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Adoption of integrated pest management (IPM) practices by the vegetable growers at sadar upazila under Jhenaidah district

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Abstract

The purposes of the study were to determine the adoption of Integrated Pest Management (IPM) practices by the vegetable growers and to explore the relationships between the adoption of IPM practices in vegetable cultivation and the selected characteristics of the vegetable growers. Data were collected from randomly selected 101 respondents of the three selected villages of ganna union under sadar upazila of Jhenaidah district using interview schedule by the researchers during May to August, 2017. Appropriate scales were used to measure the variables of the study. Correlation test was used to explore the relationships between concerned independent and dependent variables. Majority (72.28%) of the respondents had medium annual income from vegetable cultivation. Majority (58.42%) of the respondents spent moderate time in vegetable field. About one third (36.63%) of the respondents had low knowledge on IPM practices. Majority (58.42%) of the respondents had very low organizational participation and 38.62% of the respondents had low contact with IPM club and FFS. Most (98.02%) of the respondents had low cosmopoliteness. Most (80.20%) of the respondents had low extension media exposure. About half (51.49%) of the respondents had low training exposure related to cultivation practices. Majority (63.37%) of the respondent had unfavorable attitude towards IPM practices. Majority (70.30%) of the respondents had medium level adoption in commonly used IPM practices in vegetable cultivation. Use of pesticides ranked 1st(score 295) as IPM practices compared to other environment friendly practices. Among the fourteen selected characteristics of the respondents, educational qualification, time spent in vegetable field, knowledge on IPM practices in vegetable cultivation, contact with IPM club and FFS, training exposure and attitude towards IPM practices showed positive significant relationships with the adoption of selected IPM practices by the vegetable growers.

Introduction

Vegetables are the cheapest source of vitamins, minerals and proteins which majority of people can buy easily. In Bangladesh vegetables are cultivated in 0.99 millionacres of land and annual productions of vegetables are only 3.87 millionmetric tons (BBS, 2016). An adult person should consume at least 100 g leafy vegetables and 200 g non-leafy vegetables per day for maintaining good health (BIRDEM, 2013). But per capita per day consumption of vegetables in the country is only 167.30g (BBS, 2016). There are many reasons behind the insufficient vegetables production in Bangladesh. One of the major constraints to sustainable increased productivity of vegetables is the high incidence of pest infestation (Ahmed *et al.*, 2001). The average annual loss of vegetables due to pest infestation is about 25% (MoA, 2010). As a result, to ensure desire production or to minimize crop loss due to pest infestation, there is a trend to use huge chemical pesticides across the countries. Yearly use of pesticides in Bangladesh was 3,850 metric tons in 1972–1990 which was highest 44,357 metric tons in the year 2011 that decreased to 33,716 metric tons in 2016 (BBS, 2016). Although pesticides are a remarkable innovation for modern agriculture and are needed to reduce crop losses due to pest infestation, its frequent use causes the pests to become resistant and emerge as new pests (Geiger *et al.*, 2010). Besides, the frequent use of pesticides pollutes the environment through contamination of soil, ground and surface water (Kabir and Rainis, 2012; Kabir *et al*., 2010).

These adverse effects were the base to develop Integrated Pest Management (IPM), an approach where to control pest emphasizes are given on non-chemical or organic ways and chemicals are only applied when pest infestation is severe (Kabir and Rainis, 2015). IPM has evolved from a completely technical tactic to a moreholistic view of the agricultural production scheme that associates the long- termsustainability of agricultural production with socio-economic and environmental issues, including public health (World Bank, 2003). Farming systems based on Integrated Pest Management (IPM) technologies can reduce the use of pesticides to a great extent without causing harm to the yield. Therefore, Government of Bangladesh launched IPM technologies to reduce the adverse effects of pesticides in social, economic and environmental aspects (Kabir and Rainis, 2014).

With help of Food and Agricultural Organization (FAO), the government launched IPM program for rice farmers in 1981 and vegetable growers in 1996 (DAE, 2012). It has also introduced Farmers' Field School (FFS) and

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IPM club for training of farmers. Most of the IPM projects worked on rice cultivation and few on vegetable cultivation. But a few researches were conducted on adoption of IPM practices by vegetable growers and it is unknown to what extent the vegetable growers adopt it in Bangladesh. Considering the points, the present study was undertaken with a view to study adoption of integrated pest management (IPM) practices by the vegetable growers. The specific objectives of the study were to:

1. analyze the socio-economic characteristics of the vegetable growers;
2. determine the extent of adoption of IPM practices by the vegetable growers; and
3. explore the relationships between the selected characteristics of the vegetable growers and their adoption of IPM practices.

