shoes, and glasses before applying pesticides. According to this study, 39% of farmers do not use any protective measure. They wore long sleeve shirts, gamcha, a cloth over their mouth and nose. According to According to the findings of this study, 65% of respondents have had a problem as a result of using pesticides, while 35% had not. Farmers continue to experience toxicity symptoms when using pesticides despite this knowledge. They had eye, skin, and nose irritation, as well as a dry cough, headaches, and breathing difficulties (Figure 2).

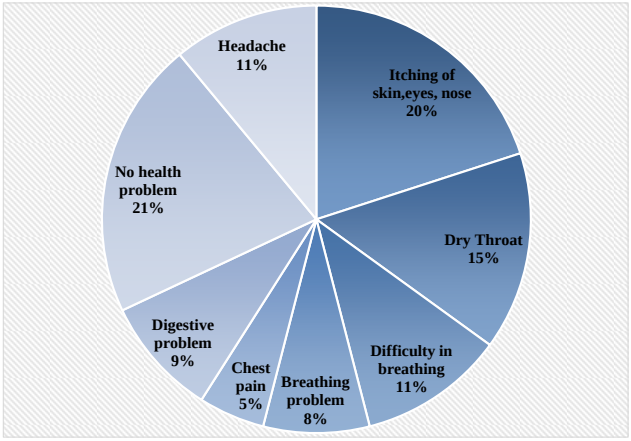

Figure 2. Health problems faced by the respondents

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Table 2. List of pesticides with their active ingredients.

Crop	Trade name	Active ingredients	Dose & Category	Application interval	Number of spray
Tomato	Emicon 200 SL	Emidacloprid 20%	0.08 (I)	15-20	3-4
	Cloben 5 SG	Amamectin Benzoid 5%	0.32 (I)	7-10	6-7
	Nondon 30 EC	Diefenaconazol 15% + Propiconazol 15%	7.5 (F)	7-10	6-8
	Ithen M 45	Mancozeb 80%	2.5 (F)	7-8	8-10
Chili	Benzine 10G	Diazinon 10%	2.5 (I)	10-14	4-5
	Bactin 4 EC	Amamectin 1% + Acetamiprid 3%	0.18 (I)	8-10	25-26
	R vit80 WDG	Sulfer 80%	0.07 (F)	12-15	26-28
	Benzol 5EC	Hexaconazol 5%	0.32 (F)	15-20	8-10
	R-zim 50 WP	Carbendazim 50%	1.5 (F)	7-8	5-6
Cabbage	Geat furan 5G	Carbofuran 5%	2.5 (I)	10-14	4-5
	Record 10 EC	Chypermethin 10%	0.6 (I)	8-10	25-26
	Mascut 550EC	Cloropairiphos 50% + Chypermethin 5%	0.98 (I)	12-15	26-28
	Benzol 5EC	Hexaconazol 5%	0.32 (F)	15-20	8-10
	Atlanta plus	Amamectin Benzoyed 20% + 20% Thaiyomethoaxam	1.2 (I)	7-10	9-10
Brinjal	Pointeer 2.5EC	Lamda chyhelothrin 2.5%	0.07 (I)	7-10	18-20
	Nine 6WDG	Amamectin 2% + Amamectin Benzoid 4%	0.75 (I)	5-7	8-9
	R-Vo 75 WG	Tebuconazol 50% + Tryfloxistrobin 25%	0.98 (F)	7-8	12-15
	Ithen M45	Mancozeb 80%	0.61 (F)	5-7	18-20
Potato	Benzine 10G	Diazinon 10%	30 (I)	25-30	1-2
	Geat Furan 5G	Carbofuran 5%	1.2 (I)	7-10	4-5
	Amazon 80Wd	Thayamethoxan 20% + Amamectin Benzoid 20%	0.98 (I)	7-8	3-4
	Contasil 72WP	Chymoxanil 8% + Mancozeb 68%	0.65 (F)	10-14	3-4
	R-vit 80WDG	Mancozeb 80%	2.5 (F)	20-30	1-2
	Benzol 5EC	Hexaconazol 5%	0.08 (F)	15-20	5-6
Radish	Kanggu 80 WDG	Nitenpiran 20% + Pimetrozin 20%	4.47 (I)	25-30	3-5
	Gender 70 WD	Emidacloprid 70%	2.5 (I)	20-30	1-2
	Nine 6WDG	Amamectin 2% + Amamectin Benzoid 4%	0.06 (I)	14-15	2-3
	Nondon 30 EC	Diefenaconazol 15% + Propiconazol 15%	0.5 (F)	10-14	2-3
	Contasill 72 WP	Chymoxanil 8% + Mancozeb 68%	1 (I)	24-30	1-2

***I=Insecticide and F=Fungicide**

Impact of pesticide on environment

Pesticides harm the environment, and the respondents were asked what they thought about it. It's critical to understand their initial thoughts on the subject. It will demonstrate how environmentally conscious they are. 23% of respondents thought that use of pesticides caused high level of water pollution whereas 69% believed that pesticides had a negative result on soil environment (Figure 3). Only 9% Respondents were concerned about the use of biological pest control methods.

