Sweet gourd production: a comparative economic study of IPM and conventional pest management

Q.M.S. Islam, M.S. Alam[1], M. Mohiuddin[2] and N.I. Toma[3]
Agricultural Economics Division, BARI, Gazipur, [1]Upazila Agriculture Office, Mirsharai, Chittagong, [2]Agricultural Economics Division, BARI, RARS, Jamalpur and [3]Department of Agricultural Economics, EXIM Bank Agricultural University, Bangladesh

Abstract: The present study is an attempt to assess the existing IPM practices on sweet gourd cultivation, cost comparison with Non-IPM (NIPM) farmers in Jessore, Magura, Comilla and Bogra districts during 2012. The yield of sweet gourd was found 20.10 t/ha and 18.20 t/ha in IPM and NIPM farmers, respectively. The cultivation of sweet gourd was profitable since BCR were 2.17 for the IPM and 1.93 for Non-IPM farmers. Gross return and gross margin of IPM farmers were 10 percent and 20 percent higher than NIPM farmers. Farmers in the study areas adopted most of the IPM practices and they were mostly influenced by IPM school. IPM farmers mainly used sex pheromone traps, soil amendment and hand picking. Trend in area of IPM practices is increasing over the last three years. Most of the sampled farmers (84 percent) showed positive attitude towards using IPM practices in sweet gourd cultivation in future. The use of pheromone traps and other IPM practices in sweet gourd cultivation was found very effective in reducing insect infestation. The availability of pheromone traps and other IPM technologies must be available in time to the farmers.
Key words: Sweet gourd, economic study, IPM, conventional pest management.

Introduction

Vegetables are the cheapest source of vitamins, minerals, salts and proteins, which are essential elements for human health. So it plays an important role in balanced diet for human being as well as it acts as an income generating source of the farmers. Fruits of sweet gourd are good and cheap sources of vitamins, especially high carotenoid pigments and minerals (Bose and Som, 1986). Besides, the tender stem, leaves and flowers are also relatively high in protein, energy, carbohydrates, minerals, calcium, phosphorus and vitamins (Bose and Som, 1986). Thus sweet gourd can contribute to improve nutritional status of the rural people. It is grown extensively throughout the country during kharif season with a total area of 67737 hectare and production of 92900 MT (BBS, 2010). Most of the vegetables grown in Bangladesh are vulnerable to be attacked by insect pests. The unfavorable weather condition (such as low temperature, dew drops stored on the leaf, continuous fog etc.) prevailing in this season causes various types of diseases and insect attack in sweet gourd which significantly contribute to high farm production costs and reduce quality and yields (Henneberry *et al*., 1991). But intensified use of insecticides can cause a serious public health hazard especially in the form of residues in food (Rola and Pingali 1993, Antle and Pingali 1995, Antle *et al,*. 1998, Ajayi 2000, Paul 2003, Mohiuddin *et al.,* 2007). Moreover, the use of insecticides is destroying the bio-diversity seriously.

Maclntyre *et al.,* (1989) reported that low-level exposure of consumers containing insecticide residues to food products over time cause cancer, genetic damage and suppression of the immune system. The IPM method cause minimal environmental damage and poses little or no risk to human health. IPM involves selection, integration and implementation of pest control actions on the basis of predictable economic, ecological and sociological consequences. The study attempts to use the IPM technologies like the use of poultry refuse, mustard oilcake and Pheromone trap in the vegetable fields to control soil borne diseases and attack from insect pest. With this view in mind, the present study has been undertaken to know the attitude towards using IPM practices and estimate cost and relative profitability of sweet gourd production with IPM and existing pest control practices.

Materials and Methods

The present study was conducted in four districts namely Jessore, Magura, Comilla and Bogra of Bangladesh. Multi-stage sampling technique was followed for the study. Firstly four districts were purposively selected considering the IPM practices on sweet gourd cultivation. From each district one Upazila and from each Upazila two villages from two blocks were selected. A complete list of sweet gourd growers in each village was prepared by the help of DAE personnel and sample farmers were selected randomly. A total of 320 farmers were selected taking 40 from each village (20 IPM and 20 Non- IPM farmers). Data were collected through pre-designed and pre-tested interview schedules. The collected data were summarized and analyzed to fulfill the objectives set for the study. Tabular method of analysis using average, percentages, ratios, etc. was applied in this study.

