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PATTERNS OF INSECTICIDE USES AND ITS IMPACT ON THE HEALTH OF THE FARMERS IN TANGAIL DISTRICT OF BANGLADESH

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Abstract

Appropriate and judicious application of insecticide is the most effective measure of crop protection against the injury and damage of insect pests. However the tendency of the farmers is to apply insecticide without maintaining proper dose, time and precautionary measures. This study was conducted in Dhanbari and Madhupur upazilas of the Tangail district during July to October 2020 to find out the patterns of insecticide use on summer vegetables and the potential risks of insecticides on the health of farmers. Data were collected from randomly selected 120 farmers through a pre-tested questionnaire. The majority of farmers within the study area obtained information regarding specific insect pests and the recommended insecticide from local retailer shops 81.7%), whereas information on insecticide dosage was primarily gathered from experts (91.7%). In the study area, farmers applied insecticides once/twice a season (66.7%). The survey report showed that 60.0% of the farmers applied insecticides without reading the label information, while all the farmers applied insecticides using hand driven sprayer machine between the hours of 10 am to 3 pm. Results revealed that 63.3% of the farmers took a moderate protective measures, but 93.3% did not consider pre-harvest Interval (PHI). A considerable portion of farmers (48.3%) kept pesticide bottles and packaging alongside other inputs, while most respondents (96.6%) disposed of these items in the fields. It was found that 70.0% of the farmers were acquainted with health hazards, 56.6% knew about water pollution, 54.1% knew about reduction of pollinators due to insecticide application. Based on the perspectives of the participants, it was also found that, 60.0% farmers suffered from physical weakness, 55.0% suffered in loss of appetite, 38.3% suffered in eye irritation, 28.3% experienced in body itching, and 12.7% suffered urinary and sexual disorder.

Keywords: Survey, health risk, pesticide application, pesticide hotspots, health hazards.

Introduction

Most farmers rely more on chemical pesticides, including toxic compounds, than on traditional methods and Integrated Pest Management (IPM) in modern era (Parveen and Nakagoshi, 2001). Sabur and Mollah (2000) observed an increasing trend in the use of pesticides by vegetable farmers in combating insect pests throughout Bangladesh. Under farmers' field conditions, yield losses range from 35% to

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80% in certain years and places – up to 100% loss has been recorded due to a single insect or disease. Therefore, the use of pesticides in Bangladesh increased over the last four decades (Rahman *et al.*, 2012a).

Despite their usefulness in increasing food production, the extensive use of pesticides during production, processing, storage, transport or marketing has led to environmental contamination and pesticide residues reaching the human body through the food chain (Deviprasad *et al*., 2015). Over 87% of farmers report openly admitting to using little or no protective measures while applying pesticides and 92% of them do not take any protective measures during use, storage, transport etc. Though insecticides are beneficial to crops but they have a severe negative impact on the environment and health (WHO, 1997; Krebs *et al*., 1999).

In a developing country like Bangladesh, more than 90% of farmers use pesticides without knowing their actual requirements and use them unnecessarily, indiscriminately and excessively at high concentrations due to their ignorance and unconsciousness about their use (Anon., 2000). Inappropriate selection of insecticides and doses, improper spray scheduling and inadequate spray coverage may cause failure to control insect pests (Phillips *et al.*, 1990). Both overuse and misuse of insecticides may lead to the development of resistance to insecticides in some insect pests, high insecticide residues, resurgence or increased infestation by some insect species due to the destruction of natural enemies and beneficial arthropods like pollinators (Ali *et al*., 2017) and can create a hazardous effect on human health, environment and the biodiversity (Rahaman and Prodhan, 2007).

Farmers of the greater Jessore region of Bangladesh, spray insecticides on country beans on every day or every alternate day thus on average, 80 sprays are applied in a single cropping season (Kabir *et al*., 1996). Paul (2003) reported that intensified use of insecticides can cause a serious public health hazards, especially in the form of residues in food. Humans are also exposed to pesticides and their residues via water and air by different routes of exposure like inhalation, ingestion and dermal contact etc. Exposure to pesticides results in acute complications such as eye irritation, excessive salivation and chronic health problems like cancer, reproductive and developmental disorders (Gupta, 2004).

