



Perceptions of Chemical Pesticides Use among Vegetable Growers in Bangladesh: Implications for Sustainable Pest Management

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The majority of farmers in Bangladesh regularly use chemical pesticides to combat insect and pest attacks on their vegetable crops, even though doing so may have negative impacts on the environment and human health. The present study was conducted to assess the socioeconomic characteristics of the vegetable growers, examine the current pest management practices, identify the farmers' perception of different aspects of chemical pesticide use and the factors that determine their perception towards pesticide use. A total of 120 vegetable growers were interviewed face to face from two unions of Gouripur upazila in Mymensingh district using a semi-structured questionnaire and following a simple random sampling technique. Data were analyzed using both descriptive and inferential statistics. The result of the descriptive analysis shows the socioeconomic

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characteristics of the respondents. The result shows that most of the respondents use chemical pesticides in vegetable cultivation and they have a positive perception of chemical pesticide use. The result of the correlation coefficient found that education, farming experience, extension media contact, and knowledge about insect pest management have positive and significant correlations with the farmers' perception. This research emphasized the requirement for prompt implementation of highly stringent pesticide use rules and suggested training courses for pest control specialists, farmers, and pesticide sellers.

Keywords: Pest attack; vegetable; chemical; pesticide; perception.

1. INTRODUCTION

Food security is a major concern worldwide due to the rapid growth of the human population. To meet up the demand for food of the growing population, it is necessary to increase the productivity of agriculture. Productivity growth in agriculture has been closely related to the increased use of chemical inputs, such as various types of fertilizers and pesticides [1;2]. Pesticides are one of the most important components of high-input farming and it is the most familiar way to control pests and insects [3]. The total use of pesticides in a year is 37,187 metric tons in Bangladesh. The growth rate of pesticide use is 10% and the use rate is 3.13 kg/ha per year which is very high [4]. The use of pesticides has come into focus to minimize the crop yield loss caused by pests in low-income countries [5;6]. In Bangladesh, vegetable farming has been an important enterprise and vegetables are more susceptible to insect and pest attacks because of their nature [7]. A large number of vegetables are produced all year round in Bangladesh [8]. Nevertheless, Bangladeshi farmers, like those in other developing nations, rely heavily on chemical pesticides to manage insect pests in vegetable farming [9]. But the excessive use of chemical pesticides in vegetable production hurts human health and is also harmful to the environment [10]. It's not only affecting short-term health effects but also can result in chronic illness [11]. In this case, integrated pest management (IPM) practices, can be used as an alternative method [12]. Yet switching over to a pesticide-free system instantly is highly burdensome; encouraging the rational use of pesticides would be more advantageous [13]. There have been many studies conducted on pesticide application by smallholders [14], and their harmful effects but few studies have been done on the farmers' knowledge, practices, attitude, and perceptions towards chemical pesticide use in Gouripur

Upazila of Mymensingh district. Therefore, this study was conducted to assess the socio-economic characteristics of the sample farmers who use chemical pesticides in their vegetable fields, identify the current pest management practices in vegetable cultivation, analyze the farmers' perceptions towards the usage of chemical pesticides and how the socioeconomic characteristics affect their attitude towards chemical pesticide use. As a whole, the obtained knowledge can be put to use to improve the socioeconomic and physical health of farmers, many of whom are unaware of the hazards resulting from current agricultural practices using chemical pesticides in vegetable cultivation.

2. MATERIALS AND METHODS

2.1 Study Area and Selection of Vegetable Growers

The study was conducted in the two unions of Gouripur upazila under the Mymensingh district of Bangladesh (Fig. 1). Gouripur upazila is a suitable area for vegetable production. Primary data were collected from 120 sample vegetable growers through face-to-face interviews using a semi-structured questionnaire and following the simple random sampling technique from Maoha and Achintapur union during the month of January and February 2023. The Upazila Agriculture Officer (UAO) of the Gouripur upazila assisted in the deliberate selection of the study areas.

2.2 Data Analysis

The collected data were analyzed by using both descriptive and inferential statistics. Microsoft Excel and the Statistical Package for Social Sciences (SPSS) version 22 were used to manage the data. On a five-point Likert scale [15], the perception index (PI) was evaluated. Farmers' perception index (PI) of different



Fig. 1. Map of the study area

aspects of pesticide use is calculated as follows: $SA \times 4 + A \times 3 + N \times 2 + D \times 1 + SD \times 0$ [16]. Where: SA = total respondents who indicated "strongly agree; A = total respondents who indicated "agree; N = total respondents who indicated "neutral; D= total respondents who indicated "disagree;" and SD = total respondents who indicated "strongly disagree" regarding their perception. Weights of 0 meant "strongly disagree," 1 meant "disagree," 2 meant "neutral," 3 meant "agree," and 4 meant "strongly agree." The farmers' perception score was calculated by averaging the response weights for each indicator. To determine the study's conclusions, descriptive statistics like frequency and percentage as well as inferential statistics like Pearson's correlation coefficient were used [13].

