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FARMERS PERCEPTIONS ON THE USE OF INSECTICIDES FOR MANAGEMENT OF BRINJAL SHOOT AND FRUIT BORER

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Abstract

The survey was conducted in Chattogram, Jashore and Mymensingh regions of Bangladesh to find out the farmers' knowledge and perceptions about insecticide usages in brinjal for management of brinjal shoot and fruit borer (BSFB) during August 2014 to April 2015. All the farmers of three different study areas reported that BSFB is a major problem and needs to be controlled. On an average, 91.68% farmers used conventional chemical method as main protection technique by using only insecticide whereas only 5.54% farmers used IPM method and 2.78% used different types of cultural pest management techniques for controlling BSFB. On an average, 40.80% farmers used insecticide as single form and 59.20% farmers used it in the form of cocktail. During three and half months crop season 36.35 to 57.33 times spray can occur depending on the regions. On an average, 73.23% farmers followed the advice of pesticide dealers in selecting pesticides and their doses for spraying against BSFB. Only 7.69% farmers followed the advice of extension workers which is much less as compared to the pesticide dealers. On an average, 73.98% farmers reported that insecticide was applied without any protection measures.

Keywords: Farmer, Insecticide, *Solanum melongena*, Shoot and fruit borer

Introduction

Brinjal (*Solanum melongena* L.) is one of the most popular and year round vegetable crops cultivated widely in Bangladesh. It covers about 22.72% of the total vegetable area of the country occupying a total area of land over 51166 ha with a total production of 507000 metric tonnes and an average yield of 7.84 t/ha (BBS, 2018). It is also a versatile and economically important leading vegetable in the country ranking first among summer and winter vegetables in terms of total acreage.

Brinjal is reported to be infested in India by 10 insect species belonging to nine families of four orders from vegetative to reproductive stage (Kumar *et al*., 2019) and in Bangladesh 9 insect species belonging to seven families of 4 orders were recorded as pest (Amin *et al.,* 2018). Among the insect pests, brinjal shoot and fruit borer (BSFB), *Leucinodes orbonalis* Guenee is considered to be the most serious pest of brinjal and it has become a very serious production constraint in all brinjal growing countries (Alam *et al*., 2003). BSFB is the key pest infesting brinjal as it causes yield losses in Bangladesh up to 86% and farmers rely

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primarily on frequent insecticide applications to reduce injury (Prodhan *et al.*, 2018). It is very difficult to control since it feeds inside the shoots and fruits (Ghosh and Senapati, 2009). Over 95% of farmers recognized BSFB as the most serious pest and nearly all of them used only chemical insecticides to combat the pest (Alam *et al*., 2003). Sometimes, the yield loss caused by this pest has been estimated more than 85% (Rashid *et al*., 2003) in Bangladesh, 85.8% (Patnaik, 2000) and 75% (Singh *et al*., 2005) in India. Brinjal production is seriously affected by damage caused by brinjal shoot and fruit borer (AVRDC, 2001).

Usually farmers use insecticides for controlling this pest due to easy availability through pesticide dealers. About 47% of the total insecticides used in vegetables are against BSFB and per hectare use of those is the highest for the pest (Alam *et al*., 2003). A survey conducted in Bangladesh during 2000-2001 showed that in the intensive vegetable production areas of Jashore, farmers sprayed insecticides up to 141 times in a season of 6-7 months (Rashid *et al*., 2003). Such insecticide use, besides being costly, is detrimental to the environment, human health, predators and parasites and also increases the cost of production making the vegetable much expensive for poor consumers (Singh *et al*., 2005). Therefore, it is important to gather ideas about farmers' knowledge and perceptions in insecticide usage for controlling BSFB. The present study using an interview survey aims to collect some information on the existing situation of insecticide usage in brinjal.