Over 87% of farmers report openly admits to using little or no protective measures while applying pesticides and 92% of them do not take any protective measures during use, storage, transport etc. Many farmers spray pesticides without taking any safety measures (wearing masks, gloves and other proper clothes) in the crop fields that are highly vulnerable to suffering from various diseases because they absorb the toxic item in different ways, including inhalation, dermal contact etc. (Gain, 1998). To promote the appropriate use of pesticides, it is critical to understand the current use of pesticides among small-scale farmers. Until now, except for Akhter *et al*. (2016) and Mohiuddin *et al*. (2009), there have been no published reports on the pesticide use pattern of small-scale farmers in vegetable production and their health hazards. Under the following circumstances, complete information about the use pattern of insecticides on vegetables and most

importantly the impacts of using insecticides on their health is barely needed.

Materials and Methods

Pre-designed and pre-tested interview schedule was used for data collection. The study was conducted in Dhanbari and Madhupur upazilas under Tangail district through personal interviews with 120 target farmers (60 farmers per upazila) from July to October 2020 with the help of the Department of Agricultural Extension (DAE) to gather knowledge on the use pattern of insecticides in available summer vegetables and the impacts on farmer's health. The selected study areas are now famous vegetable-growing regions of Bangladesh. 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 study of objectives. The SPSS/PC+ computer program was used to perform the data analysis.

Results and Discussion

General information on the insecticide-use patterns in summer vegetables

The general information on insecticide-use pattern in summer vegetables in the study area are summarized in Table 1. These results indicate that 81.7% of farmers obtained information about insect pest control from

Table 1. General information on insecticide-use pattern in vegetables

Use pattern of insecticides	No. of total respondents (120)	Per cent
A) Source of insect pest control information		
a) Extension personnel	44	36.7
b) Retail stores	98	81.7
c) Company personnel	24	20.0
d) From other farmers	48	40.0
B) Source for doses of insecticides		
a) Read the label on the packet/bottle	46	38.3
b) Expert people	110	91.7
c) From other farmers	48	40.0
C) Frequency of insecticide application		
a) Once/twice a season	80	66.7
b) Every week	10	8.3
c) Twice a week	18	15.0
d) Depend on pest number	68	56.7
D) Maintain PHI (Pre-harvest Interval)		
a) Not maintain	112	93.3
b) Partially maintain	8	6.7
c) Strictly maintain	0	0.0

(*Multiple-answer considered)

pesticides dealers, followed by 40.0% from other farmers, 36.7% from extension personnel and 20.0% from company personnel. A total of 91.7%, 40.0% and 38.3% of respondents collected the information on insecticide doses from expert people, other farmers and by reading the label of the packet/ bottle, respectively. The insecticides were applied once/twice a season by 66.7% of respondents, whereas 56.7% of respondents applied insecticides based on pests number. On the other hand, 15.0% of farmers applied insecticides twice a week and 8.3% of farmers applied insecticides every week, respectively. For maintaining the PHI (Pre-harvest Interval) after the insecticide application, most of the farmers (93.3%) had no idea about PHI and only 6.7% were found to maintain the PHI partially. No farmer was found to follow the PHI strictly after the application of insecticides.

Mohiuddin *et al*. (2009) also reported that farmers received advice on the selection of chemicals and their doses of application primarily from the pesticide sales agents (60%) followed by research workers (12%), neighbors (9%) and extension workers (8%). This indicated that the dealers of pesticides and research workers are important factors in pesticide application in the study areas.

In a developing country like Bangladesh, more than 90% of farmers use pesticides without knowing its actual requirements and they used pesticide unnecessarily, indiscriminately and excessively at high concentration and more frequent due to their ignorance and unconsciousness about their use, for example 150 sprays in a crop season in brinjal in Bangladesh (Anon, 2000). Akhter *et al*. (2016) found that only about 20% of applicators can read the labels written on Bottles or Packets while 75% cannot read the labels on bottles or packets. They mostly depend on the pesticide seller's opinion. Generally, pesticide sellers are not adequately trained and learn about pesticides mostly from the company representatives orally.

Application method of insecticides for summer vegetables

The application method of insecticides for summer vegetables in the study area is presented in Table 2. According to the results, all the respondents (100.0%) used hand-driven spray machines for insecticide application. Before the application, the labels of the packet/bottle were read by 40.0% and the information was understood by 38.3% but a major portion of farmers (60.0%) did not read the label information. Protective measures like washing hands or taking baths after spraying were taken by 46.7%, partial safety measures by 8.3% and no protective measures by 20.0% of total respondents. Insecticides were applied at noon (after 10 am to 3 pm) by 63.3% of farmers followed by 32.5% in the afternoon (after 3 pm) and 19.1% in the morning (before 10 am).

