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ORIGINAL ARTICLE

Extent of Adoption and Knowledge on Pesticide Use in Vegetable Production in Narsingdi District, Bangladesh

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Abstract

Farmers use various pesticides indiscriminately in their vegetable fields throughout the cropping seasons in Bangladesh. The present study therefore, examined farmers' extent of adoption and knowledge on pesticide use in vegetable production. The study was conducted in four villages of Narsingdi district, Bangladesh, where 110 vegetable farmers were selected as sample following disproportionate random sampling technique. Interview schedule was used for collection of data. Both descriptive and inferential statistics were used in the analysis. Results revealed that most of the respondents were 35 years above, literate, had less than seven family members, small farm size (0.02-1.01 ha), moderate contact with information sources (80.9%), low annual income (66.4%) and received training (64.54 %) on pesticide use. Brinjal and cucurbits had the highest pesticide use among the vegetables, while the mostly used pesticides were Topten 1.8 EC, Actara insecticide and Thiovit fungicide. The extent of pesticide adoption was high (91.0%) and all (100.0%) of the respondents had low to moderate knowledge on pesticide use. Contact with information sources (r = 0.32) showed significant relationship with knowledge on pesticide use. Hence, government should strengthen information and regulations in order to raise awareness on safe use of pesticide.

Keywords: *Adoption, Knowledge, Pesticide use, Vegetable cultivation*

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1. Introduction

Most of the farmers in Bangladesh cultivate rice and vegetables. Vegetables form an essential ingredient of human diets for maintenance of good health and disease prevention. Bangladesh has been experiencing annual increase in the vegetables export volume. Thus, there is a great prospect for the country to earn foreign exchange by exporting vegetables. As many as 54 different kinds of vegetables are exported from Bangladesh (BBS 2008). The vegetable sub-sector occupies a significant position in the export sector, helps increase foreign earnings as well as economic growth. Bangladesh earned BDT 1456.33 million (USD 43.33 million) in the year 2004-05 by exporting vegetables, which constitutes 70.08 percent of the earning from agricultural products (Karim et al. 2005). Recently, in the 2017-2018 fiscal year, 26,230,927 tons of vegetables was produced on 1,169,326 hectares of land (Dhaka Tribune 2020).

Cultivation of vegetables is a key employment source for the people of *Narsingdi* district. The soil and climatic conditions are favorable for vegetable production. In this study area, all the vegetable farmers earn money by selling the seasonal vegetables. However, during vegetable cultivation farmers face several problems especially insects and diseases. For more vegetables production and to overcome these problems farmers use high level of pesticide. Predominantly, for the production of high value vegetables, the pesticides are often applied indiscriminately and inappropriately, resulting in adverse effects such as burning, skin irritation, itching, residue effect in vegetables, poisoning, etc.

These farmers use different pesticides to combat pests and get more benefit from vegetable cultivation. They however, hardly abided by the recommendations of scientists of research institutes. Interestingly, they use the doses based on what the local input dealers suggest (Sharifzadeh et al. 2018). The pesticide use, which on an average was 3,850 metric tons per annum during 1973-1990, has gradually increased to a record of 37,712 metric tons in 2008 (BBS 2008; BARC 2000).

Although, a number of studies (Shadequl-Islam et al. 2012; Bhattacharjee et al. 2013; Chowdhury et al. 2014; Miah et al. 2014) that are reported on pesticide use and its harmful effects in Bangladesh, a very little was done in the area of rural vegetable farmers' adoption and knowledge on pesticide use in vegetables production. Therefore, the present research study sought to address this gap by investigating the farmers' extent of adoption and knowledge on pesticide use in vegetables production in *Narsingdi* district of Bangladesh.