Materials and Methods

The survey study was conducted in three major brinjal growing areas (Jashore, Chattogram and Mymensingh) of Bangladesh from August 2014 to April 2015. The survey was conducted according to the method of Awal *et al*. (1998). Sixty farmers in each location were randomly selected for data collection and were interviewed. Information regarding major insect pests of brinjal, pest management knowledge including insecticide names, application frequency and doses, insecticide application system and safety measures followed etc. was collected. The collected data were analyzed using SPSS software and 't' statistics were employed to find out the significant differences between various parameters.

Results and Discussions

Farmers' response regarding the insect pest of major vegetables of three different regions is presented in Table 1. Regarding the insect pest problem of four major vegetables, 100% farmers opined that brinjal is considered to be mostly affected vegetable by different insects in all the locations. On an average, 5.61 to 7.04% farmers indicated that tomato, bean and potato suffers from the insect problem. From the farmers' opinion, it is clearly understood that brinjal is a crop which is certainly attacked by insect pests.

Table 1. The percentage of farmers' respond to the insect problem in different vegetables at three regions

Vegetables	% Farmers' responded			
	Chattogram	Jashore	Mymensingh	Average
Brinjal	100	100	100	100
Tomato	4.23	5.26	7.33	5.61
Bean	8.12	3.56	6.78	6.15
Potato	6.23	9.26	5.64	7.04
t value	2.35	3.32	3.34	2.56

Farmers' opinion about the management of brinjal shoot and fruit borer is presented in Table 2. All the farmers of 3 different study areas reported that BSFB is major problem of these areas and need to be controlled. Most of the farmers (88.86%) indicated that BSFB control is difficult. A few farmers (11.14%) opined that BSFB is controllable pest. There was no doubt that BSFB caused tremendous yield loss of brinjal. Each and every farmer is in support to adopt control measures. However, it is reflected from their opinion that the pest is difficult to control. Farmers have been experienced with the unsuccessful in controlling BSFB by insecticides and in agreement that the pest is difficult to control. Opinion of the few farmers (11.14%) mentioned that the pest BSFB should be taken into consideration for developing and implementation of better management technologies .

Table 2. Farmers' opinion about the management of brinjal shoot and fruit borer

Location	% Farmers' responded		
	Need to control	Difficult to control	Controllable
Chattogram	100	91.21	8.79
Jashore	100	88.89	11.11
Mymensingh	100	86.49	13.51
Average	100	88.86	11.14
t value	NS	2.63	3.32

Farmers' opinion on the percentage of loss caused by BSFB in three different regions is presented in Table 3. There was a significant variation in damage as opined by the farmers. Loss by BSFB in all the surveyed regions was significantly higher in unsprayed field than the sprayed one. Farmers opined that BSFB is the damaging pest of brinjal irrespective of application of insecticide. Application of insecticide was found common practice for controlling BSFB in all the three areas. On an average 81.66% loss by the farmers in unsprayed plots while loss is almost half (46.80%) in sprayed plots. In Jashore region, maximum loss (91.25%) was indicated by the farmers in unsprayed plots which were reduced to a great extent (36.67%) when the brinjal plots were sprayed. It

indicated that insecticide application is indispensable to protect their crops to a large extent.

Table 3. Farmers' perception on the loss of brinjal by BSFB in sprayed and unsprayed brinjal crop

Type of field	% Loss caused by the brinjal shoot and fruit borer			
	Chattogram	Jashore	Mymensingh	Average
Sprayed field	55.36	36.67	48.37	46.80
Unsprayed field	81.33	91.25	72.40	81.66
t value	2.01	2.61	1.98	

Adoption of control measures of BSFB by the farmers of three different areas is presented in Table 4. There was a significant difference among the methods adopted by the farmers. On an average 91.68% farmers used conventional chemical method as main protection technique by using only insecticide whereas only 5.54% farmers used IPM method and 2.78% used different types of cultural pest management techniques for controlling BSFB. The farmers of Chittagong region (97.25%) solely relied on the chemical control. Data indicated that farmers largely followed the application of chemicals in controlling BSFB. Only a few farmers used the other control measures. In Jashore region, a considerable percentage (11.76%) of farmers followed IPM practice. Rashid *et al*. (2003) reported that nearly all farmers (98%) relied solely on spraying of pesticides for controlling BSFB, the remaining 2% used a combination of sanitation, removal of damaged shoots and pesticide sprays which was similar to the findings of the present study.