Results and Discussion

Agronomic practices: Agronomic practices like ploughing, laddering, sowing, weeding, spraying, irrigation, fertilizing and harvesting were included. It was observed that on an average, IPM and Non-IPM farmers ploughed their land 4 times. IPM and Non-IPM (NIPM) farmers perform laddering 3 and 2 times, respectively (Table 1). It was found that 30 and 37 percent of IPM and NIPM farmers used home supplied seeds in their plot respectively. On an average, 39 percent farmers completed their sowing within the month of October followed by September 32 percent and November 29 percent by the IPM farmers. Similar sowing time was followed by the NIPM farmers. It was observed that late sowing was followed by the farmers of Comilla and Bogra due to cultivation of sweet gourd after potato harvest. Two times weeding was done by most of the IPM and NIPM farmers. It was seen that most of the farmers of Comilla not weeded their field.

Input use pattern: Table 2 showed that in producing sweet gourd the total human labour requirement per hectare were estimated at 167 and 160 man-days for IPM

and NIPM practices respectively. More human labour was used in Jessore district due to more use of cowdung and weeding. On an average, NIPM farmers used more amount of seed (1240 gm/ha) compared to IPM farmers (1084 gm/ha). Oilcake was used only by the IPM farmers of Jessore, Magura and Bogra districts. IPM farmers used more organic fertilizers per hectare than NIPM farmers except chemical fertilizers.

Table 1. Agronomic practices of sweet gourd cultivation for IPM and NIPM farmers

Activities	Jessore		Magura		Comilla		Bogra		All areas	
	IPM	NIPM	IPM	NIPM	IPM	NIPM	IPM	NIPM	IPM	NIPM
Ploughing	4.22	4.18	4.40	4.18	3.70	3.62	5.17	4.98	4.37	4.24
Laddering	2.98	2.48	2.85	2.05	2.87	3.50	2.15	1.87	2.71	2.47
Seed (%)										
Own	3	3	3	-	77	87	38	58	30	37
Purchase	97	97	97	100	23	13	62	42	70	63
Pheromone trap	91	-	85	-	80	-	88	-	86	-
Insecticides (%)	-	95	-	97	-	73	-	85	-	87
Irrigation (%)	100	100	100	100	100	100	100	100	100	100
Sowing (%)										
September	60	65	67	57	-	-	-	3	32	31
October	27	25	28	38	28	25	73	62	39	38
November	13	10	5	5	72	75	27	35	29	31
Weeding (%)										
Zero	-	10	15	3	85	65	10	10	27	22
One	10	5	5	5	7	15	12	15	9	10
Two	55	67	50	57	5	7	45	50	39	46
Three	30	13	22	27	3	7	10	20	16	17
Four	3	-	8	5	-	3	18	5	7	3
Five	5	5	-	3	-	3	5	-	2	2

Table 2. Input use pattern for sweet gourd cultivation

Items	Jessore		Magura		Comilla		Bogra		All areas	
	IPM	NIPM	IPM	NIPM	IPM	NIPM	IPM	NIPM	IPM	NIPM
Human labour (man-days/ha)	208	204	159	151	139	129	160	155	167	160
Seed (gm/ha)	642	768	676	620	1639	2078	1378	1495	1084	1240
Cow dung (kg/ha)	6789	6122	3319	1849	5005	4117	5286	4466	5100	4732
Oilcake (kg/ha)	16	-	37	-	-	-	26	-	20	-
Urea (kg/ha)	170	222	187	205	92	101	92	98	135	157
TSP (kg/ha)	240	259	210	262	128	135	87	78	166	184
MoP (kg/ha)	120	146	99	109	93	96	60	73	93	106
Others (kg/ha)	106	134	110	207	9	28	31	25	64	99

Table 3. Cost and return of sweet gourd production for IPM and Non-IPM farmers (Tk/ha)

