

**Research Article**

## **FARMERS' KNOWLEDGE, ATTITUDE AND EXPERIENCE IN THE APPLICATION AND MANAGEMENT OF PESTICIDES**

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### **ABSTRACT**

A survey was conducted on some vegetable farmers from a few selected vegetable growing areas in Bangladesh to know their social aspects, pesticide knowledge, practices, safety measures, resources and effects of pesticides. A survey questionnaire was developed and sent to 90 randomly selected vegetable farmers to determine to what extent they used pesticides. Almost 87% of the farmers' stored pesticides in their houses without safety consideration but only about 13% used special storage. About 78.7% of farmers never read the label before applying pesticides. The most protective clothes reported by the farmers were nose masks (18.2%), and about three-fourths (71.7%) of them did not use any protective clothing. The majority (61.8%) of the farmers threw away their empty containers, and only 16.9% burned them. The majority of farmers (92.1%) applied pesticides as both curative and preventive measures. Almost all farmers reported that infested pests were identified by themselves by observing damage to flowers & fruits (86.5%) and leaves & green parts (13.5%). Most of the farmers (64%) selected pesticides for controlling pests by themselves, and 28.1% with the help of experienced farmers. Nearly 45.0% of respondents have moderate knowledge, and 44.8% have good knowledge in pesticide application and management. The most common pesticide related illnesses and injuries reported by respondents were headache/dizziness (44.9%), weakness (33.7%), stomach cramps (29.2%), and blue-red vision (16.9%). Only 23.6% of farmers observed that pesticides decrease plant yield, and 18.0% of farmers knew that pesticides destroy soil microorganisms. As the environment and human health were poorly considered, only 19.1% of respondents were bio-pesticides, 4.5% were organic pesticides, 2.2% were non-persistence pesticides, and 2.2% were natural enemy users. Respondents have very poor knowledge about modern pest control methods like beneficial microorganisms (4.7%), beneficial insects (3.5%), biological control of pests (3.5%), IPM (2.3%), SIT (1.2%), and GMO crops (1.2%). Farmers' age was correlated negatively with education ( $r = -0.380$ ) and positively with experience ( $r = 0.909$ ,  $P < 0.01$ ). Pesticide related illness and injuries had a significant correlation with age ( $r = 0.465$ ) and experience ( $r = 0.395$ ).

**Keywords:** *Farmers, Pesticides, Agroecosystem, Attitude, Experience.*

### **Introduction**

Insect pests infested in the agroecosystem hamper the quality and quantity of agricultural crops and cause a loss of huge of the world's food crops. Pesticides are the proven weapons for

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controlling pests. The modern agriculture entirely depends on the extensive and massive exercise of pesticides as a result their widespread diffusion to all environmental compartments including a wide range of organisms up to the humans (Samiee *et al.*, 2009, Abang *et al.*, 2013). Basically, pesticides must be lethal to the target pests except other organisms but this is not the case, so the controversy of use and abuse of pesticides has highlighted. Human health is adversely affected by abusive use of pesticides, *i.e.* immune suppression, reproductive abnormalities, nervous system disorders (Hanke and Jurewicz, 2004; Frazier, 2007), cancer (Weichenthal *et al.*, 2010; Amanullah and Hari, 2011), asthma and diabetes (Lee *et al.*, 2006; Jayashree and Singhi., 2011). It has been reported that transport of pesticides by surface runoff during rainfall is a major process responsible for pesticide contamination of rivers (Morohashi *et al.*, 2012), and groundwater (Sorensen *et al.*, 2011). Almost high doses and frequent pesticide usages have adversely affected natural enemies (Al-Zyoud, 2014), birds (Tanabe *et al.*, 1998), wildlife (Espin *et al.*, 2010), adjuvant soil microorganisms, plant yields (Glover-Amengor and Tetteh, 2008), caused phytotoxicity (Fishel, 2011), and contributed to ozone depletion (Giri, 1998). Abuse of pesticides can also cause undesirable residue accumulation in food crops (Caldas *et al.*, 2011), acute and chronic health problems to human (Firestone *et al.*, 2005).

