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Comparative Study of IPM Technologies and Farmers' Conventional Pest Management Practices on Cabbage Cultivation

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Abstract

The present study was constructed in Comilla, Jesore and Lalmonirhat districts during 2002-03 to determine and compare the relative profitability of IPM technologies over farmers' existing pest management practices. A total of 300 farmers were purposively selected taking 100 from each district. The current practice of farmers is to use higher amount of inputs including insecticides and these resulted in higher costs but lower yields and returns compared to the IPM technologies. It was found that the use of labor and insecticides cost were saved in the experimental plots since the spraying was not allowed there. The use of IPM technologies was found economically beneficial for the farmers with respect to gross margins, benefit cost ratios (1.35 to 4.39), return to labor and return to irrigation per Taka invested. The most important constraints to IPM technologies were non-availability of poultry refuse in required quantity, lack of quality seeds and high price of mustard oilcake and fertilizers and insecticides and lack of knowledge of improved technologies for vegetables production. However, the farmers in the study areas were very enthusiastic about the IPM technologies for vegetables. For successful and effective dissemination of IPM technologies, the demonstration trials, field days, training of farmers and extension workers and distribution of leaflets and mass campaign for IPM technologies are useful tools to be followed.

Keywords: *IPM technologies, conventional pest management practice, cabbage cultivation*

Introduction

Vegetables are very important group of crops and they constitute a major part of the diet contributing nutrients and vitamins. 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 of vegetables. Pests, including insects, mites, pathogens (disease causing organisms), weeds, nematodes, rodents and others significantly contribute to high farm production costs and reduce quality and

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yields (Henneberry *et al*., 1991). The use of insecticides has become indispensable in increasing vegetable crops production because of its quick effect, ease of application and its availability. But intensified use of insecticides can cause a serious public health hazard especially in the form of residues in food (Paul, 2003). Moreover, the use of insecticides is destroying the bio-diversity seriously. It has been reported that the farmers of Jessore region of Bangladesh spray insecticides in the eggplant fields at every alternate day and more than 80 times throughout the cropping season (Anonymous, 1994). A few insecticides are available in Bangladesh whose retention period is less than 3-5 days. These harmful insecticides are dissolved in our water system and ultimately enter into the system of human, fishes and many other animals and cause severe damage to their health (Khandakar, 1990). But the sole reliance on the application of insecticides has shown many side effects and limitations. Maclntyre *et al.* (1989) reported that low-level exposure of consumers containing insecticide residues to food products over time cause cancer, teratogenesis, genetic damage and suppression of the immune system. The IPM methods cause minimal environmental damage and pose 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 and mustard oilcake in the vegetable fields to control soil borne diseases. With this consideration, the present study has been undertaken with a view to determine the relative profitability of IPM technology and existing pest control practices.

Methodology

Five farmers were selected from each year to participate in testing the IPM-CRSP derived activities. Each of these farmers had one plot, which was divided into two parts. Another 15 farmers were also selected with their own practice as control. A total of 300 farmers taking from each of Comilla, Jessore and Lalmonirhat were selected for the mentioned technologies and vegetables. Two types of IPM technologies like the use of i) Mustard oilcake and Poultry refuse were included in the study. The cabbage (Altas-70) was considered. Six month old poultry refuse of broiler chicken 3 t/ha and mustard oilcake 300 kg/ha was applied in the soil before 15 days of transplanting of vegetables seedling. Before launching technology diffusion activities in the farmers' fields, the selected farmers as well as the enumerators were trained about the IPM derived technologies. The collected data were summarized and analyzed with the help of tabular methods using averages, percentages, ratios etc. The observed data on yield were analyzed by two factors. Completely Randomized Design (CRD) and the treatment means were compared by Duncan's Multiple Range Test (DMRT), t-test was also used to find at significant differences of the means of yields of the experiments. Attempt was also made for the significance test for cabbage yields among the treatments. The study was conducted during winter and summer season of 2002-03.