Table 4. Percentage of farmers of three regions adopted different control measures against BSFB

Method of BSFB control	% Farmers' responded			
	Chattogram	Jashore	Mymensingh	Average
Chemical control	97.25	85.90	91.89	91.68
Cultural control	1.00	2.34	5.01	2.78
IPM	1.75	11.76	3.11	5.54
LSD (0.01)	2.05	2.40	1.53	

Pattern of insecticide use by the brinjal farmers in three selected regions is given in Table 5. As many as 13 insecticides were found as common in all the three areas. In Chattogram region, Marshal 20EC (Carbosulfan), Perfecthion 40EC (Dimethoate), Ostad 20EC (Cypermethrin) and Ripcord 20EC (Cypermethrin) were found most preferred insecticides by the farmers. In Jashore region, Cartap 50SP (Cartap), Suntap 50SP (Cartap), Cymbush 20EC (Cypermethrin), Karate 2.5EC (Lambda cyhalothrin), Actara 25WG ((Thiamethoxum) and Shobicron 25EC (Carbosulfan + Cypermethrin) were found most preferred insecticides. In Mymensingh region, Kanika 25EC (Quinalphos) was most common insecticide

followed by Agromethrin and Cup. Out of thirteen insecticides, Cypermethrin occurred four times in different trade names. Dimethoate and Cartap occurred twice. Carbosulfan, Quinalphos, Lambda cyhalothrin and Thiamethoxum were used under single trade name.

In Jashore region, maximum farmers used Suntap (66.66%), Shobicron (55.56%) and Karate (55.56%). Data pattern of insecticide use indicated that all the insecticides were not equally preferred by the farmers of different regions. For example, Marshal and Ostad were preferred insecticides in Chattogram. Suntap, Karate and Shobicron in Jashore and Kanika in Mymensingh. No clear reason for this preference of different insecticides in different regions for controlling BSFB was mentioned by the farmers. Some of the farmers were influenced by their neighbors to use a particular product. Another reason might be the promotional activity of particular company for a specific product in specific locality.

Table 5. Pattern of use of common insecticides by brinjal farmers in three study areas

Sl. No.	Name of common insecticides	% Farmers' responded					
		Chattogram	Average	Jeessore	Average	Mymensingh	Average
	Carbosulfan:						
1.	Marshal 20EC	44.55	39.35	21.05	20.31	18.36	29.83
	Cartap:						
2.	Cartap 50SP	22.35	18.46	44.44	55.55	23.24	17.89
3.	Suntap 50SP	14.56	16.35	66.66	52.36	12.54	11.36
	Dimethoate:						
4.	Perfekthion 40EC	35.45		10.28		14.57	25.81
5.	Agromethrin 40EC	18.43	26.94	20.58	15.43	37.05	35.36
	Quinalphos:						
6.	Kanika 25EC	25.39	26.38	33.56	29.67	59.25	28.03
	Cypermethrin:						
7.	Ostad 10EC	39.09	28.93	15.56	14.36	18.46	16.35
8.	Ripcord 10EC	37.78	36.25	10.22	20.09	13.56	21.54
9.	Cymbush 10EC	17.58	16.35	38.89	36.35	24.51	24.35
10.	Cup 10EC	21.25	20.36	15.66	14.65	29.62	27.65
	Lambda cyhalothrin:						
11.	Karate 25EC	16.89	14.36	55.56	53.56	25.87	40.56
	Thiamethoxum:						
12	Actara 25WG	11.23	12.36	33.33	31.25	30.67	32.00