In most cases farmers apply pesticides without understanding of the impact on human health and environment (Ngowi, 2003). In Bangladesh, like other Asian countries, the unbridled use, handling and misuse of pesticides are well known. Several studies on various awareness aspects associated with pesticide use have been conducted among farmer populations worldwide including the developing countries (Clarke *et al.*, 1997; Wesseling *et al.*, 1997; Perry *et al.*, 2000; Yassin *et al.*, 2002). Majority of Bangladeshi farmers have few or no knowledge on pesticides harmful effect on health and environment. They overestimate their benefits and use higher doses and more frequent than necessary (Al-Zyoud, 2014). The fate and impact of pesticide application not seen in bare eye therefore they ignore to follow the rules given or written in the containers.

As the after-use acute toxicity is rarely seen, the farmers are not much interested to follow any instructions. Thus, farmers' perception of pesticide practices and, their level of awareness on adverse effects of pesticides on environment and human health need to be determined. Therefore, a survey was made on some vegetable farmers from few selected vegetable growing areas in Bangladesh to know their social aspects, pesticides knowledge, practices, safety measures, resources and effect of pesticides. The present study was aim to highlight some aspects on the side effects of improper pesticides uses and helps to understand the policymakers for further development of new protocols on safe application and management of pesticides in agriculture to save the human and environment.

## **Materials and Methods**

### *Study area*

The survey was conducted in ten villages of Jhenaidah and Jashore districts which are adjacent and situated in the south-western region of Bangladesh. The research areas under Jhenaidah included Gobrapara and Shonatonpur villages under Doulatpur Union, Horinakunda Upazila located at 23.6177°N and 89.0214°E and Radhanagor, Gilapole and Batikadangga villages under Shaganna Union, Sadar Upazila located at 23.5640°N and 89.0475°E. The study sites under

Jashore district were Shahbajpur, Abdullahpur, Rahmathpur, Mathurapur and Shamoshpur villages under Haibatpur Union, Sadar Upazila located at 23.2527°N and 89.1661°E.

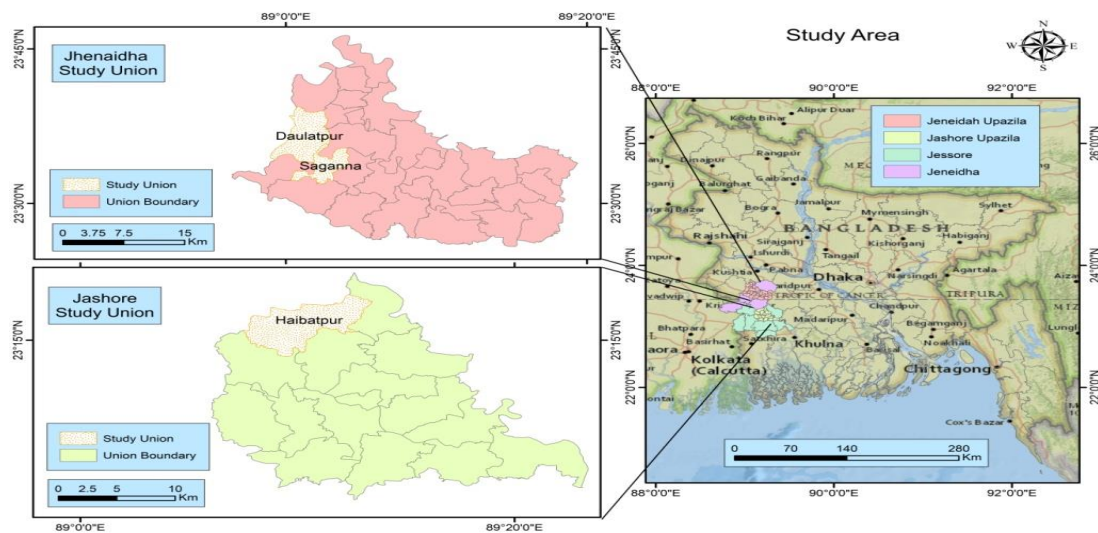


Fig. 1. Study areas.

#### *Questionnaire development*

The survey questionnaire was developed to document the current activities and perspectives to the application and management of pesticides by winter vegetables farmers in selective areas of Jhenaidah and Jashore districts. The questionnaire was sent to 90 randomly selected vegetables farmers to determine to what extent they used pesticides. Although sampling was random, an effort was made to ensure that the selected farmers represented different locations, age groups, farm sizes and literacy levels. The paper format questionnaire was accompanied by a cover letter. The target of the study was explained to these respondents through the cover letter to seek their consent. This was done in order to ensure their cooperation, which was very important for the study. The study was carried out by survey during October 2022 to January 2023.

