

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

## 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 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

34 the crop yield loss caused by pests in low-income countries [5]; [6]. In Bangladesh,  
35 vegetable farming has been an important enterprise and vegetables are more susceptible to  
36 insect and pest attacks because of their nature [7]. A large number of vegetables are  
37 produced all year round in Bangladesh [8]. Nevertheless, Bangladeshi farmers, like those in  
38 other developing nations, rely heavily on chemical pesticides to manage insect pests in  
39 vegetable farming [9]. But the excessive use of chemical pesticides in vegetable production  
40 hurts human health and is also harmful to the environment [10]. It's not only affecting short-  
41 term health effects but also can result in chronic illness [11]. In this case, integrated pest  
42 management (IPM) practices, can be used as an alternative method [12]. Yet switching over  
43 to a pesticide-free system instantly is highly burdensome; encouraging the rational use of  
44 pesticides would be more advantageous [13]. There have been many studies conducted on  
45 pesticide application by smallholders [14], and their harmful effects but few studies have  
46 been done on the farmers' knowledge, practices, attitude, and perceptions towards chemical  
47 pesticide use in Gouripur Upazila of Mymensingh district. Therefore, this study was  
48 conducted to assess the socio-economic characteristics of the sample farmers who use  
49 chemical pesticides in their vegetable fields, identify the current pest management practices  
50 in vegetable cultivation, analyze the farmers' perceptions towards the usage of chemical  
51 pesticides and how the socioeconomic characteristics affect their attitude towards chemical  
52 pesticide use. As a whole, the obtained knowledge can be put to use to improve the  
53 socioeconomic and physical health of farmers, many of whom are unaware of the hazards  
54 resulting from current agricultural practices using chemical pesticides in vegetable  
55 cultivation.

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## **2. MATERIALS AND METHODS**

### **2.1 Study Area and Selection of Vegetable Growers**

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



Figure 1. Map of the Study Area

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## 2.2 Data Analysis

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## 3. RESULTS AND DISCUSSION

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### 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

91 attribute across multiple categories. Age, family size, education, farm size, vegetable farming  
 92 experience, annual income, training received, extension media contact, and knowledge of  
 93 insect pest management were among the features.

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**Table 1. Socioeconomic Characteristics of the Sample Farmers (n=120)**

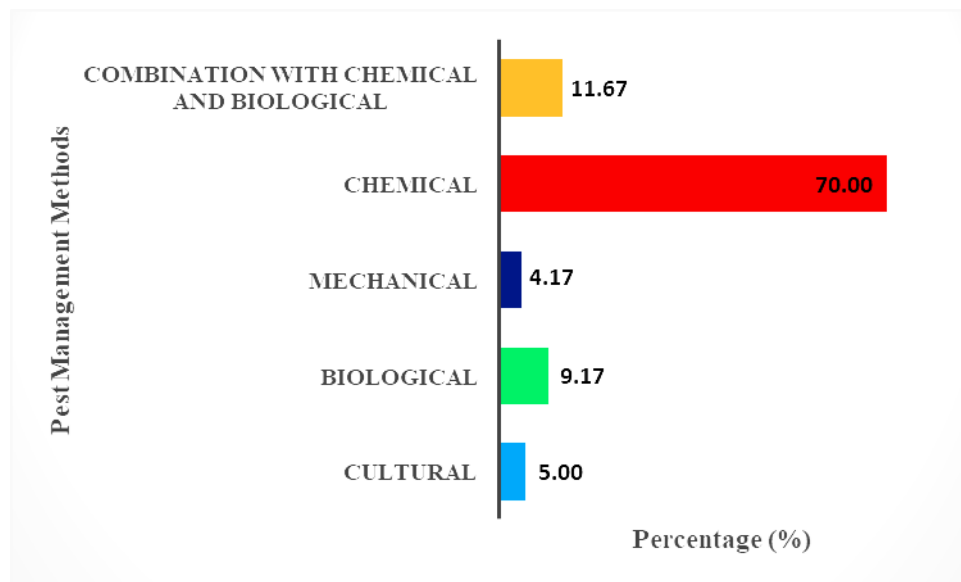
Characteristics	Scoring Method	Categories	Frequency	Percentage (%)
Age	Years	Young aged (18-35)	38	31.67
		Middle aged (36-50)	55	45.83
		Old aged (>50)	27	22.50
Family Size	Number	Small family (0-4)	40	33.33
		Medium family (5-6)	58	48.33
		Large family (>6)	22	18.33
Education	Years of Schooling	Illiterate (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