Findings and Discussion

Input use pattern different experiments

The per hectare family labor use in the experimental plots varied from 70 man-days to 135 man-days and in the control plot it varied from 115 man-days. The per hectare hired labor use in the experimental plots varied form 50 man days to 95 man days and in the control plots varied from 50 man days to 100 man days. The per hectare animal power use in MOC, PR and control plots were 23 pair days, 27 pair days and 28 pair days in Comilla, 39 pair days and 42 pair days in Lalmonirhat respectively. In Jessore per hectare animal power use were 27 pair days in each of experimental and control plots . The per hectare seedling use in Jessore and Lalmonirhat was 48475 (no.) and 32000 (no.) respectively (Table 1) In Comilla, per hectare seedling use was 32812, 32689 and 32811 (no) for MOC, PR and control plots respectively. The per hectare use of owned and purchased cowdung were 2902 kg and 3992 kg in Comilla and 9200 Kg in Lalmonirhat. The use of poultry reefers in the experimental plots was recommended and it was 3000 kg per hectare. The use of mustard oilcake was also recommended in the experimental plots and it was 300 kg per hectare. It was observed that the farmers used higher doses of fertilizers in the control plots of cabbage than the experimental plots. Urea, TSP and MP were the commonly used fertilizers in all the areas Table1.

Table 1. Use of inputs under cabbage (HYV) experiments

Item	Comilla			Jessore			Lalmonirhat		
	MOC	PR	C	MOC	PR	C	MOC	PR	C
1. Human Labor (day/ha):									
Owned	100	70	137	110	100	115	130	135	200
Hired	67	95	29	84	94	100	50	70	50
Total	167	165	166(17)	194	194	215(8)	180	205	250(15)
2. Animal power (Day/ha):									
Owned	23	27	28	20	20	20	27	27	27
Hired	-	-	-	7	7	7	12	12	15
Total	23	27	28	27	27	27	39	39	42
3. Seedlings (No/ha)	32812	32869	32818	48475	48475	48475	32000	32000	32000
4. Cowdung (kg/ha):									
Owned	-	-	2902	-	-	-	-	-	9200
Purchased	-	-	3992	-	-	-	-	-	9300
Total	-	-	6894		-	-	-	-	18500
5. Poultry Refuse (kg/ha)	-	3000	-	-	3000	-	-	3000	-
6. Oilcake (kg/ha)	300	-	-	300	-	-	300	-	-
7. Fertilizers (kg/ha)									
Urea	322	400	478	492	492	409	376	336	445
TSP	234	252	446	361	279	336	285	245	312
MP	282	460	361	430	451	262	332	342	430
Zinc sulphate	-	-	-	16	16	-	36	36	-
Gypsum	-	-	247	-	-	127	140	140	360
Borax	-	-	-	-	-	-	40	40	-
Hyper	-	-	147	-	-	-	-	-	-
SSP	-	-	-	-	-	41	-	-	-

Note: MOC= Mustard oilcake, PR=Poultry refuse, C=Control; Power tiller, insecticides and irrigation were cash paid and these were added in the cost analysis. Figures in the parentheses represent the per hectare labor use only for insecticides spraying.

Total cost of production of cabbage

The total cost of production of cabbage in Lalmonirhat was found higher in control plots (Tk.55142/ha) than in the experimental plots (Tk. 44945/ha for MOC and Tk.43442/ha for PR). The higher cost was due to the use of more labour, fertilizers, manners and insecticides (Table 2). Again in Comilla, the farmers incurred higher costs in the control plots (Tk.52679/ha) than in the experimental plots of mustard oilcake (Tk 40085/ha) and poultry refuse (Tk. 45364/ha) mainly due to more use of labour, fertilizers, manures and insecticides, The reverse findings were observed in Jessore. The cost of cabbage production under farmers' practices was found lowest (Tk. 46875/ha) compared with the cost under MOC experiments (Tk. 47058/ha) and PR experiments (Tk. 46946/ha) Table 2.

