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BIO RATIONAL MANAGEMENT OF LEAF EATING CATERPILLARS OF CABBAGE

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Abstract

The study was carried out to evaluate some biorational approaches for the management of two leaf eating cabbage caterpillars (*S. litura* and *P. xylostella)* at three planting dates of cabbage. We did not find the population of *Pieris brassicae* in this study. In the 1st planting, the lowest percent head infestation (3.79%) were recorded in the pheromone mass trap+ Bt+ SNPV treated plot followed by hand picking + pheromone for trapping *S. litura* and *P. xylostella*+ spraying Bt (5.79%) and pheromone for trapping *S. litura* and *P. xylostella*+ spraying Bt treated plots (6.01%) as against 10.35% infestation in untreated control. Similarly, the lowest percent head infestation were recorded in the pheromone + Bt+ SNPV treated plot from 2nd and 3rd planting dates 10.85% and 16.33%, respectively. *P. xylostella* larvae was not found at 1st planting. The highest percent reduction of head infestation over control was recorded from pheromone mass trap+ Bt+ SNPV treated plots which were 63.4%, 49.7% and 46.62% respectively at three planting dates. Significantly the highest marketable yield (56.86 t ha^{-1})) and highest BCR (4.32) was recorded from pheromone + Bt+ SNPV treated plot in three date of planting. Interaction of pheromone mass trap+ Bt+ SNPV and 1st planting of cabbage was proved to be the most effective management approaches against two leaf eating caterpillars of cabbage. The population of leaf eating caterpillar of cabbage at elarly planting was much less. Thus, it does not require too much spraying to suppress leaf eating caterpillar of cabbage at early planting.

Keywords: *Bacillus thurigiensis*, biorational, *Spodoptera litura, Plutella xylostella*, pheromone.

Introduction

Common armyworm is considered as the most destructive insect pest in Bangladesh. It has wide host range and can damage various types of vegetable crops in Bangladesh including cabbage. Although *S. litura* and *P. xylostella* are the most important and destructive insect pests of cabbage, little attention has been paid on their population dynamics (Zalucki and Furlong, 2011) as well as their time-bound effective management. Forecasting of the population dynamics of leaf-eating caterpillars are not easy as many factors influence its abundance and fluctuation (Schellhorn *et al*., 2008; Muthuthantri *et al*., 2010). The development of a bio-rational based management strategy following their fluctuation pattern is also difficult. However, to develop a proper planning for the

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management of this pest, prediction of the population abundance, proper timing and level of pest occurrence are highly important (Maelzer *et al*., 1996). The larvae of *S. litura* can cause 26–100% yield loss in field (Tuan *et al.*, 2014). Hence, the proper management of these pests (*Plutella xylostella* and *Spodoptera litura)* is very much important for a successful production of cabbage through various method. Mechanical, biological and chemical etc. control has been reported throughout the world. The farmers of Bangladesh are using chemical insecticides indiscriminately to combat these insect pests of cabbage. Chemical control become a matter of great concern of human health and environmental pollution (Rikabdar, 2000). Considering the hazardous impacts of chemical insecticides, the utilization of safe bio-control agents and hazards free tactic for the environmental pollution free management of insects pests are important.

So, it is high time to develop IPM package(s) having effective, environmental friendly tactics against *S. litura* and *P. xylostella*. Hench, the present study was undertaken for the assessment of bio-rational based integrated management packages against those two pests and their effect on yield contributing parameters at different planting dates under field conditions.