#### *Structure of the questionnaire*

For addressing the knowledge, attitude and experience in the application and management of pesticides by winter vegetables farmers, the following questionnaire used in this survey. (Table 1)

Table 1. A list of questionnaires for analysis of farmers' knowledge, attitude and experience in the application and management of pesticides.

Sections	Questions
1. Mode of pesticide application and management	<ul style="list-style-type: none"> <li>● Location of buying pesticides &amp; storing place</li> <li>● Reading label before application</li> <li>● Using protective clothing</li> <li>● Metrological considerations during application</li> <li>● Fate of empty containers</li> <li>● Keeping pesticides using records</li> </ul>

Sections	Questions
2. Farmers' behavioral patterns and attitude towards pesticides application and management	<ul style="list-style-type: none"> <li>● Controlling measures type of pesticide used</li> <li>● Purchasing time of pesticides</li> <li>● Purposes of using pesticides</li> <li>● Attitude to pesticides use</li> <li>● Numbers of pesticides applications</li> <li>● Pesticides application time</li> <li>● Metrological considerations during application</li> <li>● Checking the pesticide level of toxicity</li> <li>● Effectiveness of pesticides</li> <li>● Pesticides application rate</li> <li>● Searched alternative way for pest control</li> <li>● Tendency to bio-pesticides or organic pesticides</li> <li>● Tendency to modern pest control technologies</li> <li>● Still apply pesticides in coming years.</li> </ul>
3. Knowledge and experience on pesticide application and management	<ul style="list-style-type: none"> <li>● Educational level</li> <li>● Completion of any training or course</li> <li>● Farming knowledge from</li> <li>● Pest management resources</li> <li>● Pest identification methods</li> <li>● Selection of pesticides by</li> <li>● Involvement in any training or workshop,</li> <li>● Tendency to attend in any training or workshop</li> <li>● Seeking for more pesticides information</li> <li>● Types of information needed</li> <li>● Pesticides application &amp; management knowledge</li> </ul>
4. Faced pesticide related illnesses and injuries	<ul style="list-style-type: none"> <li>● Faced pesticide-related illnesses and injuries</li> <li>● Side effects of extensive use of pesticides</li> </ul>
5. Advanced practices and modern technologies knowledge.	<ul style="list-style-type: none"> <li>● Advanced practices related to insecticides use</li> <li>● Modern technologies knowledge</li> </ul>

### *Response outcome and statistical analysis*

Ninety completed questionnaires were evaluated and compiled in a spreadsheet, and were coded. The data were analyzed using descriptive statistics and percentages were generated and shown in graphs. The spearman's correlation analysis procedure was used to examine pair-wise associations between demographics variables of the farmers (age, experience, education and training) and particular pesticides practice (Zar, 1999). All analyses were performed using the IBM SPSS version 25.0 (SPSS, 2017).

## **Results and Discussion**

### *Mode of pesticides application and management*

The mode of pesticide application and management as answered by respondents is shown in the Fig. 2.