2. Materials and Methods

The study was conducted in four villages namely *Dewaner Char*, *Char Ujilab*, *Amlaba* and *Baroicha* in *Narsingdi* district, Bangladesh. *Narsingdi* district was selected due to its high level of pesticide use by the vegetable farmers, easy accessibility of the area to the researcher and cooperation of the farmers in providing the necessary data required for the study. A total of 110 vegetables farmers were selected as sample respondents taking 30 from each of the

three villages except *Baroicha* because vegetable farmers there were comparatively low. Respondents in these villages were selected following disproportionate random sampling technique. For collection of primary data an interview schedule was used. Extent of adoption was estimated by using the following formula, based on adoption index used by Hedayet (2011). Adoption index is the summation of obtained score of the practice divide by possible maximum score of the practice under study multiply by hundred. Thus, calculated using the following formula:

$$\frac{\text{Area under pesticide use}}{\text{Potential area under pesticide use}} X 100$$

Based on the scores (%) obtained, the respondents were categorized into low, medium and high adoption.

On the other hand, knowledge on pesticide use was measured through eleven constructed questions that covered relevant areas of pesticide use. Two marks were allotted for each question. A respondent is given full marks (2) for correct answer; half (1) for partial answer and zero for incorrect answer or no answer. Thus, the total marks to eleven constructed question is 22. To measure respondents' contact with information sources (television, radio, change agent, NGOs, newspaper, friends, family, relative, model farmers and local leaders etc.), a 4-point rating scale was used for checking any of the responses-most often, often, rarely and never with scores of '4', '3', '2', and '1', respectively. The total rank score for a farmer was obtained by adding the individual score of each item which was subsequently cumulated and categorized into low, moderate and high.

The SPSS (Statistical Package for Social Sciences) was used to perform data analysis. Descriptive statistical measures such as frequency, mean, percent and standard deviation were used to describe and interpret the data. Correlation (Spearman's rho) was employed to explore the relationship between selected socioeconomics characteristics of the respondents and their knowledge on pesticide use in vegetable production.

3. Results and Discussion

Socioeconomic characteristics of the respondents

Information shown in Table 1 displays the socioeconomic characteristics of the respondents. The highest proportion of the respondents was 35-50 years (46.4%). This implies that a majority of the respondents contribute meaningfully to productive activities in the middle years of their life. Chakma (2016) reported similar findings where 50.0 percent of the respondents were found in middle aged. Based on literacy, 53.6 could read and write. Half (50%) of them were in the medium family category of 5-7 members, while only 10 percent had more than 7 members in a family unit.

The respondents were classified into three categories on the basis of their farm size according to BBS (2009). Almost all (99.1%) of the respondents had small farm size category (0.02-1.01 ha). None of them had a large farm size (>3.03 ha). These findings are similar to those of Islam (2000). The majority of respondents (64.54%) did receive training;

Table 1: Distribution of the respondents according to socioeconomic characteristics

Variables	Categories	No.	%
Age	Young age (up to 35)	21	19.1
	Middle age (35-50)	51	46.4
	Old age (above 50)	38	34.5
Literacy level	Illiterate	8	7.3
	Can read only	1	0.9
	Can read and write	59	53.6
	Can sign	42	38.2
Family size	Small (up to 4 members)	44	40.0
	Medium (5-7 members)	55	50.0
	Large (above 7 members)	11	10.0
Farm size	Small farm size (0.02-1.01 ha)	109	99.1
	Medium farm size (1.01-3.03 ha)	1	0.9
	Large farm size (>3.03 ha)	0	0.0
Training received	Received	71	64.54
	Did not receive	39	35.45
Membership of association	Do not participate	52	47.27
	Participate	58	52.72
Contact with information sources	Low (14-20)	13	11.8
	Moderate (20-30)	89	80.9
	High (above 30)	8	7.3
Annual income	Low (up to BDT 150,000)	73	66.4
	Medium (BDT 151,000-300,000)	26	23.6
	High (above BDT 300,000)	11	10.6

However, the fate of its utilization was blurred. The respondents were classified into three categories on the basis of their farm size according to BBS (2009). Almost all (99.1%) of the respondents had small farm size category (0.02-1.01 ha). None of them had a large farm size (>3.03 ha). These findings are similar to those of Islam (2000). The majority of respondents (64.54%) did receive training; however, the fate of its utilization was blurred.

Majority of the respondents participate in associations. This implies that high number of the respondents showed a tendency to undertake social responsibility (commonly carried out by members of association) which might sometimes help resolve sensitive issues through group interactions. Results further show that high proportion of the respondents had medium contact with the sources of information (80.9%). It is evident that based on annual family income, majority of the respondents

belonged to the low annual income category (66.4%) of Taka 151,000-300,000.