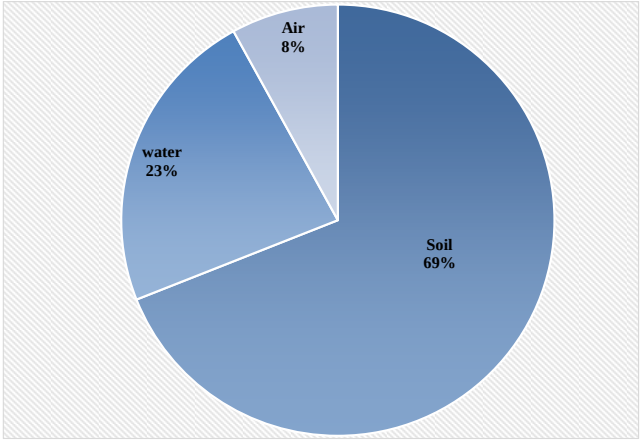

Figure 3. Impact of pesticides on Environment

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Respondent Characteristics and Perception on pesticide use

Twenty seven percent of the respondents had primary level education whereas 29 percent had secondary and above secondary level education. 36% of farmers had been growing vegetables for over 15 years. More than 0.4 ha of cultivable land was owned by 34% of those polled. Pesticide knowledge was discovered to be significantly higher than that of the small landowner. It was noticed that 59% of farmers failed to read the pesticide label. 71% of farmers complained the recommended level of insecticides was ineffective against insects whereas 13% of farmers applied overdose to check their affectivity A survey conducted in Dhaka, Bangladesh showed that farmers (86.1%) had a low to medium perception of pesticides' negative environmental impacts, whereas only 13.9 percent had a high perception (Kabir and Rainis, 2012). According to our study, only 28% of the total respondents had received training on safe pesticide use from government and private organizations. Another study conducted by Dasgupta et al., 2007, in 11 districts of Bangladesh with 821 farmers, found that only 4% of the farmers had received basic training on pesticide application. In this survey, 41% of respondents didn't understand the pesticide label and the majority didn't think it was necessary.

Pesticide used in winter vegetables

In this study, Ithen M 45 (Mancozeb 80 percent) was used 8 to 10 times in tomato growing, while Cloben 5 SG (Amamectin Benzoid 5 percent) was used 8-9 times. According to the respondents, the most commonly used pesticides for chilli growing were Bactin 4 EC (Amamectin 1% + Acetamiprid 3%) and R-vit 80 WDG (Sulfer 80%). The insecticide Bactin 4 EC was the most commonly used, with 2.5 kg/ha reported. In Bactin 4 EC, R-vit 80 WDG had the most applications with the longest application interval (28-30 times). From Jeyanthi and Kombairaju (2005) farmers in Tamil Nadu used an average of 5.13 kg/ha of pesticide in 13 times on their cultivation field. Pesticides such as Record 10 EC (Chypermethin 10%) and Mascut 550 EC (Cloropairiphos 50% + Chypermethin 5%) were used in cabbage farming. A recent study in Tamil Nadu showed that cabbage required 15 applications (Jeyanthi and Kombairaju, 2005). A variety of pesticides have been used for brinjal cultivation. This study found that Pointer 2.5 EC was acting on both commonly used pesticides and insecticides (Lambda chyhelothrin 2.5 percent) for brinjal cultivation. A similar study was carried out in Kustia on the pesticides used in brinjal cultivation (Raza et al., 2018). They were Choice 1.8 EC (Abamectin), Manik 20 SP (Acetamiprid), Surate 20 EC (Fenvalerate), Vetrimec 1.8 EC (Abamectin), Prize 20 SP (Acetamiprid), Proclaim 5 SG (Emamectin Benzoate), Regent 50 SC (Fipronil), Licar 1.8 EC (Abamectin), Volium Flexi 300 SC. In potato cultivation, insecticides like Great Furan 5 G (Carbofuran 5%) and Amazan 80 WD (Thayamethoxam 20% + Amamectin Benzoid 20%) were used commonly. Fungicides include R-vit 80 WDG (Mancozeb 80 percent) and Benzol 5 EC (Hexaconazol 5 percent). Great Furan 5 G was the most common insecticide used in potato production (4-5 times). Great Furan 5 G (Carbofuran 5%) reported a 1.2 kg/ha dosage with a 7–10-day application interval. Benzol 5 EC (Hexaconazol 5%) was applied every 15-20 days at a rate of 0.075 kg/ha. According to Al-Emran et al., (2020) Indofil M-45 (Mancozeb a.i. 80 percent) and Companion (Carbendazim 12 percent) are commonly used fungicides in potato cultivation. For fungicides, Thiovit (80 percent sulfur) and Antracol70 WP (70 percent propineb) were used in our study areas.