Methodology

Data were collected from 101 randomly selected respondents of the three selected villages of ganna union under sadar upazila of Jhenaidah district through interview schedule by the researchers during May to August, 2017 on some selected characteristics of the respondents which were treated as independent variable *viz*. age, educational qualification, family size, farm size, annual family income, annual income from vegetable cultivation, time spent in vegetable field, knowledge on IPM practices in vegetables cultivation, organizational participation, contact with IPM club and FFS, cosmopoliteness, extension media exposure, training exposure and attitude towards IPM practices in vegetable cultivation. Adoption of IPM practices was treated as dependent variable of the study. A list of 10 commonly used IPM practices were taken by reviewing different literature related to it. The respondents were asked to identify their extent of using 10 selected IPM practices in terms of 'frequently', 'occasionally', 'rarely' and 'never' and the scores assigned against these responses were 3, 2 ,1 and 0, respectively. The total score of a respondent was calculated by summing up the scores obtained from the selected practices. Adoption scores for the selected commonly used IPM practices of the respondents could range from 0 to 30. To compare among different IPM practices adopted by the farmers, an IPM Practices Use Index (IPUI) was calculated using the following formula,

$IPUI = N_f \times 3 + N_o \times 2 + N_r \times 1 + N_n \times 0$

Where,

IPUI = IPM Practices Use Index

N_f = Number of respondents rated the extent of adoption as frequently

N_o = Number of respondents rated the extent of adoption as occasionally

N_r = Number of respondents rated the extent of adoption as rarely

N_n = Number of respondents never adopted the IPM practices

The IPUI score could range from 0 to 303 where "0" indicate no use and "303" indicate highest extent of use of particular IPM practice. Statistical treatments such as number, percent, rank order, range, mean and standard deviation were used to interpret data. To explore relationship between any two variables Pearson's product correlation coefficient 'r' was employed. Data were analyzed using the concerned software Microsoft Excel and Statistical Package for Social Science (SPSS) 22.

Results and Discussion

Selected Characteristics of the Respondents

About half (48.52%) of the vegetable growers were middle aged, 28.71% were old and 22.77% were young aged**.** Zul-Ekram (2014) and Kabir (2015) also found almost similar findings regarding age of the vegetables growers. Elderly farmers seem to be somewhat less motivated to adopt new farm practices than younger ones. Young and middle aged people generally show more favorable attitude towards trying new ideas. Half (50.50%) of the respondents had secondary level of education while 39.00% farmers had primary level of education. Only a few (6.93% and 3.96%) of the respondents were illiterate and having above secondary education respectively. Jalal (2009) also found almost similar findings in his study. Educated people are more innovative and more conscious about environment. More than half (52.48%) of the respondents had medium sized family while 40.59% of the respondents had small sized family and 6.93 percent of the respondents had large sized family. The average family size (5.12) of the study area indicates that the respondents are not conscious about their family size and population growth because the average family size of the study area is more than that of national average (4.4; BBS, 2011). Most (85.15%) of the respondents had small farm size while about 15.00% belonged to medium farm size. The average farm size of the farmers of the study area (0.70 ha) were higher than that of national average (0.60 ha) of Bangladesh (BBS, 2014). More than three-fourths (76.24%) of the respondents had medium annual income while only 7.92% of the respondents had low annual income and 15.84% of the respondents had high annual income. Majority (72.28%) of the respondents had medium annual income from vegetable cultivation, compared to 17.82% high annual income and 9.90% low annual income from vegetable cultivation respectively. It indicated that majority of the respondents had medium annual income from vegetable cultivation. Roy (2014) also found almost similar findings. The average annual income from vegetable cultivation of the farmers of the study area was much higher. It indicates that highest portion of their annual income comes from vegetable cultivation and most of the farmers solely depend on vegetable cultivation. Majority (58.42%) of the respondents spent moderate time in vegetable field followed by 33.66% spent moderate time and only 7.92% spent short time in vegetable field respectively.

Highest proportion (36.63%) of the respondents had low knowledge while 28.71% of the respondents had medium knowledge and 34.66% had high knowledge on IPM practices in vegetable cultivation. More than half (58.42%) of the respondents had low participation as compared to no participation (38.61%) and medium participation (2.97%) in different organizations respectively. Highest proportion (38.62%) of the respondents had low contact while 24.75% had no contact, 30.69% had medium contact and only 5.94% had high contact with IPM club and FFS. Most (98.02%) of the respondents had low cosmopoliteness. Only a few (1.98%) had medium cosmopoliteness. Most (80.20%) of the respondent had low extension media exposure while 19.80 percent had medium extension media exposure. Majority (51.49%) of the respondents had low training exposure while 26.73 percent had medium and 18.81%had no training exposure respectively. Only a few (2.97%) had high training exposure. Zul-Ekram (2014) also found almost similar findings on training for vegetables growers. Majority (63.37%) of the respondents had unfavorable attitude while 37.63% of the respondents had favorable attitude towards IPM practices in vegetable cultivation.