3. RESULTS AND DISCUSSION

3.1 Socioeconomic Characteristics of the Vegetable Growers

The socioeconomic characteristics of vegetable growers in the study areas are shown in Table 1. The information is based on the scoring system and frequency distribution for each attribute across multiple categories. Age, family size, education, farm size, vegetable farming

experience, annual income, training received, extension media contact, and knowledge of insect pest management were among the features.

In the study, the socioeconomic traits of vegetable farmers (Table 1.) show that the majority of the participants (45.83%) were middle-aged, had families with five to six members (48.33%), and had only completed their secondary level of education (49.17%). Furthermore, the bulk of them were small farmers (40%) with average vegetable farming experience (48.33%) and an average annual income of 61000 to 150000 Taka (49.17%). The largest group (51.67%) did not receive any training, and a sizable chunk earned poor scores for extension media interaction (46.67%) and medium scores for knowledge of insect pest control (48.33%).

3.2 Current Pest Management Practices in Commercial Vegetable Production

According to the findings, 70.00% of vegetable growers in Gouripur Upazila used chemical pest management as their primary pest control technique (Fig. 2). This shows that a sizable proportion of vegetable farmers heavily rely on

chemical pesticides to manage pests in their farms. Similar results were found by Rijal et al., [17]. It was encouraging to see that a substantial number of producers (11.67%) were using a mix of chemical and biological pest control strategies (Fig. 2). This suggests that some farmers are implementing more comprehensive pest control strategies that include the use of both chemical and biological treatments to combat pest problems.

Additionally, only a lesser proportion of farmers use cultural (5.00%) and mechanical techniques (4.17%) respectively for pest control (Fig. 2). In contrast to mechanical approaches, which entail physically removing or trapping pests, cultural practices often include modifying agricultural practices or cropping systems to lower pest incidence. The use of biological approaches, which made up 9.17% (Fig. 2.) of all methods used, is especially encouraging because it encourages a more sustainable and ecologically sound approach to pest management by using pests' natural enemies or beneficial species to combat them.

3.3 Farmers' Perceptions towards Different Aspects of Chemical Pesticide Use

A perception index was developed to determine the extent of farmers' perceptions of chemical pesticide use in vegetable cultivation (Table 2). To ascertain their perceptions, twelve perception statement was used [13;18]. Results show that most of the farmers perceived that they use

chemical pesticides to gain quick advantages (score: 421; rank: 1). A large number of farmers' perceived that harmful insect pest management becomes challenging without chemical pesticides (score: 396; rank: 2). This indicates that farmers mainly depend on chemical pesticides to control pests as they have limited knowledge about other control measures. Statement 3 shows that farmers are more accustomed to using chemical fertilizers.

Perception scores from Table 2 mainly represent that most of the farmers favorably perceived only the positive immediate effect of chemical pesticides to control insects and pests attack but the majority of vegetable growers were unaware of the negative effects. They had lower perception scores on the adverse effect of chemical pesticides and negatively perceived the environmental damage, health hazards, and crop quality deterioration. Similar findings were reported by Nguyen et al., [19], Rana et al., [13], Khan et al., [18] and Aktar et al., [20].

3.4 Factors Influencing Farmers' Perceptions towards Chemical Pesticide Use in Vegetable Cultivation

To examine the correlations between the farmers' perception of chemical pesticide use and the chosen socioeconomic characteristics, an attempt has been done in Table 3. Pearson's Product Moment Correlation coefficient (r) was used to analyze the correlations.

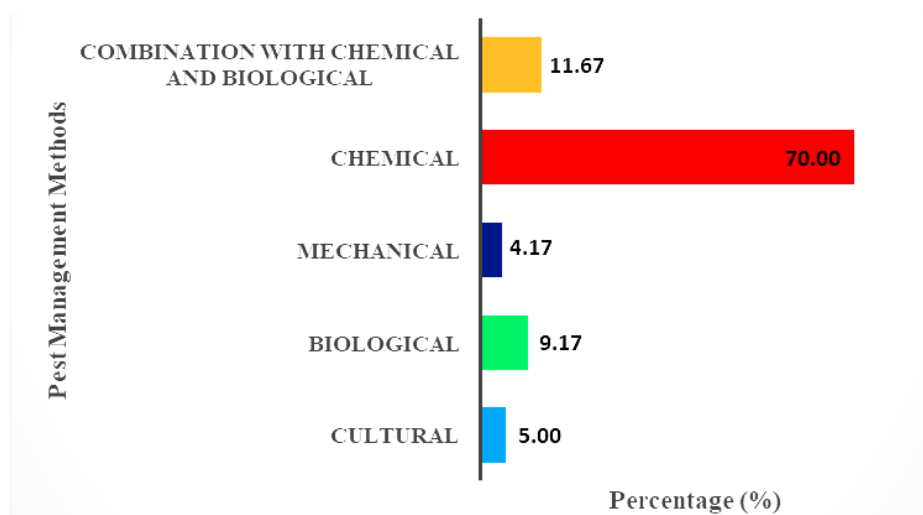


Fig. 2. Pest management practices among vegetable growers in Gouripur upazila, Bangladesh (n=120)

Table 1. Socioeconomic characteristics of the sample farmers (n=120)