Materials and Methods

Cultivation of cabbage and application of biorational approaches

The study was conducted in the research field of Entomology Division, Bangladesh Agricultural Research Institute (BARI), Gazipur, from 2014 to 2015. The area was situated at 24.09° and 90.26° with an elevation of 8.4 meters from the sea level. The variety of cabbge Atlas-70 was used in this study. The study consisted of 5 treatment packages. The packeges were comprising 5 treatments viz., T_1= Hand picking + Pheromone for mass trapping *S. litura* and *P. xylostella* (Spodo-o-lure or *S. litura* pheromone lure and DBM lure or *P. xylostella* pheromone lure from Ispahani-Biotech) + spraying Bt (0.4g^{-1} of water, 4 sprays at 15 days interval starting from the appearance of pest attack); T_2= Pheromone for mass trapping *S. litura* and *P. xylostella*+ spraying Bt (as above); T_3= Pheromone for mass trapping *S. litura* and *P.xylostella*+ spraying Bt (as described) + spraying SNPV (0.2g^{-1} of water, 4 sprays at 15 days interval starting from the appearance of pest attack); T_4= Farmer’s practices: Spraying of Cypermethrin (Ripcord) 10 EC @ 1ml^{-1} of water at 7 days interval starting from the apperrance of pest attack and continued to last harvest; T_5= Untreated control. The experiment was laid out in a factorial experiment setup in randomized complete block design including three planting dates (2 November 2014, 13 December 2014 and 19 January 2015) and five treatment packages with three replications each having an unit size of 10 meters width and 10 meters length transplanted with 40 days old cabbage seedlings. Seedling were transplanted in three different dates on 2 November 2014, 13 December 2014 and 19 January 2015. Total number of experimental plot was 45. Each unit plot consisting of fourty (40) cabbage plants, having five (5) rows and every row consisted of eight (8) plants. Plant to plant distance was 60 cm and row to row distance was 60 cm. The crop was raised following the recommended agronomic practices, including normal weeding, irrigation practices, fertilisation and sanitation etc. except plant protection measures as described by Rashid, 1999. The appearance of leaf eating caterpillars in the filed was keenly monitored. The first application of treatments was initiated after 4^{th} week of transplantation and subsequent applications of each treatment were made at seven days intervals with the help of a high volume knapsack sprayer. Only water was spreyed in the untreated control plots. Sex pheromone traps were installed in the experimental field at 25 days after sowing (DAS) and maintained 25 m distance among the traps. Sex pheromone lures of *S. litura* and *P. xylostella* (Spodo-o-lure for *S. litura* and DBM lure for *P. xylostella*) were placed in BARI developed water traps for capturing adult moths. The pheromone traps were placed just above the crop canopy by means of bamboo support. The traps were kept once in cabbage field throughtout the cropping season.

Data collections

Data were collected on some pre- selected parameters, such as yield contributing characters of cabbage like number of healthy heads, infested heads per plot, and finally yield of cabbage. Observation on the population of diamondback moth and common cutworm by sex pheromone trap and symptoms developed on the leaves and number of heads per plot were recorded at an interval of 7 days starting from the 4^{th} week after transplanting and continued up to harvest. Observations on the larval population of diamondback moth and common cutworm were recorded from randomly selected plants in each plot. To estimate the larval population of diamondback moth and common cutworm direct visual counting method was used in the field and laboratory (Lal, 1998). Ten heads were randomly selected from each plot. The selected heads were observed at weekly intervals. Healthy and infested heads were counted for estimating infestation rate. The data were converted to mean healthy and infested heads per plot. The cumulative yield of cabbage heads per plot from total harvests was calculated in three planting dates and it was expressed as t ha^{-1}. The benefit cost-analysis was expressed in terms of benefit cost ratio (BCR). Cost benefit analysis was also evaluated. The recorded data were statiscally analyzed by MSTAT-C software and the means values were separated by using Duncan's Multiple Range Test (DMRT) at 5% level of significance. Datasets were performed on weekly pest scouting data on healthy and infested head and yield t ha^{-1} using IBM SPSS 21.0. Dependent variables (e.g. cabbage infestation and yield) were subjected to multivariate analysis of variance (ANOVA, $P < 0.05$) to test the effects of planting dates ($n = 3$) and treatments ($n = 5$) as categorical predictors. Significant data means were compared by post hoc Tukey's HSD test ($P < 0.05$), and pearson correlation ($p<0.05$) was performed to determine the degree of association between dependent variables and categorical predictors.

Results and Discussion

Cabbage planted on 2 November and harvested in January was infested with only common cutworm (*S. litura*). The percent head infestation was ranges from 3.79-10.35 (Table 1). Significantly higher head infestation were recorded in the untreated control plots (10.35%) than the farmer's practice (8.67%). The lowest percent head infestation were recorded in the Bt (EG 7841) + SNPV treated plots (3.79%). Number of common cutworm was the highest in the untreated control plots (2.13) and second highest was recorded in the farmer's practice plot (1.73). The lowest number of caterpillar was recorded in the Bt (EG 7841) + SNPV treated plots (0.83) (Table 1). However, there was no infestation of *P. Xylostella* was found in the first planting of cabbage (2 November).