Table 1. Distribution of the vegetable growers on the basis of their selected characteristics

Characteristics	Categories (Score)	Respondents (N=101)		Mean	SD	Min	Max
		No.	(%)				
Age (Years)	Young (up to 35)	23	22.77	44.89	10.05	28	68
	Middle (36 to 50)	49	48.52				
	Old (> 50)	29	28.71				
Educational qualification (Years of Schooling)	Illiterate (0)	7	6.93	5.63	3.29	0	16
	Primary (1 – 5)	39	38.61				
	Secondary (6 – 10)	51	50.50				
	Higher secondary or above (> 10)	4	3.96				
Family size (No.)	Small (1-4)	41	40.59	5.12	1.26	3	9
	Medium (5-7)	53	52.48				
	Large (>7)	7	6.93				
Farm size (Ha)	Landless (<0.02)	0	0	0.70	0.33	0.32	1.9
	Marginal (0.02-0.20)	0	0				
	Small (0.21-1.0)	86	85.15				
	Medium (1.01-3.0)	15	14.85				
	Large (>3.0)	0	0				
Annual income (000'Tk)	Low (up to 75)	8	7.92	111.47	32.12	50	250
	Medium (75.01-150)	77	76.24				
	High (>150)	16	15.84				
Annual income from vegetable cultivation (000'Tk)	Low (up to 25)	10	9.90	42.61	11.46	20	70
	Medium (25.01-150)	73	72.28				
	High (>150)	18	17.82				
Time spent in vegetable field (Hours/Day)	Short (< 4 Hrs/Day)	8	7.92	5.08	0.98	3	7
	Moderate (4-5 Hrs/Day)	59	58.42				
	Long (> 5 Hrs/Day)	34	33.66				
Knowledge on IPM in vegetable(Score)	Low (1-8)	37	36.63	12.04	5.41	6	22
	Medium (9-16)	29	28.71				
	High (>17)	35	34.66				
Organizational participation (Score)	No (0)	39	38.61	1.88	2.63	0	10
	Low (1-8)	59	58.42				
	Medium (9-16)	3	2.97				
	High (>10)	0	0				
Contact with IPM club and FFS (Score)	No (0)	25	24.75	8.38	6.62	0	23
	Low (1-10)	39	38.62				
	Medium (11- 20)	31	30.69				
	High (21-30)	6	5.94				
Cosmopoliteness (Score)	Low (1-5)	99	98.02	2.34	1.21	1	6
	Medium (6-10)	2	1.98				
	High (>10)	0	0				
Extension media contact (Score)	Low (0-30)	81	80.20	26.56	4.43	20	37
	Medium (31-60)	20	19.80				
	High (>60)	0	0				
Training exposure(No.)	No (0)	19	18.81	3.39	2.41	0	10
	Low (1-4)	52	51.49				
	Medium (5-8)	27	26.73				
	High (>8)	3	2.97				
Attitude towards IPM Practices (Score)	Unfavorable (<28)	64	63.37	27.13	10.57	15	51
	Neutral (28)	0	0				
	Favorable (>28)	37	36.63				

Source: Field Survey, 2017

Adoption of IPM Practices in vegetable cultivation

Adoption of IPM practices scores of the respondents ranged from 7 to 25 with an average of 16.23 and standard deviation of 4.05, respectively. According to adoption of selected commonly used IPM practices in vegetable cultivation, the respondents were classified into three categories as shown in Table 2. Data presented in Table 2 revealed that majority (70.30%) of the respondents had medium adoption as compared to high adoption 15.84 percent and low adoption 13.86 percent respectively.

Table 2. Adoption of IPM Practices in vegetable cultivation

Categories & score	Respondents (N=101)		Mean	SD	Min	Max
	Number	Percent				
Low (1-10)	14	13.86				
Medium (11- 20)	71	70.30	16.23	4.05	7	25
High (21-30)	16	15.84				
Total	101	100				

Source: Field Survey, 2017

The findings of the study indicated that adoption of commonly used IPM practices by the vegetables growers was not so high. It might be due to their low contact with IPM club or FFS and low training exposure which made their attitudes unfavorable towards IPM practices. It might be also due to unpopularity of other practices. As a result, they could not adopt IPM practices properly in vegetables field. Kabir and Rainis (2015) found that less than one third (30%) farmers used IPM while others fully dependent on chemical method for controlling of pest. Haque *et al.* (2016); George *et al.* (2012) and Hossain *et al.* (2012) also found almost similar findings in their study.