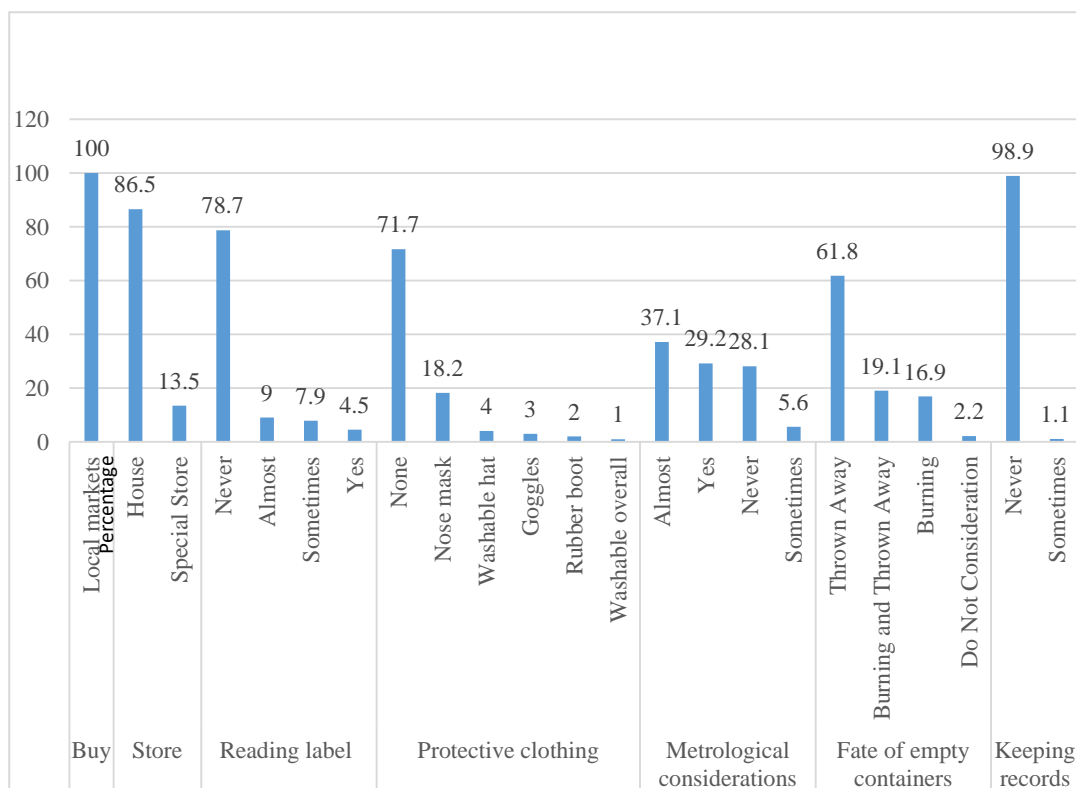


Fig. 2. Mode of pesticide application and management of farmers.

Almost 87% of the farmers stored pesticides in their house without safety consideration but only about 13% used special store. A high percentage (78.7%) of farmers never read the label before applying pesticides. The most protective cloths reported by the farmers were nose mask (18.2%) and about three-fourth (71.7%) of them did not use any protective clothing. The majority (61.8%) of the farmers thrown away their empty containers and only 16.9% burned them. Most of farmers were cautious about metrological considerations during pesticides application and almost (98.9%)

farmers did not keep any records of used pesticides such as date and time, pesticide name and rate etc.



Fig. 3. Indiscriminate use and disposal of pesticides in study areas.

Actually the farmers do not read or properly follow the label before application for safe usage of pesticides (Dey, 2010). This survey found that 78.7% of farmers never read the label before applying pesticides which is close to what of Abd Rabou *et al.* (2002) were found (75%). In contrast, high percentage (85%) of label reader was reported by Al-Zyouid (2014). This study data indicated that 71.7% farmers do not wear any protective clothing which is approximately same to Owusu-Boateng and Amuzu (2013) and Abd Rabou *et al.* (2002) findings (75% and 78% respectively), while only 15% are reported by Al-Zyouid (2014). The present results showed that only 13% respondents store pesticides in special store and 87% in their house. In addition, only 16.9% farmers burned the empty containers and 61.8% thrown away. In this regard, Wesseling *et al.* (1997) reported that the mismanagement of pesticides containers is common in the developing countries. In contrast, Owusu-Boateng and Amuzu (2013) stated that 85% farmers disposed off emptied containers by burning, digging up the soil or placing in the communities' waste bins and Abd Rabou *et al.* (2002) stated that 66% farmers used special store for keeping pesticides.

#### *Farmer's behavioral patterns and attitudes to pesticides application and management*

Farmer's behavioral patterns and attitudes to pesticides application and management as answered by respondents are shown in the Fig. 4.