Table 2. Cost of production under cabbage (HYV) experiments

Cost Item	Comilla			Jessore			Lalmonirhat		
	MOC	PR	C	MOC	PR	C	MOC	PR	C
1.HumanLabour :									
Owned	4320	3710	8155	5500	5000	5750	5860	6120	9200
Hired	3332	5035	1819	4200	4700	5000	3210	3340	2300
Total	7652	8745	9974	9700	9700	10750	9070	9460	11500
2. Animal power:									
Owned	1290	1080	1557	1400	1400	1400	1872	1872	1872
Hired	-	-	-	490	490	490	852	852	852
Total	1290	1080	1557	1890	1890	1890	2724	2724	2724
3. Power tiller (hired)	787	1075	1037	4426	4426	4426	-	-	-
4. Seedlings (purchased)	10237	10774	10327	4098	4098	4098	10700	10700	10700
5. Cowdung									
Owned	-	-	498	-	-	-	-	-	1292
Purchased	-	-	543	-	-	-	-	-	1093
Total	-	-	1041	-	-	-	-	-	2385
6. Poultry Refuse	-	900	-	-	900	-	-	1500	-
7. Mustard Oilcake	2400	-	-	3000	-	-	1875	-	-
8. Fertilizers:									
Urea	1935	2400	2871	2952	2952	2454	2259	1200	2670
TSP	3221	3528	6038	5415	4185	5040	3865	3305	4212
MP	2820	4600	3615	4300	4510	2620	3325	3425	4300
Zinc sulphate	-	-	-	560	560	-	1260	1260	-
Gypsum	-	-	1235	-	-	635	560	-	-
Hyper	-	-	294	-	-	-	-	-	1440
SSP	-	-	-	-	-	123	-	-	-
Borax	-	-	-	-	-	-	1280	-	-
Total	7976	10528	14053	13227	12207	10872	12549	9190	12622
9. Insecticides	-	-	2575(5)	-	-	1131(2.5)	-	-	5200(9)
10. Irrigation	4604	4604	4420	6557	6557	6557	2800	2800	2800
11. Land use cost	7000	7000	7000	6500	6500	6500	6500	6500	
12. Interest on operating capital	539	658	695	660	668	651	602	568	711
13.TotalCost (Fixed+variable)	40085	45364	52679	47058	46946	46875	44945	43442	55142
Total variable cost	33085	38364	45679	40558	40446	40375	38445	36942	48642

Total cash cost	26936	32916	34774	32998	33378	32574	30111	28382	35567

Note: MOC = Mustard oilcake, PR = Poultry refuse, C = Control; Bracketed figures represent the percentages of insecticides to total costs

Yield performance of cabbage

On average, the yields of cabbage under mustard oilcake and poultry refuse experiments were found much higher (10-50%) than the control plots. The yield of cabbage under poultry refuse was found higher than mustard oilcake in all study areas (Table 3).It indicated that the vegetables under poultry refuse performed better than mustard oilcake. However, the yields under both the treatments were found much higher than that of the control plots.

Table 3. Yields of cabbage under different experiments

Study Area	Crop	Yield (t/ha)		
		Experiment		Control
		Mustard Oilcake	Poultry Refuse	
Comilla	Cabbage (HYV)	55.26*(42)	58.00*(49)	38.84
Jessore	Cabbage (HYV)	65.00*(10)	66.00*(12)	59.00
Lalmonirhat	Cabbage (HYV)	74.00*(36)	81.34*(50)	54.30

Note: Bracketed figures represent the percentages of increased yields over the controls.
** Significant at 1% level of probability*

The per hectare gross margin of cabbage varied from Tk.14042 to Tk. 110180 under mustard oilcake, Tk.14994 to Tk.125048 under poultry refuse and Tk. 9185 to Tk. 62148 under control plots. The highest net return was obtained in the poultry refuse plot of Lalmonirhat (Tk. 118548) compared to mustard oilcake plot (Tk.103680/ha) and control plot (Tk. 55648/ha). Again in Jessore, highest net return was obtained in poultry refuse plot (Tk.8494/ha) compared to mustard oilcake plot (Tk. 7542/ha) and control plot (Tk. 2685/ha). In Comilla, mustard oilcake plot produced higher net return (Tk.85577/ha) than poultry refuse plot (Tk. 68896/ha) and control plot (Tk. 51319/ha) (Table 4).