In another survey made by Mohiuddin *et al*. (2009) reported that most farmers (80%) used sprayer machines to spray insecticides, while only 20% used *piskari*, which was locally made of bamboo culm.

In a similar study in Jhenidah district of Bangladesh, most farmers (77%) reported applying pesticides with Knapsack or hand-driven spray machines. About 14% farmers used pesticides through the injection process

Table 2. Application method of insecticides for vegetables in the study area

A) Methods of application	No. of respondents	B) Label information of insecticide used	No. of respondents
a) Hand-driven spray machine	120 (100)	a) Read the label of packet/bottle	48 (40.0)
b) Injection	0 (0.0)	b) Don't read the label of packet/ bottle	72 (60.0)
c) Both with hand-driven spray machine and injection	0 (0.0)	c) Understand the label of insecticide	46 (38.3)
C) Protective measures taken after using insecticide		D) Time of insecticide application	
a) Partial safety measures	46 (38.3)	a) In the morning (before 10am)	23 (19.1)
b) No protective measures	24 (20.0)	b) In the noon (after10am to 3pm)	76 (63.3)
c) Washing hands or taking a bath after spraying	56 (46.7)	c) In the afternoon (after 3pm)	39 (32.5)

(*Multiple-answer considered; value in the parenthesis denotes the percentage of total respondents)

(Akhter *et al*., 2016). In Bangladesh, many farmers spray pesticides without taking any safety measures (wearing masks, gloves and other proper clothes) in the crop fields that are highly vulnerable to suffering from various diseases because they absorb the toxic item in different ways, including inhalation, dermal contact etc. (Gain, 1998).

Storage and disposal of insecticide packets/ bottles by vegetable farmers

Storage and disposal of insecticide packets/ bottles by vegetable farmers in the study area are presented in Table 3. According to respondent opinions, 48.3% of the farmers were found to store their packets/bottles of insecticides with other agricultural inputs. The packets/bottles of insecticides were stored in the kitchen by 41.6% of farmers and in the living room by 25.0%, while 23.33% did not store the insecticide. In disposing of packets/ bottles of insecticide, 96.6% of farmers threw away the packets/bottles into the open field while 23.3% of farmers carried these at home and 8.3% burnt those packets/bottles. None of them returned the packets/bottles of insecticide to the distributer.

Akhter *et al*., (2016) reported that about 80% of the farmers throw away the bottles or packets in their agricultural fields after use and 20% return bottles of pesticide in their homes for further use. They have no concern about these things after use as a result; they throw it here and there. But it has negative impacts on health and the environment.

Self-protective measures taken during the application of insecticides by vegetable farmers

Self-protective measures taken during the application of insecticides in vegetables by farmers in the study area are presented in Table 4. According to the response of the farmers, 88.3% of respondents wore long sleeve shirts during insecticide application, 73.3% of respondents took shower after handling of insecticides, 66.6% took wind conditions into account for the application, 60.0% wore long trousers/pants, 45.0% used face masks, 26.3% was used to smoking cigarettes, 23.6% used their hands during mixing, 23.3% used hand gloves, 15.0% used boots and hats, 10.0% used to drinking water, 8.3% used goggles and

Table 3. Storage and disposal of insecticides by vegetable farmers in the study area

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	28 (23.33)	a) Returned to the distributor	0 (0.0)
b) Living room	30 (25.0)	b) Throw it to the open field	116 (96.6)
c) Kitchen	50 (41.6)	c) Burnt	10 (8.3)
d) With other inputs	58 (48.3)	d) Carry at home	28 (23.3)

(*Multiple-answer considered; value in the parenthesis denotes the percentage of total respondents)

Table 4. Personal protective measures taken during the application of insecticides by vegetable farmers

Item	No. of respondents	Item	No. of respondents
a) Use of face masks	54 (45.0)	g) Use of trousers/long pants	72 (60.0)
b) Use of goggles	10 (8.3)	h) Taking a shower after handling	88 (73.3)
c) Use of hand gloves	28 (23.3)	i) Use of hand during mixing	32 (23.6)
d) Taking wind conditions into account	80 (66.6)	j) Smoke cigarettes	38 (26.3)
e) Use of boots and hats	18 (15.0)	k) Drink water	12 (10.0)
f) Long sleeve shirts	106 (88.3)	l) Take rice and other foods	2 (1.67)

(*Multiple-answer considered; value in the parenthesis denotes the percentage of total respondents)

1.67% was used to eat rice and other foods during insecticide application.