Table 1. Percent head infestation and number of *P. xylostella* and *S. litura* on cabbage planted on 2 November 2014 at BARI

Treatments	Head infestation (%)	No. of *P. xylostella* larvae $^{-1}$ head	No. of *S. litura* larvae $^{-1}$ head
Hand picking + Pheromone mass trapping + Bt (EG 7841)	5.79c	0	1.05
Pheromone mass trapping + Bt (EG 7841)	6.01c	0	1.15
Pheromone mass trapping + Bt (EG 7841) + SNPV	3.79d	0	0.83
Cypermethrin 10 EC (Ripcord) (Farmer's practice)	8.67b	0	1.73
Untreated control	10.35a	0	2.13
CV%	7.08		

At 2nd planting on 13 December, cabbage head infestation ranged from 10.85-21.57% (Table 2). The lowest head infestation (10.85%) was recorded from Bt (EG 7841) + SNPV treated plots. The highest head infestation was observed in the untreated control plots (21.57%). The number of *P. xylostella* and *S. litura* in the different treated plots ranged from 0.85-2.40 and 0.46-1.46, respectively. Number of *P. xylostella* and *S. litura* was higher in the untreated and farmer's practiced plots. The lowest number of *S. litura* (0.46) and *P. xylostella* (0.85) was recorded in the Bt (EG 7841) + SNPV treated plots.

Table 2. Percent head infestation and number of *P. xylostella* and *S. litura* on cabbage planted on 13 December 2014 at BARI

Treatments	Head infestation (%)	No. of *P. xylostella* larvae $^{-1}$ head	No. of *S. litura* larvae $^{-1}$ head
Hand picking+Pheromone mass trapping + Bt (EG 7841)	13.08c	1.10	0.86
Pheromone mass trapping + Bt (EG 7841)	12.93c	0.93	0.69
Pheromone mass trapping + Bt(EG 7841) + SNPV	10.85d	0.85	0.46
Cypermethrin 10 EC (Ripcord) (Farmer's practice)	17.36b	1.60	1.06
Untreated control	21.57a	2.40	1.46
CV%	6.33		

Percent head infestation ranged from 16.33-30.59% during 3rd transplantation (19 January) (Table 3). The lowest head infestation (16.33%) was recorded from Bt (EG 7841) + SNPV treated plots and the highest head infestation was observed in the untreated control plots (30.59%). It was significantly higher than that of farmer's practice plots (26.42%). The number of *P. xylostella* and *S. litura* larvae was ranged from 0.93-4.40 and 0.40-1.73, respectively. Number of *Plutella xylostella* and *Spodoptera litura* was higher in the untreated and farmer's practice plots than the other package treated plots. The lowest number of *Spodoptera litura* (0.40) and *Plutella xylostella* (0.93) was observed in the Bt (EG 7841) + SNPV treated plots (Table 3).

Table 3. Percent head infestation and number of *P. xylostella* and *S. litura* on cabbage planted on 19 January 2015 at BARI

Treatments	Head infestation (%)	No. of *P. xylostella* larvae $^{-1}$ head	No. of *S. litura* larvae $^{-1}$ head
Hand picking+Pheromone mass trapping + Bt (EG 7841)	19.24c	1.24	1.20
Pheromone mass trapping + Bt (EG 7841)	19.30c	1.26	0.66
Pheromone mass trapping + Bt (EG 7841) + SNPV	16.33d	0.93	0.40
Cypermethrin 10 EC (Ripcord) (Farmer's practice)	26.42b	2.53	1.56
Untreated control	30.59a	4.40	1.73
CV%	6.63		

All bio-rational management approaches provided significantly decreased number of infested head per plot compared to untreated control plot. In the month of November to January (1st planting) the lowest percent of infested head per plot was recorded in mass trapping+ Bt (EG 7841) + SNPV (3.79%) sprayed plot which was significantly lower than all other treatments. The highest percent of infested head per plot was found in the untreated control plot (10.35%) (Table 4). Percent head infestation by *S. litura* at first planting indicated that among the treatments, mass trapping+ Bt (EG 7841) + SNPV was found to be more effective in reducing the head damage. Accordingly highest percent reduction of head infestation over control (63.40%) was also observed in mass trapping + Bt (EG 7841) + SNPV treated plots (Table 4).