Characteristics	Scoring method	Categories	Frequency	Percentage (%)
Age	Years	Young aged (18-35)	38	31.67
		Middle aged (36-50)	55	45.83
		Old aged (>50)	27	22.50
Family Size	Number	Small family (0-4)	40	33.33
		Medium family (5-6)	58	48.33
		Large family (>6)	22	18.33
Education	Years of Schooling	Illiterate (0)	35	29.17
		Primary (1-5)	20	16.67
		Secondary (6-10)	59	49.17
		Higher secondary and above (>11)	6	5.00
Farm size	Acres	Landless farmers (<0.05)	22	18.33
		Marginal farmers (0.05-0.49)	31	25.83
		Small farmers (0.5-2.49)	48	40.00
		Medium farmers (2.5-7.49)	11	9.17
		Large farmers (>7.5)	8	6.67
Experience in Vegetable farming	Years	Low (5-10)	32	26.67
		Medium (11-15)	58	48.33
		High (>16)	30	25.00
Annual Income	'000 Bangladeshi Taka	Low (<60)	45	37.50
		Medium (61-150)	59	49.17
		High (>150)	16	13.33
Training Received	Times	Not received (0)	62	51.67
		Low (1-2)	22	18.33
		Medium (3-4)	30	25.00
		High (>4)	6	5.00
Extension Media Contact	Score	Low (<13)	56	46.67
		Medium (14-26)	39	32.50
		High (>26)	25	20.83
Knowledge of Insect Pest Management	Score	Low (>11)	39	32.50
		Medium (12-22)	58	48.33
		High (>22)	23	19.17

Source: Field Survey, 2023

Table 2. Farmers' perceptions of chemical pesticide use (n=120)

Perception statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Perception score	Rank order
1. Chemical pesticides are used by farmers to gain quick advantages.	86	20	5	7	2	421	1
2. Without chemical pesticides, harmful insect pest control becomes challenging.	73	29	4	9	5	396	2
3. Farmers are more habituated to chemical pesticides than to other insect pest management strategies.	63	31	7	15	4	374	3
4. Chemical pesticides can harm the environment if they are used excessively.	45	57	3	5	10	362	4
5. Using chemical pesticides on the crop will be helpful to get more market value.	39	52	9	13	7	343	5
6. Vegetables contaminated with pesticides may occur several fatal illnesses.	48	40	6	9	17	333	6
7. Skipping safety measures when handling pesticides may cause health hazards.	36	41	10	19	14	306	7
8. Chemical pesticides can damage the fertility of the soil.	35	42	9	18	16	302	8
9. Chemical pesticides are the causes of death of aquatic organisms and poultry.	24	35	19	23	19	262	9
10. The use of chemical pesticides is harmful to beneficial insects and organisms in the soil.	23	40	10	23	24	255	10
11. To ensure safety, pesticide containers should be buried or burnt.	19	29	12	40	20	227	11
12. The use of chemical pesticides is more harmful than its benefits.	10	22	7	42	39	162	12

Source: Field Survey, 2023

Table 3. Summary result of the product moment correlation coefficient (n=120)

Dependent variable	Independent variables	Computed value of correlation coefficient (r)	Tabulated value of “r” with 100 degrees of freedom	
			at 0.05 level	at 0.01 level
Farmers’ Perception towards Chemical Pesticide Use	Age	0.010		
	Family Size	-0.051		
	Education	0.198*		
	Farm size	0.007		
	Experience in Vegetable farming	0.303**	0.195	0.254
	Annual Income	0.020		
	Training Received	0.065		
	Extension Media Contact	0.315**		
	Knowledge of Insect Pest Management	0.201*		

Note: * significant at the 0.05 probability level; ** significant at the 0.01 probability level
Source: Field Survey, 2023

Results in Table 3 demonstrate that among nine independent variables, education ($r=0.198$), experience in vegetable farming ($r=0.303$), extension media contact ($r=0.315$) and knowledge of insect pest management ($r=0.201$) positively and significantly related to farmers’ perceptions. The result indicates farmers with more educational status, farming experience, extension media contact and knowledge about insect pest management are more likely to use chemical pesticides in vegetable growing. The results discovered in this study are also supported by the study of Rana et al., [13], Adebayo and Oladele, [21], Khan et al., [18] and Zakir, [22].

4. CONCLUSION

Insect and pest management in commercial vegetable cultivation are major constraints in Bangladesh. The study found that farmers mainly use chemical pesticides for pest management practices although it hurts the environment and human health. Farmers have a positive perception of chemical pesticide use as it works immediately to control the pest attack and they have very limited knowledge of other insect pest management techniques. The majority of farmers have little awareness of the precautions to take, the damaging effects of chemical pesticides on the environment, and the potential health risks. The presence of growers using integrated approaches involving biological methods and

combinations of chemical and biological methods suggests a growing awareness and adoption of more sustainable and environmentally friendly practices in pest management, even though chemical-based pest management techniques are still the most common among vegetable growers in Gouripur Upazila. The region may experience more sustainable and efficient pest control as a result of efforts to further support and promote integrated pest management techniques.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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