Types of pesticide used on vegetables

Distribution of the respondents according to the pesticide used with respect to various vegetables is shown in Table 2. In the study area, cultivated vegetables were mainly Brinjal, tomato, radish, cauliflower, beans, okra, potato, papaya, chili, and different types of cucurbits like pumpkin, bottle gourd, ash gourd, snake gourd, pointed gourd, bitter gourd etc. The production tread of vegetables increases day-by-day. Vegetables farmers use different types of pesticide for a single vegetable. Largely, they use Actara insecticide, Thiovit fungicide, Voliam flexi 300 SG, Proclaim 5 SG, Topten 1.8 EC, Nucklam 5 SG, Team 5 SG, Indofile M 45, Ridomil gold MZ 68WG, Vertimac 018, Pegasus insecticide, Tilt fungicide.

Results in Table 2 indicates that majority the respondents used Actara for *Brinjal* (67.6%), cauliflower (55.9%) and Chili (59.1%). For cucurbitaceous family vegetables production, majority used Topten 1.8 EC (68.5%) and Thiovit (65.8%). In case of tomato (51.8%) and potato (47.3%), majority used Voliam flexi 300 SG. Majority (66.4%) of the respondents used Proclaim 5 SG pesticide for bean production. In case of chilli production around half (50.0%) of the farmers' use Actara, Indofil M 45, and Tilt. For papaya production, pesticide use was comparatively low. Around 1/3 of the respondents uses Proclaim 5 SG, Topten 1.8 EC, Nucklam 5 SG, and Team 5 SG. The various kinds of pesticides used by the respondents affirm the commonality of pesticides application in rural vegetable farming. However, adherence to the manufacturers' instructions cannot be guaranteed. This has been corroborated by Yeasmin et al. (2018).

Extent of adoption of pesticide in vegetable production

The possible range of extent of adoption of pesticides by the respondents was 33.33 to 100 percent. The mean adoption score was 85.62. Based on observed range of extent of adoption, the respondents were classified into three categories as presented in Table 3.

Information contained in Table 3 reveal that majority (91.0%) of the respondents had high level of adoption of pesticide compared to 9.0 percent having medium adoption of pesticide for vegetable production. Findings clearly indicate that majority of the respondents had medium to high adoption of pesticide for vegetable production. So, pesticide use is very high in the selected area. This scenario has been reflected in the present study. Nahar (2013) found similar result with regards to adoption BRRI dhan28 in the coastal areas of Bangladesh.

Table 2: Distribution of the respondents according to the types of pesticide use in vegetables

Pesticide Name	Name of the Vegetables							
	Brinjal	**Cauliflower**	**Cucurbits**	**Tomato**	**Bean**	**Chilli**	**Papaya**	**Potato**
Actara insecticide	75 (67.6)	62 (55.9)	64 (57.7)	0	0	65 (59.1)	0	51 (46.4)
Thiovit fungicide	0	0	73 (65.8)	27 (24.5)	0	0	0	25 (22.7)
Voliam flexi 300 SG insecticide	63 (56.8)	0	0	57 (51.8)	62 (56.4)	0	0	52 (47.3)
Proclaim 5 SG insecticide	67 (60.4)	0	0	48 (44.9)	73 (66.4)	0	32 (29.1)	0
Topten 1.8 EC insecticide	0	0	76 (68.5)	53 (48.2)	0	0	33 (30.0)	0
Nucklam 5 SG insecticide	0	0	60 (54.5)	0	0	0	36 (32.7)	0
Team 5 SG insecticide	0	0	0	0	0	0	28 (25)	0
Indofil M 45 fungicide	0	61 (55)	0	0	0	62 (56.4)	0	0
Ridomil gold MZ 68 WG fungicide	0	0	0	30 (27.3)	0	0	0	0
Vertimac 018 insecticide and acaricide	60 (54.1)	0	0	0	0	0	0	0
Pegasus insecticide	0	0	0	0	59 (53.6)	0	0	0
Tilt fungicide	0	0	0	0	0	55 (50.0)	0	0