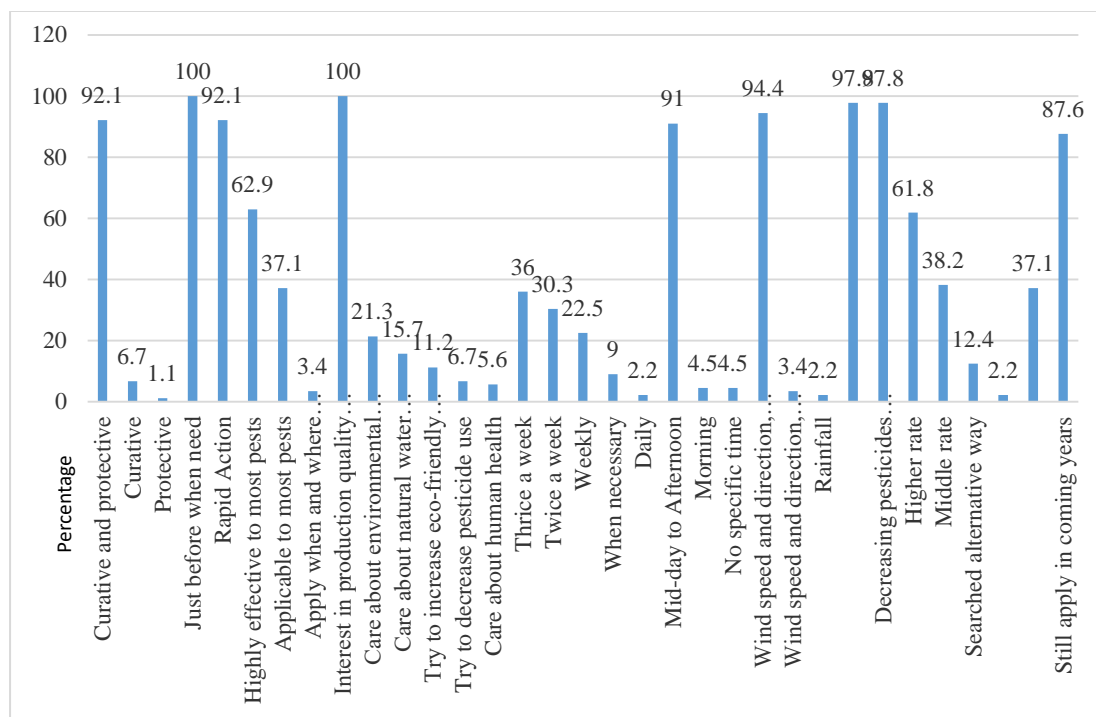


Fig. 4. Farmers' behavioral patterns to pesticide applications and management.

Most of the farmers (92.1%) applied pesticides as both curative and preventive measures and almost all purchased pesticides just before when need. Main purposes of using pesticides are rapid action (92.1%), enable high level of control of most pests (62.9%) and applicable to most pests (37.1%). Cent percent respondents reported that they are very highly interested in production quality and quantity but 21.3% care about environmental pollution, 15.7% care about pesticide effects on natural water reservoir and only 5.6% care about human health. In addition, attempts of farmers to increase eco-friendly pest control (11.2%) and decrease pesticide (6.7%) was very low. Almost 98% of the respondents never checked the pesticide's level of toxicity before using it. More than one-third of the farmers (36.0%) applied pesticides thrice a week, 30.3% applied twice a week and 22.5% applied weekly. Almost all of the farmers (91.0%) applied pesticides from mid-day to afternoon and only 4.5% at the morning, while 4.5% had no specific time. High pesticides rate was applied by 61.8% and middle rate by 38.2% of the farmers, in contrary 87.6% farmers did not search alternative way of pest control, 97.8% and 62.9% farmers had no positive tendency to apply bio-pesticides or organic pesticides and modern pest control technologies respectively. Most of the respondents (94.4%) were cautious about meteorological considerations during pesticides application. Nearly 98% farmers believed that the effectiveness of pesticides decrease gradually as a result 100% farmer must increase the volume of pesticides next coming years. The current results showed that majority (92.1%) farmers used pesticides as both curative and preventive measures which is supportive to what Abd Rabou *et al.* (2002) found (71%). This

result proved that most farmers believe in more applying of pesticides means more agricultural yield which is in complete agreement with the findings of Wesseling *et al.* (1997) and Abd Rabou *et al.* (2002).

#### Knowledge and experience on pesticides application and management

Farmer's knowledge and experience on pesticides application and managements answered by respondents is shown in the Figure no 5.