Rashid *et al*. (2003) reported that proliferation of red spider mite and whiteflies are likely to be induced by heavy use of chemicals in controlling BSFB. In the present study it was found that the frequency of Cypermethrin use is higher (28.93%) in Chattogram region (Table 5). A similar level of Cypermethrin use was found in Jashore (20.09%) and Mymensingh region (21.54%). Ahmed *et al.*

(2005) showed that farmers used 13-18 types of insecticides against BSFB in a single season in Jashore region. Thirteen common insecticides of different chemical groups in three different regions were recorded in the present study. Rashid *et al*. (2003) reported that Quinalphos, Cartap and Carbosulfan were the most popular insecticides being used by 54, 52 and 50% of the brinjal growers, respectively in Jashore region whereas it was 33.56, 44.44 and 21.05%, respectively. The use of Cartap remained more or less steady but the use of Quinalphos and Cabosulfan decreased.

The form of insecticide with dose and application frequency used by the farmers is presented in Table 6. Regarding the use of insecticides, farmers opined that insecticides were used either singly or in the form of cocktail–a mixture of two or more products. A good number of farmers were found to use the insecticide in the form of cocktail although the use of cocktail has not been prescribed or recommended by government or any responsible organization. It can be assumed that when farmers failed to control BSFB by application of single product, they have been motivated to make a mixture of two or more chemicals for controlling the pest. Using of cocktail by higher percentage of farmers indicated that cocktail were more effective than the single insecticide in controlling BSFB. On an average, 40.80% farmers used insecticide as single form and 59.20% farmers used it in the form of cocktail.

Table 6. The form of insecticide, dose and application frequency as in farmers' practice in controlling BSFB

Region	% Farmers' responded					
	Form of insecticides		Dose		Application interval	
	Single	Cocktail (mixture)	Recommended dose	Over dose	Recommended	Less than recommended
Chattogram	47.35	52.65	44.51	55.49	16.67	83.33
Jashore	31.63	68.37	41.74	58.26	13.38	86.62
Mymensingh	43.41	56.59	64.36	35.64	37.56	62.44
Mean	40.80	59.20	50.20	49.79	22.54	77.46
LSD (0.05)	3.53	2.91	3.41	1.96	2.87	3.48

In case of dose, on an average 50% farmers used the recommended dose and the others used over dose of insecticide. There was a significant difference in the farmers of different regions in using the dose of insecticides. In Mymensingh region, a higher percentage (64.36%) of farmers used recommended dose. In Jashore and Chattogram region, statistically similar percentage (41.74% and 44.51%) of farmers used recommended dose. Rest of the farmers used over dose. It is noted that none of the respondent used lower dose than the recommended. A large majority of farmers of different regions opined that the insecticides were used at interval less than recommended one. There was a significant difference in application interval of insecticide in different regions. Comparatively higher percentage (37.56%) of farmers used recommended interval in Mymensingh

region. In Chattogram and Jashore region, a few respondents opined for using insecticides at recommended intervals which were statistically identical. On average of 22.54% respondents of three study areas used recommended interval. In Chattogram and Jashore region, application of insecticides is more frequent against BSFB. Alam *et al.* (2006) also reported that 90% of the farmers in Uttar Prodesh sprayed more frequently than recommended, 43% used over dosages and nearly 60% used illegal mixture of pesticides which is somewhat more or less similar with the results.. In the present study on an average, 49.79% farmers used excessive dose and 77.46% farmers applied insecticides more frequently which was not similar as reported by Alam *et al*. (2006) but similarity was found in case of using illegal mixture of pesticide.