Items		Jessore		Magura		Comilla		Bogra		All areas	
		IPM	NIPM	IPM	NIPM	IPM	NIPM	IPM	NIPM	IPM	NIPM
Human labour	Family labour	14404.69	8576.18	12270.65	9271.32	10512.84	6323.60	10213.61	1000.08	11850.45	6292.79
	Hired labour	31690.31	36283.82	27546.35	28565.68	31238.16	32521.40	29644.39	37752.92	30029.80	33780.96
Land preparation		9644	9440	8060	7883	-	-	-	-	4426.00	4330.75
Seed	Own	3552.34	3715.33	4374.56	2867.34	434.26	611.16	1250.94	1326.96	2403.02	2130.20
	Purchased	2963.66	3893.67	3018.44	4243.66	514.74	658.84	1401.06	1507.04	1974.48	2575.80
Fertilizers											
Cow dung	Own	2964	1643	1864	117	2369	1103	2187	1124	2346.00	996.75
	Purchased	3825	4479	1455	1732	2636	3014	3099	3342	2753.75	3141.75
Oilcake		405	-	935	-	-	-	614	-	488.50	-
Urea		3400	4400	3731	4005	1282	1587	1844	1969	2564.25	2990.25
TSP		5566	5834	5493	6698	2098	2828	2068	2571	3806.25	4482.75
MoP		1848	1909	1590	3149	1070	1321	935	1115	1360.75	1873.50
Others		1291	1599	1917	2596	90	228	635	625	983.25	1262.00
Pheromone trap		3378	-	3052	-	2927	-	3126	-	3120.75	-
Insecticides		-	4490	-	4115	-	4341	-	4113	-	4264.75
Irrigation		3373	4369	4132	4379	3369	3851	2929	3068	3450.75	3916.75
Land use cost		4217	4267	3605	3712	3267	3391	3190	3198	3569.75	3642.00
Interest on operating capital		1727.86	1966.57	1562.41	1727.37	1159.82	1291.17	1187.27	1437.56	1409.34	1605.67
a) Total variable cost		69111.84	78664.07	62492.21	69093.72	46384.72	51641.40	47482.71	57500.53	56367.87	64224.93
b) Total cost		94249.86	96865.57	84606.41	85061.37	62967.82	63070.17	64324.27	64149.56	76537.09	77286.67

Table 4. Profitability of sweet gourd production for IPM and Non-IPM farmers

Items	Jessore		Magura		Comilla		Bogra		All areas	
	IPM	NIPM	IPM	NIPM	IPM	NIPM	IPM	NIPM	IPM	NIPM
c) Yield (t/ha)	17.50	15.37	16.43	15.21	23.77	21.14	22.68	21.06	20.10	18.20
d) Gross return (Tk.)	178492	162508	161440	140706	138190	122084	147073	135694	156299	140248
e) Gross margin (d-a)	109380.2	83843.93	98947.79	71612.28	91805.28	70442.6	99590.29	78193.47	99931.13	76023.07
f) Net return (d-b)	84242.14	65642.43	76833.59	55644.63	75222.18	59013.83	82748.73	71544.44	79761.91	62961.33
g) Rate of return (d/b)	1.89	1.68	1.91	1.65	2.19	1.94	2.29	2.12	2.04	1.81

Cost of production: Costs are the expenses for organizing and carrying out the production process. The cost of production included different variable cost items like land preparation, human labour, seed, organic and inorganic fertilizers, irrigation, pheromone trap and insecticides etc. Both cash expenditure and imputed value of family supplied inputs were included.

Human labour was the major cost items which was more in IPM (41880 Tk/ha) than NIPM farmers (40074 Tk/ha (Table 3). Land preparation cost was slightly higher in

IPM farmers but seed and fertilizers cost were more in NIPM farmers due to more used of these inputs. But cowdung was used more by the IPM farmers. Total variable cost was estimated at Tk 73155 and Tk74114 per hectare by IPM and NIPM farmers, respectively.