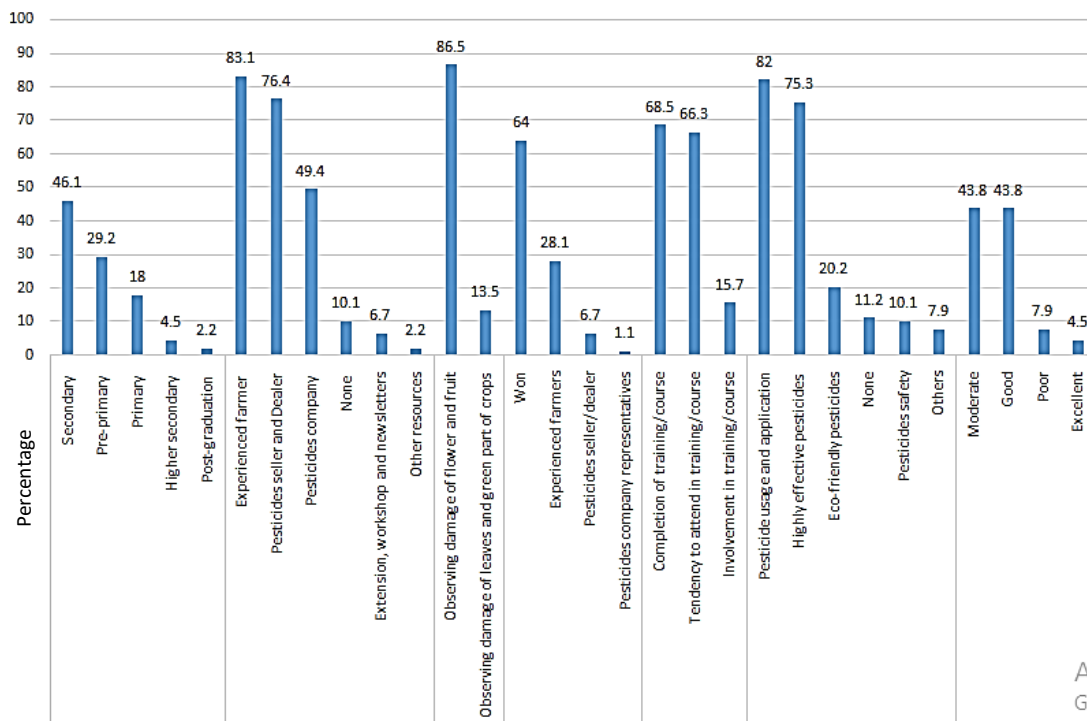


Fig. 5. Farmers' pest control knowledge, information source, experience, training and educational level.

Completion of secondary level of education was the most dominant among the farmers with 46.1%, followed by pre-primary level (29.2%) and primary level (18.0%). Meanwhile, university post-graduation level (2.2%) was the lowest among the respondents. Majority farmers (68.5%) had been taken in pest related training program. In addition, 15.7% respondents involved in training or workshop and 66.3% had shown their eagerness to attend in training or workshop during the survey period. Farmers were not rely upon and believe in only one source of information in case of insecticides application, although experienced farmers (83.1%) was the most popular. Besides pesticides seller & dealer (76.4%) and pesticides companies (49.4%) information had been taken parallel. All respondents (100%) reported that infested pest are identified by themselves with observing damage of flowers & fruits (86.5%) and leaves & green parts (13.5%). Most of the farmers (64%) selected pesticides for controlling pest by won self and



28.1% with the help of experienced farmers. Most of the respondents (61.8%) searched more pesticides information and expressed highly interest in pesticides usage and application (82.0%) and highly effective pesticides (75.3%), unfortunately low interest was found in eco-friendly pesticides (20.2%) and pesticides safety (10.1%). It was observed that nearly 45.0% of respondents having moderate and 44.8% respondents having good knowledge in pesticides application and management. In addition, 7.9% respondents found poor and 4.5% respondents excellent in application and management of pesticides respectively. Good knowledge may be related to educational level attainment (Owusu-Boateng and Amuzu, 2013) but more inclined to use pesticides according to the recommended guidelines (Abd Rabou *et al.*, 2002) and Yassin *et al.*, 2002).

*Pesticide related illnesses and injuries and knowledge of effects of extensive pesticides use*

Pesticides related illnesses and injuries as answered by respondents is shown in the fig. 6.