Farmers' perception on health hazard

According to the survey, 61% of farmers used some form of protection, while 39% did not. When spraying 23% of respondents wore long sleeve shirts, ensuring that the pesticide did not enter the body. Because of detrimental health effects on themselves and other farmworkers, they believed that during applying pesticide they should dress within protective clothing. During pesticide application, 25 percent of respondents used long sleeve shirts and gamcha, 37% of respondents used long sleeve shirts, gamcha, or cloth over the mouth and nose, while only 15 percent of respondents did not take any protective measures. At all stages of pesticide use, farmers within lower safety behavior displayed higher risk of health hazards (Sookhtanlou et al., 2022). Ibn Chittagong, 39% of farmers did not use any safety precautions at all. Only 8% farmers use a cloth to cover their faces during the application, and roughly 32% did not use any safety precautions. About 21% said they covered their faces as well as their bodies. No farmer wore glasses or any sort of eye protection while applying pesticides. Respondents claimed to have experienced certain side effects while applying pesticides. Sixty-five percent of those polled said they had experienced some symptoms. According to this survey, pesticide application caused itching of the eyes, skin, and nose of about 20% of respondents. Remaining respondents suffering from, headache (11%), dry throat (15%), digestive problem (9%), breathing problem (11%), chest pain (5%), and 21% within no health problems. Another study found that 38 percent of people had dizziness, 30.9 percent had a headache, 26.9% had vomiting, and 26.9% had a fever (Kachaiyaphum et al., 2010). In a similar study in Mazandaran, Iran, 21.4 percent of respondents said pesticides were not dangerous, while 52.6 percent thought they were slightly harmful. Pesticides are poisonous to their target organisms by composition and mode of action and can be lethal to humans, other non-target organisms, and environmental matrices (Yawson, 2022). According to the current investigation by conducting poll, 39% of the farmers had no precautions during applying pesticides. A study conducted by Dasgupta et al. (2007), 87 percent of farmers did not take any precautions when handling pesticides.

Farmers' perception on the negative effects of pesticide on environment

Farmers polled revealed that 68 percent had no prior experience with pesticide-related accidents. Only 20% of farmers, on the other hand, said they had experienced fish mortality. 48% of respondents thrown away containers to the dump yard, while 24% kept it in the field and 17% tossed it into a water body by 13% of respondents. Kabir and Rainis

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(2012) said that, above 86.10% of the farmers had low to medium level of perception, while only 13.90% farmers had high perception about health hazards of pesticides. 25% prawn mortality was occurred from the pesticide use in some selected areas of Khulna (Sumon et al., 2016). Another study from Sumon et al. (2018) in north-west Bangladesh on environmental monitoring and risk assessment finding that chlorpyrifos is the most harmful to Daphnia and fish due to use of organophosphate pesticides in aquatic ecosystems.

CONCLUSION

The farmers used more than 20 different pesticides for growing winter vegetables. The most usable insecticides were Mascut 550 EC and Bactin 4 EC and the longest applications interval were Gender70 WD and Kanggaru 80 WDG. For potato farming, three insecticides and pesticides have been recorded. The findings of this study also revealed that very fewer portion of the farmers are aware about the detrimental health impacts of pesticides and impacts on the environment. In Bangladesh, millions of farmers become dependent on pesticides for crop production to meet the need of growing population on their limited land. As a result, there is a critical need to improve their perception level, not only for the sake of a safer environment but also for long-term agricultural sustainability. Organizations like DAE, DoF, and NGOs should implement specific types of extension programs to provide effective training on the use and adverse effects of pesticides to protect the environment. This could reduce the occupational health risk faced by vegetable farmers. IPM (Integrated Pest Management) approaches are also suggested as a possible alternative to avoid the hazard. Applying various print and electronic media, the government should promote activities related to safe food production. After all, the study was only conducted in three communities within a single union. This study suggests future research works across the country to gain a comprehensive understanding of this problem.

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