Table 5. Per hectare comparative profitability of sweet gourd production for IPM and Non-IPM farmers

Items	IPM	Non-IPM	Mean difference	Percent higher/lower
Total variable cost (Tk.)	56367.87	64224.93	-7857.06	-13.94
Yield (T/ha)	20.10	18.20	1.90	9.45
Gross return (Tk.)	156299	140248	16051	10.27
Gross margin (Tk.)	99931	76023	23908	23.92

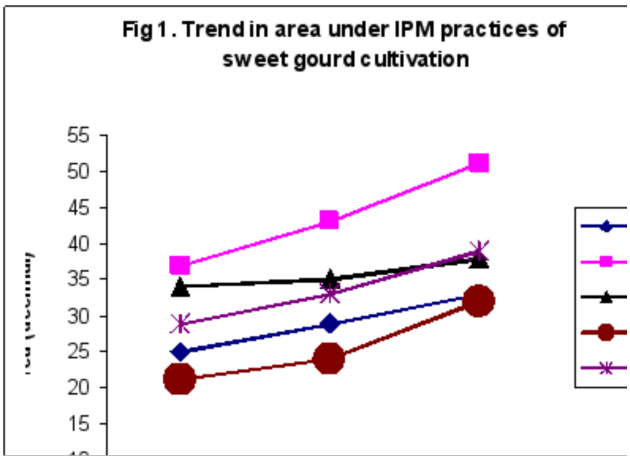
Table 6. Sources of information about IPM practices (percent)

Sources	Category		
	High	Medium	Low
Family members	7	18	26
Neighbours	10	32	17
Relatives	5	4	20
Mass media	-	6	22
IPM School	46	25	6
Demonstration	-	3	5
Others	8	6	-

Table 7. Percentage of farmers using different IPM practices

Locations	IPM practices		
	Soil amendment	Pheromone trap	Hand picking
Jessore	10	91	40
Magura	28	85	47
Comilla	-	80	51
Bogra	40	88	38
All areas	20	86	44

Profitability: On an average, yield of sweet gourd was found 20.10 t/ha and 18.20 t/ha by IPM and Non-IPM farmers respectively. Potential yield of sweet gourd was 30-45 t/ha (Khishi Projukti Hathboy, 2011). The yield of sweet gourd was observed comparatively higher in Comilla and Bogra districts due to after potato harvesting, farmers were cultivated sweet gourd and there may be some residual effects. The reason may be cultivation of sweet gourd after potato harvesting. The average gross return from sweet gourd production was found Tk. 156299/ha for IPM farmers and Tk. 140248/ha for Non-IPM farmers. Gross margin was found Tk. 83143/ha for IPM farmers and Tk. 66134/ha for Non-IPM farmers. The benefit cost ratio was estimated at 2.17 and 1.93 for IPM and Non-IPM farmers respectively.



Comparative profitability: Table 5 revealed that, the mean differences in total variable cost, yield, gross return and gross margin were -7857.06, 1.90, 16051 and 23908 respectively and percentage of higher and lower were -13.94, 9.45, 10.27 and 23.92, respectively.

Sources of information about IPM: About 46percent of the IPM farmers reported that they were highly influenced by IPM school to adopted IPM practices. The IPM farmers reported that they were influenced by neibours (32 percent), relatives (20 percent) and mass media (22 percent) to some extent (Table 6).

IPM practices used: About 86 percent of the IPM farmers used sex pheromone trap in sweet gourd cultivation in all the areas. The use of sex pheromone trap was highest in Jessore and lowest in Comilla district which was depends on the availability of traps. In case of soil amendment, farmers used only oilcake in the study areas. It was found highest in Bogra (40 percent) compared to Magura (28 percent) and Jessore (10 percent). On an average, 20 percent of the farmers practicing soil amendment in their sweet gourd field (Table 7). Hand picking was practiced by 44 percent farmers and it was found more in Comilla district.

Trends in IPM practices: Use of IPM technologies in Bangladesh has slightly increased in the recent years. It is evident from fig 1 that the trend in area of IPM practices is increasing over the last three years. Average area under IPM practices in the study areas was increased from 29

decimal to 39 decimal in during the period of 2009 to 2011.