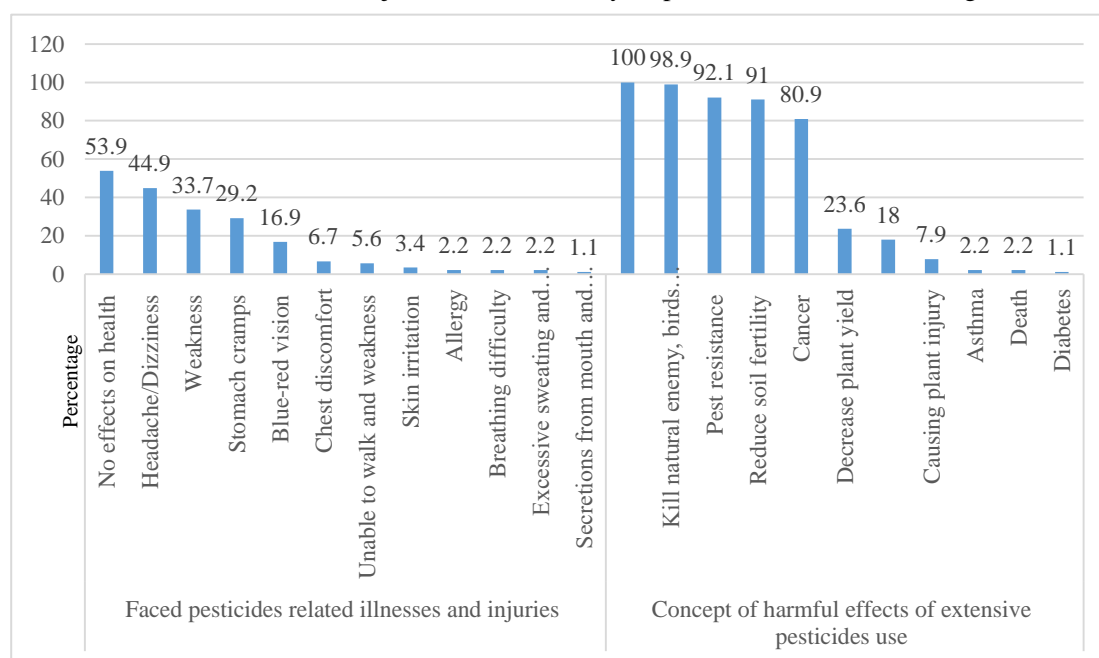


Fig. 6. Pesticide related illnesses and injuries faced by respondents (n=90) and knowledge of effects of extensive use of pesticides in agriculture.

More than half of the farmers (53.9%) amazingly answered that pesticides have no effects on their health. The most faced pesticides related illnesses and injuries reported by respondents are headache/dizziness (44.9%), weakness (33.7%), stomach cramps (29.2%) and blue-red vision (16.9%). Only 23.6% farmers observed that pesticides decrease the plant yield and 18.0% farmers known that pesticides destruct soil micro-organisms. Results showed that there was no pesticides related effects on 53.9% respondents' health but rest of them faced problems were headache/dizziness (44.9%), weakness (33.7%), stomach cramps (29.2%) and blue-red vision (16.9%). This result agree with the findings of many other researchers in which interviewed

farmers mentioned several similar pesticide-related illness and injuries (Abd Rabou *et al.*, 2002; Safi, 2002., Abang *et al.*, 2013; Miah *et al.*, 2014., Esechie and Ibitayo, 2011). FAO (2001) stated that pesticide exposure-related health problems are mimic and natural in the rural area, and the most common symptoms are headaches, dizziness and vomiting and according to WHO at least 20,000 workers die from exposure to pesticides every year (WHO, 2004).

### **Advanced practices and knowledge about modern technologies**

Advanced practices and knowledge about modern technologies as answered by respondents is shown in the Fig. 7.