*Numbers in parenthesis indicate percent

Table 3: Distribution of the respondents according to extent of adoption of pesticide

Categories	Respondents		Mean	SD
	Number	**Percent**		
Low adoption (up to 33%)	0	0.0	85.6213	13.37605
Medium adoption (33-66%)	10	9.0		
High adoption (Above 66%)	100	91.0		
Total	**110**	**100.0**		

Knowledge on pesticide use in vegetable production

Here, knowledge refers to the awareness of the vegetable farmers about different activities related to pesticide use for vegetable production in the selected areas. The computed knowledge score of the respondents in the present study ranged from 9 to 20 with a mean 15.25 and standard deviation 2.58. The respondents were grouped into three categories presented in Table 4.

Table 4: Distribution of the respondents according to the knowledge on pesticide use

Categories	Respondents		Mean	S. D
	Number	Percent		
Low (score 10-15)	47	42.7	15.24	2.58
Moderate (score 15-20)	63	57.3		
High (score above 20)	0	0.0		
Total	**110**	**100.0**		

Findings in Table 4 depict that, more than half (57.3%) of respondents had moderate knowledge, while 42.7 percent had low knowledge, with nobody having high knowledge on pesticide use for vegetable production. Thus, all the respondents (100.0%) belong to low and moderate categories. Akter (2015) found the similar results in Bangladesh. Inadequate knowledge on pesticides use is quite clear among the respondents. And this does more harm than good to agricultural production and environment in general. In fact, the small-scale farmers who have inadequate knowledge, no formal training or fail to wear protection have been observed to cause many fatal consequences. In the vein, Jallow et al. (2017) reported similar findings with regards farm workers' poor knowledge on pesticides use in Kuwait.

Relationship between Selected Socioeconomic Characteristics of the respondents and their Knowledge on Pesticide Use in Vegetable Production

Relationship between selected socioeconomic characteristics of the respondents and their knowledge on pesticide use in vegetable production was examined by testing the null hypothesis:

"There is no significant relationship between selected socioeconomic characteristics of the farmers and their knowledge on pesticide use".

Table 5: Relationship between selected socioeconomic characteristics of the respondents and their knowledge on pesticide use in vegetable production

S/N	Independent variables	Correlation coefficient (r)	*P* value
1	Age	-0.013	0.893
2	Literacy	0.096	0.320
3	Family size	-0.021	0.829
4	Farm size	0.051	0.596
5	Contact with information sources	0.315**	0.001
6	Income	-0.044	0.651
7	Membership of association	-0.042	0.661
8	Training received	-0.052	0.592

** *P<0.01*

The findings presented in Table 5 indicate that source of information had weak positive significant (r = 0.315) relationship with farmers' knowledge on pesticide use for vegetable production. It means that respondents with the higher contact with source of information attain increase in knowledge on pesticide use in vegetable production, but on a low scale given the correlation coefficient value obtained. This therefore, buttress what was noted initially that, most often than not vegetable farmers act based on the information or suggestions gathered from the input dealers who are part if not major source of information to them. Ghosh (2013) found dissimilar results in his study. But, Yeasmin et al. (2018) corroborate the present findings from a study conducted in Gazipur district of Bangladesh. However, literacy, farm size, age, family size, income, membership of association and training experience were not found significant.

4. Conclusions

Based on the major findings and their logical interpretation, the following conclusions have been drawn:

Major percentage of the respondents in the study area were middle aged, had high literacy level, medium family size, small farm size, medium information source use, low annual income and received training on pesticide use. Thus, with required public education and strengthened communication structures by the government and pesticide manufacturers' proper choice and safe use of pesticides could be achieved. In addition, government needs to impose standards and regulations on pesticides use.

The respondents adopted pesticides to a high extent and all of them had low to moderate knowledge on pesticide use in vegetable production. Owing to this, information dissemination through mass media must be undertaken on the proper dose application of insecticide as well as the detrimental effect of pesticide use in vegetable production.

Contact with sources of information (r = 0.315) significantly relates with knowledge on pesticide use in vegetable production. Therefore, increase in contact with information source will lead to increase (though minimal) in

knowledge on pesticide use in vegetable production.

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