Data on the use of different forms of insecticides, their dose and application frequency indicated that majority of the farmers were not following the recommendation of application of insecticides for controlling BSFB. One of the reasons for not following the recommendation could be the failure in achieving the expected level of control. Farmers were found to be motivated to use the insecticides indiscriminately with an intention of ensuring early harvesting of insect free brinjal fruits to get higher market price. Many insecticides available in the market are not pure. As a result, farmers are not getting expected results from their usual application of insecticides. A report on the purity of market collected samples indicates that many of the insecticides are not available in pure form in the market (Anonymous, 2010). However, the concern about the hazardous effects of insecticide residues in brinjal fruits and other environmental effects were not at all a matter of their consideration. Farmers have been motivated to achieve higher level of control of BSFB at any cost like use of cocktail, over dose, frequent application etc.

There is a significant difference in the percent farmers' responded in viewing the percentage of reduction of BSFB infestation with the use of insecticides (Table 7). An average of 55.36% brinjal farmers viewed that insecticide application can reduce up to 25% of BSFB infestation. According to the opinion of 37.83% farmers, a range of 25-50% reduction of BSFB infestation is possible with the use of insecticide. Only 5.35% respondents believed that it is possible to reduce the pest problem by insecticide up to 75% and none of the farmers indicated that the reduction level more than that. Although farmers are using insecticides frequently even at higher dose, not a maximum of 75% . As per opinion of the majority of the farmers, reduction of BSFB could be possible up to 50%. Alam *et al*. (2006) reported that nearly 97% farmers of Uttar Prodesh, India believed that pesticide use can reduce pest damage up to 50% as similar to the findings of present study.

Although farmers are using insecticides frequently even higher than the recommended dose, the damage reduction is not up to the expected. There might be several reasons for this partial success. One of the reasons may be due to circumstantial increase in selection pressure of insecticide on the insect causing resistance among the target population (Ali, 1994).

Spraying interval and the total number of spray followed by brinjal farmers of different regions is presented in Table 7. Farmers used to apply insecticides at different time intervals in different regions ranging from 1.96 to 2.89 days. In Mymensingh region, the average time intervals for spraying the brinjal crop is 2.89 says. In Jashore and Chattogram region, farmers followed spraying interval 1.83 and 1.96 days, respectively. The total number of spray varied from region to region ranging from 36.35 to 57.33 days. Farmers started to spray when the crop in the main field is about 45 days old. Thereafter the spraying continued for several months mostly at specific intervals and sometimes at scattered intervals. Majority of the farmers opined that the spraying continued up to the active fruit bearing stage which is usually three and half months in winter crop. During this three and half month's time 36.35 to 57.33 times spray can occur depending on the regions. These numbers of spray vary depending on the cropping season. Ahmed *et al*. (2005) reported that 54.33% farmers followed 131-160 times spraying of insecticides in brinjal crop during the summer season and 15.33% farmers followed 160-180 times spraying. Some farmers (6.66 to 33.33%) were reported to spray insecticides on the brinjal every day and in some cases even twice a day. Rashid *et al*. (2003) reported that about 60% of brinjal growers applied insecticides more than 141 times during the rainy season. Alam *et al*. (2006) reported that the farmers sprayed their winter brinjal crop 90 times and summer crop 110 times during the 5-6 month season. Such frequent application of insecticide was not found in the present study.

Table 7. Spraying pattern of insecticide and farmers' view of different regions about the effect of insecticide on the reduction of BSFB problem

Region	Spraying pattern		% Farmers' responded			
			% Reduction of BSFB infestation			
	Spraying Interval(day)	Total number of spray	Up to 25	25-50	50-75	>75
Chattogram	1.96	53.44	52.35	40.23	7.42	0.00
Jashore	1.83	57.33	63.31	29.58	7.11	0.00
Mymensingh	2.89	36.35	54.41	43.67	1.52	0.00
Average	2.23	49.04	55.36	37.83	5.35	0.00
LSD (0.05)	2.32	1.57	3.31	2.34	3.23	NS

The findings of the present study about the spraying interval and the reports of the other authors indicate that the farmers do not follow the recommendations rather they have developed their own style of spraying which is alarming for the human health and environment. Degradation of the majority of the insecticides is not completed in such short period of time. A considerable amount of toxic element remained with the spraying materials.