97 *Source: Field Survey, 2023*

98 In the study, the socioeconomic traits of vegetable farmers (Table 1) show that the majority  
99 of the participants (45.83%) were middle-aged, had families with five to six members  
100 (48.33%), and had only completed their secondary level of education (49.17%).  
101 Furthermore, the bulk of them were small farmers (40%) with average vegetable farming  
102 experience (48.33%) and an average annual income of 61000 to 150000 Taka (49.17%).  
103 The largest group (51.67%) did not receive any training, and a sizable chunk earned poor  
104 scores for extension media interaction (46.67%) and medium scores for knowledge of insect  
105 pest control (48.33%).  
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### 107 **3.2 Current Pest Management Practices in Commercial Vegetable Production**

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109 According to the findings, 70.00% of vegetable growers in Gouripur Upazila used chemical  
110 pest management as their primary pest control technique (Figure 2). This shows that a  
111 sizable proportion of vegetable farmers heavily rely on chemical pesticides to manage pests  
112 in their farms. Similar results were found by Rijal et al., [17]. It was encouraging to see that a  
113 substantial number of producers (11.67%) were using a mix of chemical and biological pest  
114 control strategies (Figure 2). This suggests that some farmers are implementing more  
115 comprehensive pest control strategies that include the use of both chemical and biological  
116 treatments to combat pest problems.  
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120 **Figure 2. Pest management practices among vegetable growers in Gouripur**  
121 **upazila, Bangladesh (n=120)**  
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123 Additionally, only a lesser proportion of farmers use cultural (5.00%) and mechanical  
124 techniques (4.17%) respectively for pest control (Figure 2). In contrast to mechanical  
125 approaches, which entail physically removing or trapping pests, cultural practices often  
126 include modifying agricultural practices or cropping systems to lower pest incidence. The use  
127 of biological approaches, which made up 9.17% (Figure 2) of all methods used, is especially  
128 encouraging because it encourages a more sustainable and ecologically sound approach to  
129 pest management by using pests' natural enemies or beneficial species to combat them.  
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### 131 **3.3 Farmers' Perceptions towards Different Aspects of Chemical Pesticide Use**

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133 A perception index was developed to determine the extent of farmers' perceptions of  
 134 chemical pesticide use in vegetable cultivation (Table 2). To ascertain their perceptions,  
 135 twelve perception statement was used [13]; [18]. Results show that most of the farmers  
 136 perceived that they use chemical pesticides to gain quick advantages (score: 421; rank: 1).  
 137 A large number of farmers' perceived that harmful insect pest management becomes  
 138 challenging without chemical pesticides (score: 396; rank: 2). This indicates that farmers  
 139 mainly depend on chemical pesticides to control pests as they have limited knowledge about  
 140 other control measures. Statement 3 shows that farmers are more accustomed to using  
 141 chemical fertilizers.

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

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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	23	40	10	23	24	255	10

pesticides is harmful to beneficial insects and organisms in the soil.

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

144 Source: Field Survey, 2023

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

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154 **3.4 Factors Influencing Farmers' Perceptions towards Chemical Pesticide Use**  
 155 **in Vegetable Cultivation**

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

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

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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		

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Extension Media Contact 0.315\*\*

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Knowledge of Insect Pest Management 0.201\*

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

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

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#### 176 **4. CONCLUSION**

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178 Insect and pest management in commercial vegetable cultivation are major constraints in  
179 Bangladesh. The study found that farmers mainly use chemical pesticides for pest  
180 management practices although it hurts the environment and human health. Farmers have a  
181 positive perception of chemical pesticide use as it works immediately to control the pest  
182 attack and they have very limited knowledge of other insect pest management techniques.  
183 The majority of farmers have little awareness of the precautions to take, the damaging  
184 effects of chemical pesticides on the environment, and the potential health risks. The  
185 presence of growers using integrated approaches involving biological methods and  
186 combinations of chemical and biological methods suggests a growing awareness and  
187 adoption of more sustainable and environmentally friendly practices in pest management,  
188 even though chemical-based pest management techniques are still the most common  
189 among vegetable growers in Gouripur Upazila. The region may experience more sustainable  
190 and efficient pest control as a result of efforts to further support and promote integrated pest  
191 management techniques.

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194

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198 information for conducting this study.

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200 **COMPETING INTERESTS**

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202 The authors declare no conflict of interest.

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204 **AUTHORS' CONTRIBUTIONS**

205

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

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