A survey on insecticide uses in vegetable cultivation at the farm level in the Chittagong region by Akhter *et al*. (2016) found that 15% of users took partial safety measures (wearing shirt and trousers, gloves, masks, etc.) during pesticide application. Around 80% did not wear any protective measures before spraying and cleaning hands and face with soap after finishing. About 5% took baths after pesticide use to get rid of the odor. Farmers said that pesticide spraying is regular work for them, so taking any protective measure is unnecessary. They also said that they are habituated to this activity.

Mohiuddin *et al*. (2009) found that 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 cloths during application, while nearly 32% covered their bodies and wore shirts during insecticide application.

In another survey, only 21% of farmers reported that they covered both their faces and bodies. No farmer used glasses or other protective devices to protect their eyes during pesticide application. The majority of respondents reported that they consume something during application of pesticide in the fields. Among them, the highest proportion (80%) of respondents said that they often smoke cigarettes and drink water 15% and 5% take rice or other foods during the period of pesticide application, which makes them more

vulnerable in terms of user health (Akhter *et al*., 2016).

Impact of insecticide hazards on farmer's health

The impact of insecticide hazards on farmer's health in the study area is presented in Table 5. According to respondents, in the case of skin diseases, 28.3% of farmers suffered from body itching, while 20.0% of farmers experienced body irritation and rashes. Regarding eye diseases, 38.3% of farmers suffered from eye irritation, 31.6% suffered from eye pain and 20.0% had poor vision. In accordance with the opinions of the respondents regarding gastrointestinal maladies, 55.0% of farmers suffered from loss of appetite, 33.3% of farmers experienced digestion issues and 8.33% of farmers experienced vomiting during insecticide application. In terms of urinary and sexual disorder, 11.6% of farmers suffered from urinary control issues while only 1.67% of farmers experienced a decrease in sexual desire. Regarding chronic impacts on the health of farmers, 6.6% of farmers were diagnosed with asthma while no response was found regarding cancer and birth defects. On the other hand, 60.0% of farmers who experienced of physical weakness, followed by 38.8% who experienced vertigo and 8.3% who experienced respiratory problems.

The rate of dermal absorption of pesticide residues varied with the body parts 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 the foot (1.6%). For these reasons, they suffer from various health problems such as abdominal pain, dizziness, headaches, nausea, vomiting and skin and eye problems (Rahman *et al*., 2012b).

Mohiuddin *et al*. (2009) found that approximately 45% of the farmers opined that

Table 5. Impacts of insecticide hazards on farmer's health in the study area

Farmer's health hazards	No. of respondents	Farmer's health hazards	No. of respondents
A) Skin diseases		D) Urine and sexual diseases	
a) Body itching	34 (28.3)	a) Kidney problem	0 (0.0)
b) Body irritation	24 (20.0)	b) Urine control problem	14 (11.6)
c) Rashes	24 (20.0)	c) Reduction of sexual urge	2 (1.67)
B) Eye diseases		E) Chronic impact	
a) Eye pain	38 (31.6)	a) Cancer	0 (0.0)
c) Eye irritation	46 (38.3)	b) Birth defect	0 (0.0)
b) Poor vision	24 (20.0)	c) Asthma	8 (6.6)
C) Gastrointestinal disease		F) Other diseases	
a) Digestion problem	40 (33.3)	a) Physical weakness	72 (60.0)
b) Loss of appetite	66 (55.0)	b) Dizziness	46 (38.8)
c) Vomiting	10 (8.33)	c) Breathing problem	10 (8.3)

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

insecticide application polluted water, 61% of them believed that insecticide application was harmful to the health of farm labours, over 34% of the farmers felt that insecticide application polluted the air. A proportion of 38% of the farmers reported that insecticides caused harm to natural enemies of insects. Thus, most farmers believed that the adverse effect of insecticide application was more serious than the effect of other farm operations.

The World Health Organization (WHO) and the United Nations Environment Program estimate that nearly 4.0 million people suffer from severe pesticide poisoning and its rate is 2-3 per minute, with approximately 20,000 workers dying from exposure every year, the majority in developing countries (Pimental *et al*., 1992).

In a study in the Jhenidah district of Bangladesh, 60% of farmers reported that they were suffering from skin disease, 64% of farmers were suffering from eye disease, 64% of farmers were suffering from gastrointestinal disease, and 54% of farmers were suffering from urine and sexual diseases (Akhter *et al*., 2016).

Conclusion

This report has presented a relatively current snapshot of inappropriate insecticide use in summer vegetables by small-scale farmer 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 amongst farmers on environmental issues including health impacts due to usage of insecticides in Bangladesh.

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