Percentage of farmers' opinion about the precaution measures during the application of insecticide is presented in Table 8. On an average 73.98% farmers reported that

insecticide is applied without any protection measures. Only 12.22% farmers used the musk to cover the face. A similar number used musk and protective clothes during spraying. Only a very few farmers (1.28%) used eye glasses.

Data of the Table 8 indicate that the precaution measures taken by the farmers of three different regions are similar. In all the regions, 3/4 of the total farmers were found to use insecticides without any protection measures. Rashid *et al*. (2003) reported that 74% farmers did not use any safety measures at all during pesticide application. Only 11% covered their body and 6% covered their faces with cloth to reduce the exposure to the chemicals. Only 3% used gloves and no farmer used glasses or other form of protective devices. A similar protection measures during pesticide application was reported by Alam *et al*. (2003). In UP, India 74% farmers were reported to use protective clothing while applying pesticides and every operator was found to wash their hands using soap after spraying of pesticides (Alam *et al.,* 2006). The findings of Rashid *et al*. (2003) and Alam *et al.* (2003) supported the results of present study. The protection measures taken by the farmers during insecticide application in Uttar Prodesh, India are not same with the farmers of Bangladesh. The farmers of Uttar Prodesh, India are more conscious about their safety than the farmers of Bangladesh.

Casual observation indicates that many farmers in different regions of Bangladesh use pesticides without any protection measures during spraying. Some of them occasionally were found to suffer from various illness symptoms. At the beginning of insecticide spraying, some farmers became senseless during spraying in the field. Sometimes pesticide contact caused irritation of body which developed the vomiting tendency. There might be many long term effects of body but farmers failed to give such type of information.

Table 8. The measures used by the farmers as precaution during the application of insecticide in brinjal

Precautionary measures	% Farmers' responded			
	Chittagong	Jessore	Mymensingh	Average
Use of musk	11.75	13.89	11.03	12.22
Use of musk and covering body with cloth	12.45	12.78	12.32	12.52
Use of eye glass	1.33	1.20	1.30	1.28
No precaution measure	74.47	72.13	75.35	73.98
t value	2.45	3.17	2.35	2.21

As per opinion of the farmers, there were six different sources of advice they followed the application of pesticide. The sources mentioned were pesticide dealers, neighbours, TV/radio, relatives, extension workers and company agents. Percentage of farmers' opinion about the sources of advice is presented in Table 9. On an average 73.23% farmers followed the advice of pesticide dealers in selecting pesticides and their doses for spraying against BSFB. Rest of the

farmers followed the advice of neighbors (5.21%), TV/radio (3.06%), relatives (6.16%), extension workers (7.69%) and company staff (4.65%) in using pesticides for controlling BSFB. So it clearly indicates that farmers are mainly dependent on the pesticide dealers for pest control advice especially pesticide use. Only 7.69% farmers followed the advice of extension workers which is much less as compared to the pesticide dealers.

Table 9. Source of advice about insecticide use of farmers of different regions in controlling BSFB

Source	% Farmers' responded			
	Chittagong	Jessore	Mymensingh	Average
Pesticide dealers	73.65	75.78	70.27	73.23
Neighbours	3.41	4.11	8.11	5.21
TV/radio	2.28	2.56	4.31	3.06
Relatives	7.31	4.67	6.50	6.16
Extension workers	6.31	8.67	8.11	7.69
Company agent	7.04	4.21	2.70	4.65
t value	2.32	2.45	3.11	3.32

Rashid *et al.* (2003) reported that about 61% farmers received advice from pesticide dealers in selecting the pesticides and their doses. Alam *et al.* (2003) showed that 65% farmers received advice from pesticide sales agents in selecting the product and their doses, 18% from neighbors, 8% from relatives and remaining 9% from extension workers. Alam *et al*. (2006) reported that nearly all farmers of Uttar Pradesh, India followed the advice of pesticide sales agent during the selection of chemical and frequency of application.