Farmer's attitude towards IPM technology: It is evident from table 8 that 84 percent of the IPM farmers were willing to increase the IPM practices in near future. Highest 89percent of the respondents mentioned that less harmful to health was the major reason behind the increase of IPM practices in future followed by reduction in pesticide cost (86 percent) and higher income (78 percent). On the other hand, 16percent of the respondents opined that they are not willing to increase the IPM practices in future due to lack of technical knowledge about IPM practices (38 percent), not effective for all insects (36 percent), slow work (28 percent) and non-availability of sex pheromone traps (13 percent).

Table 8. Willingness of increasing IPM practices in future

Type of facility	percent respondent				
	Jessore	Magura	Comilla	Bogra	All areas
Willingness to increase					
a. Willing to increase	90	85	80	82	84
b. Not increase	10	15	20	18	16
1. Reason for increasing					
a. Higher income	85	80	75	70	78
b. Reduce the cost of pesticide	90	88	80	84	86
c. Less harmful to health	93	90	85	86	89
d. Easy to use	20	18	15	14	17
2. Reasons for not increasing					
a. Lack of technical knowledge about IPM practices	30	35	45	40	38
b. Slow to work	25	22	30	33	28
c. Not effective for all insects	40	30	45	35	36
d. Non availability of pheromone traps	16	12	15	10	13

Table 9. Facilities needed by the farmers

Facilities	Jessore	Magura	Comilla	Bogra	All areas
Availability of pheromone traps	40	50	45	38	43
Training on IPM practices	35	32	28	25	30
Financial support	10	15	12	18	14
Others*	8	7	8	9	8

* Free supply of IPM technologies and Contract farming

The farmers in the study areas benefited from the IPM technologies with higher yields 9 percent and higher gross margin 20 percent. Rate of return (BCR) was 2.17 which was more than the farmers own practices (1.93). The technology was found to be encouraging by the farmers. Trend of IPM practices was observed increased. About 84percent farmers were willingness to increase IPM practices in future. For successful adoption of the technologies, the availability of sex pheromone trap must be ensured to the farmers. Government can encourage some entrepreneurs to make available sex pheromone trap throughout the country. Training should be arranged for the farmers, extension personnel and NGO officials for the effective dissemination of IPM technologies.

References

Ajayi, O.C. 2000. Pesticide use practices, productivity and farmers' health: The case of cotton-rice systems in Cote d'Ivoire, West Africa. Germany: University of Hanover. Pesticide Policy Project special issue publication series no 3. xxvii+172+xii p

Antle, J.M. and Pingali, P.L. 1995. Pesticides, productivity, and farmer health: A Philippine case study. In: Pingali PL and PA Roger (eds), Impact of pesticides on farmer health and the rice environment. Los Banos (Philippines): International Rice Research Institute (IRRI). p 361–385.

Antle, J.M., Cole, D.C. and Crissman, C.C. 1998. Further evidence on pesticides, productivity and farmer health: Potato production in Ecuador. *Agricultural Economics* **18**: 199–207

BBS, 2010. Bangladesh Bureau of Statistics, Statistical Yearbook of Bangladesh, Statistics Division, Ministry of Planning, GOB.

Bose, T. K. and Som, M.G. 1986. Vegetable Crops in India, Naya Prokash, Calcutta. 92-95 pp.

Henneberry, T. J., Glass, E. H., Gilbert, R.G. and Ding, E. G. 1991. "Integrated Pest Management. A Sustainable Technology" Agriculture and the Environment, The 1991 yearbook of agriculture, US Govt. printing office, Washington DC. pp.150-159

Mohiuddin, M., Hossain, M. M., Rahman, A. K. M. M. and Palash, M. S. 2007. Socio-economic study of insecticide use on vegetable cultivation at farm level in Chittagong region. J. Bangladesh Agril. Univ. 7(2): 343–350.

Maclntyre, A.N.N., Allison, N. .and Penman, D.R. 1989. insecticides: issues and options for New Zealand Ministry of the Environment, Wellington, New Zealand.

Paul, N. K. 2003. Residue Analysis of two common insecticides used against shoot and fruit borer in eggplant fruit, M. S thesis, Dept.of Entomology, BAU, Mymensingh.

Rola, A. C. and Pingali, P. L. 1993. Pesticides, Rice Productivity, and Farmers' Health-An Economic Assessment. World Resources Institute and International Rice Research Institute, Los Banos, Laguna, Philippines.