Table 4. Returns from cabbage (HYV) experiments

Items	Comilla			Jessore			Lalmonirhat		
	MOC	PR	C	MOC	PR	C	MOC	PR	C
1. Cost (Tk../ha):									
Full cost (Fixed+variable)	40085	45364	52679	47058	46946	46875	44945	43442	55142
Total variable cost	33085	38364	45679	40558	40446	40375	38445	36942	48642
Total cash cost	26936	32916	34774	32998	33378	32574	30111	28382	35567
2. Yield (t/ha)	55	58	39	65	66	59	74	81	55
3. Gross Return (Tk../ha)	125662	114260	103998	54600	55440	49560	148625	161990	110790
4. Gross Margin (Tk../ha):									
Total variable cost basis	92577	75896	58319	14042	14994	9185	110180	125048	62148
Total cash cost basis	98726	81344	69224	21602	22062	16986	118514	133608	75223
5.Net Return (Tk../ha)	85577	68896	51319	7542	8494	2685	103680	118548	55648
6. BCR:									
Total variable cost basis	3.80	2.98	2.28	1.35	1.37	1.23	3.87	4.39	2.28
Total cash cost basis	4.67	3.47	2.99	1.65	1.66	1.52	4.94	5.71	3.11
7. Return to labour (Tk../ha)	600	513	411	122	127	93	662	656	295
8. Return to irrigation per	21	17	14	3	3	2	40	46	23

Taka invested

Note: MOC = Mustard oilcake, PR = Poultry refuse, C = Control

The BCR (total variable cost basis) of cabbage varied from 1.35 to 3.87 under mustard oilcake, 1.37 to 4.39 under poultry refuse and 1.23 to 2.28 under control plots (Table 6). The farmers also received much higher return to labour per day (Tk.122 to Tk.662) under the experimental plots than the control plots (Tk.93 to Tk.411) against the normal daily wage rate of Tk.50. Return to irrigation per Taka in vested varied from Tk.3 to Tk. 46 under experimental plots and Tk.2 to Tk.23 under control plots.

Test of overall significance for cabbage

An attempt was made for the significance test for cabbage yields among the treatments. It was found that the estimated value of F with (2, 36) df was 12.3881 which was greater than the tabulated value of F with same df at 1% level of significance. This means there was a significant difference among the effects of the three technologies on the yields of cabbage Table 5.

Table 5. Test of significance among the treatments of cabbage

Source	DF	Sum of Squares	Mean squares	F Value	Probability
Place (A)	2	1330265.288	665132.644	124.4704	0.0000
Treatment (B)	2	132397.154	66198.577	12.3881	0.0001
AB	4	9687.857	2421.964	0.4532	
Error	36	192373.313	5343.703		
Total	44	1664723.613			

Duncan's multiple range test (DMRT) for cabbage

It was obvious from the DMRT that both poultry refuse and mustard oilcake plots displayed significantly better performance than the control plots (Table 6). So, both the treatments can be recommended as an effective IPM practice. But considering the input cost, it could be recommended that poultry refuse as the best IPM practice, since poultry refuse was relatively cheaper and gave relatively higher yield than mustard oilcake.

Table 6. Test of significance between the treatments MOC and PR of cabbage

Treatment	Mean Yield (kg/ha)	DMRT*
Poultry refuse	65324.31	A
Mustard oil cake	63731.29	A
Control	52302.21	B

** Any two means having a common letter are not significantly different at 5% level of significance*

Conclusion

Based on the findings of the study, the following conclusions and recommendations can be drawn:

- The farmers in the study areas benefited from the IPM technologies with higher yields (cabbage 10-50%) and higher returns (BCR 1.35 to 4.39) than the farmers' own practices. The technologies were found to be very promising and encouraging by the farmers. Therefore, the technologies should be disseminated to other farmers' various extension provides such as DAE, NGOs etc.
- For successful adoption of the technologies throughout the country, the availability of poultry refuse, mustard oilcake and pheromone must be ensured in the farmers' fields. For the availability of poultry, government can encourage small-scale poultry farming in rural and semi-urban areas and marketing system of this input can be developed in the country like other chemical fertilizers.

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