Data on different sources of advice for pesticide use in managing BSFB was found more or less similar with the findings of the above authors. However, the percentage of respondent followed the advice of pesticide dealers was found little higher than the other authors. It indicates that the growers are not motivated to receive the information from the relevant sources i.e., the extension personnel of DAE. Retailers of pesticides play an important role in the use of pesticide for controlling BSFB in Bangladesh. On the other hand, the wide spread misuse of pesticides also indicates that pesticide dealers do not have the expertise to provide the guidelines to the farmers in controlling BSFB effectively by using pesticides. The retailers are more inclined to make profit by selling the specific pesticide product rather being concern about the efficacy. Results of the survey also put the extension workers in question about their motivating ability and their expertise although it has not been evaluated. No attempt was made to receive the information from any extension personnel directly. This is the only farmers' opinion. It is interesting to note that in some areas pesticide agents directly visit the brinjal field and provide advice to the farmers for spraying specific pesticide product. In some cases farmers are exploited by applying insecticides with the

condition of payment to be made after harvesting the crops. Some of the farmers especially those who are needy accept the offer of sales men as they do not need to pay the price of pesticide instantly. Due to use of large amount of pesticides of inappropriate products and doses, farmers frequently fail to achieve the expected control of the pest. The huge amount of pesticides used by the farmers in controlling the BSFB is not at all justified.

Information about the efficacy of insecticides in controlling BSFB is presented in Table 10. On an average, 51.44% farmers opined that insecticide application was effective in controlling BSFB while the others opined negatively. Data on the information about the efficacy of insecticides in controlling BSFB highlights that 50% pest can be effectively be controlled by spraying insecticides.

Farmers sprayed insecticides in the brinjal field at different situations of pest attack. About 61.67% farmers started spraying insecticides from beginning of the crop growth and continued it up to final harvest as a routine application in a certain interval irrespective of infestation by BSFB (Table 10). About 31% farmers started spraying insecticides after observing the presence of any insects in the field. A very few percentage (5.27%) of farmers used insecticides after being confirmed about infestation of insect pests. Alam *et al.* (2006) reported that over 90% of the farmers in Uttar Prodesh, India applied pesticides when they found damage in the field and 75% of them began spraying within one month after transplanting. Alam *et al.* (2003) reported that 82% farmers began spraying their crop at the first sign of damage and continued thereafter on a routine basis.

Table 10. Farmers' opinion of different regions about the efficacy and application of insecticide based on the BSFB infestation

Region	% Farmers' responded about the efficacy and application of insecticide					
	Insecticide effective	Insecticide not effective	As Preventive measure	Routine appli-cation	After detecting pest	Presence in the field
Chattogram	43.67	56.33	1.92	61.58	5.05	31.45
Jashore	61.47	38.53	1.75	66.67	4.33	27.25
Mymensingh	49.19	50.81	2.58	56.76	6.43	34.23
Average	51.44	48.56	2.08	61.67	5.27	30.98
t value	2.91	3.09	2.67	NS	NS	3.43

The results of the present study have the similarity with the findings of the above authors with few exceptions. Over 90% of the farmers in Uttar Prodesh, India and 82% in Jashore region started to apply insecticides immediately after appearance of the damage symptoms in the field whereas 31% farmers were found to follow that in the present study. About 62% farmers used insecticides as routine programme without evaluating its need.

Conclusion

Use of insecticides in controlling BSFB in different locations was found as common practice. In most cases farmers failed to control BSFB even after several applications of chemical insecticides expending huge amount of money. However, it is important to motivate the farmers to apply IPM approach for the management of brinjal shoot and fruit borer.

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