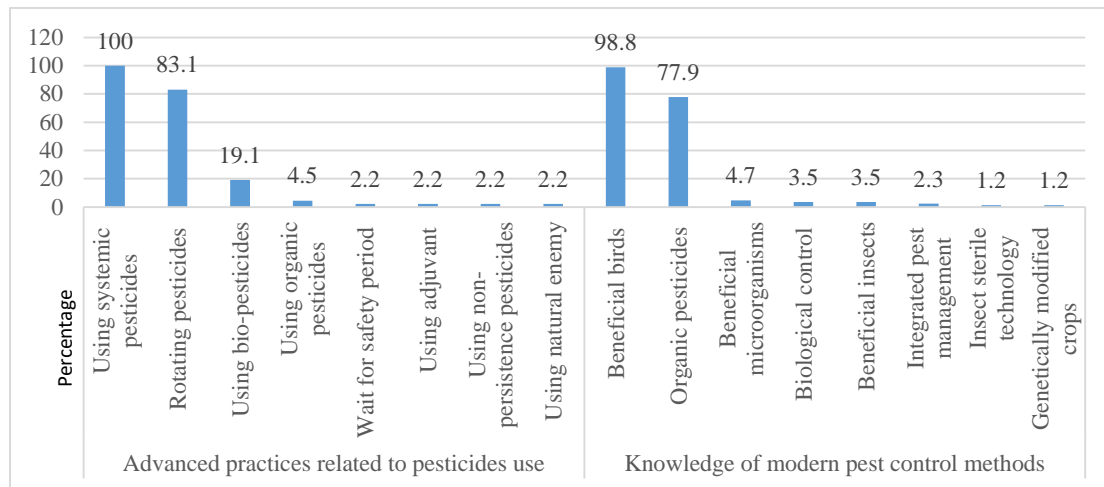


Fig. 7. Farmers' advanced practices and knowledge of modern pest control methods.

Although all respondents (100%) chosen the systemic pesticides as a principle tools for pest control, but they have a high level of concern about resistance management by rotating pesticides (83.1%). As the environment and human health were poorly considered, only 19.1% bio-pesticides, 4.5% organic pesticides, 2.2% non-persistence pesticides and 2.2% natural enemy user respondents had been found. Very poor amount of farmers reported that they wait for safety period of the pesticide before harvesting (2.2%) and use adjuvant to improve safety and efficacy of applications (2.2%). It is reported that majority of respondents know about beneficial birds (98.8%) and organic pesticides (77.9%). In addition, respondents have very poor knowledge about modern pest control methods those were beneficial microorganisms (4.7%), beneficial insects (3.5%), biological control of pest (3.5%), IPM (2.3%), SIT (1.2%) and GMO crops (1.2%). The result showed that almost all farmers rely on systemic pesticides which contaminate all parts of the crops so it is tough to remove from fruits and vegetables. Result indicated that only 2.2% farmers wait for safety period which is agree with Al-Sead *et al.* (2011) who stated that most of the famers seldom followed the instructions of safety period and Miah *et al.* (2014) who mentioned that only 25 farmers out of 600 were concerned about safety period.

*Correlation involve in pesticides application and management*

Farmers' age is correlated negatively with education ( $r = -0.380$ ) and positively significant with experience ( $r = 0.909$ ,  $P < 0.01$ ) (Table 6). It is the matter of concern that pesticide related illness & injuries had correlation with age ( $r = 0.465$ ) and experience ( $r = 0.395$ ). Age, experience even education or training had no positive significant correlation with knowledge of pesticides application and management, label indication practices and advance practices.

Table 6. Showing the important correlations between demographics variables of the farmers and particular pesticides' practices/issues (n=90)

<b>Correlated variables</b>	<b>r</b>	<b>Significance</b>
Age vs education	-0.380**	0.000
Age vs experience	0.909**	0.000
Age vs training	-0.175	NS
Knowledge of pesticides application and management vs age	0.040	NS
Knowledge of pesticides application and management vs education	0.149	NS
Knowledge of pesticides application and management vs experience	-0.001	NS
Knowledge of pesticides application and management vs training		
Label indication practices vs age	0.186	NS
Label indication practices vs education	-0.134	NS
Label indication practices vs experience	0.146	NS
Label indication practices vs training	-0.274**	0.009
Advance practices vs age	0.173	NS
Advance practices vs education	-0.131	NS
Advance practices vs experience	0.139	NS
Advance practices vs training	-0.247	NS
Pesticides related illness and injuries vs age	0.142	NS
Pesticides related illness and injuries vs experience	0.465**	0.000
	0.395**	0.000

NS and \*\* Not significant and significant at 0.01 respectively.

**Conclusion**

Pesticides are essential candidates for pest control and agricultural production. Without use of pesticides, there would be a 78% loss of fruit production, a 54% loss of vegetable production, and

a 32% loss of cereal production. Although pesticides play a key role in controlling pest infestations in agricultural settings, the present study provides necessary warnings about indiscriminate use of pesticides in Bangladesh leading to a number of negative effects to the environment, farmers and human health. Therefore, there is necessary to control pesticide contamination and its negative influence on environmental and other non-target organisms.

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