Comparison of adoption of different IPM practices by the vegetable growers based on IPM Practices Use Index (IPUI)

According to IPM Practices Use Index (IPUI), use of pesticides, use of weed management and use of healthy seeds were ranked 1st, 2nd and 3rd respectively. On the other hand, collection and destruction of eggs and larvae by hand picking, use of light trap and others indigenous methods (spraying of ashes/spraying of neem water) were ranked 8th, 9th and 10th respectively (Table 3).

Table 3. Comparison of the adoption of different IPM practices based on IPM Practices Use Index (IPUI)

Sl. No.	Name of IPM practices	IPUI	Rank
1	Collection and destruction of eggs and larvae by hand picking	79	8th
2	Use of light trap	49	9th
3	Sex pheromone trap	110	7th
4	Adoption of crop rotation	236	4th
5	Perching in the field for insect control	195	5th
6	Weed management	287	2nd
7	Use of healthy seed	243	3rd
8	Cultivation of resistant variety	122	6th
9	Use of pesticides	295	1st
10	Others indigenous methods (spraying of ashes/spraying of neem water)	23	10th

Source: Field Survey, 2017

The highest level of adoption of pesticides might be due to more susceptibility of vegetables to pest, availability of pesticides and lack of proper and clear knowledge on IPM practices.

Relationship between individual characteristics of the vegetable growers and their adoption of IPM practices in vegetable cultivation

In order to find out the extent of relationship between adoptions of IPM practices by vegetable growers and their selected characteristics, Pearson's Product Correlation Co-efficient was computed. Results of correlation is shown in Table 4. Educational qualification showed (0.254*) a positive and significant relationship with adoption of IPM practices. Hossain *et al.* (2012) and George *et al.* (2012) also found similar result. Time spent in vegetable field showed (0.245*) a positive and significant relationship with adoption of IPM practices. Knowledge on IPM practices showed (0.496**) a positive and significant relationship with adoption of IPM practices. Haque *et al.* (2016) and Hossain *et al.* (2012) also found similar result. Contact with IPM club and FFS showed (0.464**) a positive and significant relationship with adoption of IPM practices.

Training exposure showed (0.337^{**}) a positive and significant relationship with adoption of IPM practices. Haque *et al.* (2016) also found similar result. Attitude towards IPM practices showed (0.254^{*}) a positive and significant relationship with adoption of IPM practices. George *et al.* (2012) also found similar result. It means that by increasing these characteristics, we can increase adoption of IPM practices.

Table 4. Pearson's Product Moment Correlation coefficient showing relationship between independent and dependent variables

Independent variable	Dependent variable	Co-efficient of correlation 'r'
Age	Adoption of IPM practices in vegetable cultivation	-0.162^{NS}
Educational qualification		0.254^{*}
Family size		-0.178^{NS}
Farm size		0.082^{NS}
Annual family income		0.090^{NS}
Annual income from vegetable cultivation		0.084^{NS}
Time spent in vegetable field		0.245^{*}
Knowledge on IPM practices in vegetable cultivation		0.496^{**}
Organizational participation		0.117^{NS}
Contact with IPM club and FFS		0.464^{**}
Cosmopoliteness		0.080^{NS}
Extension media exposure		0.135^{NS}
Training exposure		0.337^{**}
Attitude towards IPM practices		0.457^{**}

[NS= Non-significant, **Correlation highly significant at 1% level of probability and *Correlation highly significant at 5% level of probability]

Source: Field Survey, 2017

Conclusion

The findings of the study indicated that the adoption of selected IPM practices was medium. Most of them used pesticides at high extent for controlling pest. They also used other pest controlling practices which were environment friendly. Significant positive relationship of educational qualification, time spent in vegetable field, knowledge on IPM practices in vegetable cultivation, contact with IPM club and FFS, training exposure and attitude towards IPM practices with adoption of selected IPM practices indicate that by increasing these characters, adoption of IPM practices can be increased.

Environment friendly IPM practices like cultivation of resistant variety, use of sex pheromone trap, light trap, collection and destruction of eggs and larvae by hand picking and others indigenous methods were rarely used by the vegetables growers. Therefore, it may be concluded that unless or until these environment friendly practices are not popularized among the vegetables growers and the availability of pesticides are not decreased, the overall adoption of IPM practices would not be increased.

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