Table 4. Effect of different treatments on the management of *P. xylostella* and *S. litura* infesting cabbage on three dates of planting

Treatments	1st planting, 2 November		2nd planting, 13 December		3rd planting, 19 January	
	Head infestation (%)	Reduction of head infestation over control (%)	Head infestation (%)	Reduction of head infestation over control (%)	Head infestation (%)	Reduction of head infestation over control (%)
Hand picking + Pheromone mass trapping + Bt (EG 7841)	5.79c	44.05	13.08c	39.36	19.24c	37.10
Pheromone mass trapping + Bt (EG 7841)	6.01c	41.93	12.93c	40.05	19.30c	36.90
Pheromone mass trapping + Bt (EG 7841) + SNPV	3.79d	63.40	10.85d	49.70	16.33d	46.62
Cypermethrin 10 EC (Ripcord) (Farmer's practice)	8.67b	16.23	17.36b	19.51	26.42b	13.63
Untreated control	10.35a	-	21.57a	-	30.59a	-
CV (%)	7.08		6.33		6.63	

Table 5. Interactive effects of planting dates and treatments of two leaf eating caterpillars of cabbage .

Treatments	Healthy head/plot	Infested head/plot	Yield (t ha^{-1})
Planting			
P_1	65.40a	4.85c	50.40a
P_2	60.05b	10.75b	46.33b
P_3	54.66c	15.76a	45.61b
LSD (0.05)	1.14	0.54	1.60
F-test	**	**	*
Treatment Packages			
T_1	61.34b	8.94c	49.60b
T_2	61.51b	8.98c	51.53b
T_3	63.32a	7.26d	53.84a
T_4	58.35c	12.37b	43.27c
T_5	55.65d	14.69a	38.99d
LSD (0.05)	1.47	0.70	2.08
F-test	**	**	**
Planting ×Treatments			
P_1T_1	65.82b	4.04j	55.56ab
P_1T_2	66.31ab	4.25j	54.13abc
P_1T_3	68.45a	2.70k	56.86a
P_1T_4	64.23bc	6.10i	44.33f
P_1T_5	62.19cd	7.18hi	41.13fg
P_2T_1	61.40de	9.26g	48.79e
P_2T_2	61.24def	9.03g	50.61cde
P_2T_3	62.70cd	7.62h	52.93bcd
P_2T_4	58.94efg	12.38ef	42.36fg
P_2T_5	55.96h	15.38c	36.96h
P_3T_1	56.81gh	13.52de	44.46f
P_3T_2	57.00gh	13.62d	49.85de
P_3T_3	58.80fg	11.48f	51.75cde
P_3T_4	51.88i	18.64b	43.13f
P_3T_5	48.81j	21.51a	38.90gh
LSD (0.05)	2.55	1.21	3.59
F-test	ns	**	*
CV%	2.53	6.94	4.53

In a column means having similar letter (s) are statistically similar and those having dissimilar letter (s) differ significantly, ns = non significant, * = significant at 5% , ** = significant at 1% .

In the 2nd planting (13 December 2014 – March 2015) the lowest percent of infested head per plot was recorded from pheromone mass trapping+ Bt (EG 7841) + SNPV (10.85%) sprayed plots and which was significantly lower than other treatment plots. The highest percent of infested head per plot was recorded from the untreated control plot (21.57%) followed by the farmer's practice plots (17.36%). Percent head infestation by *P. xylostella* and *S. litura* in second planting indicated that among the bio-rational treatments, Bt (EG 7841) + SNPV was found to be more effective in reducing the head damage. Higher percent reduction of head infestation over control was also observed in mass trapping+ Bt (EG 7841) + SNPV treated plots (49.70%). In third planting (19 January), the lowest percent of infested head per plot was recorded in mass trapping+ Bt (EG 7841) + SNPV (16.33%) sprayed plot which was significantly lower than other treatments. The highest percent of infested head per plot was found in the untreated control plot (30.59%). Among the bio-rational treatments, mass trapping+ Bt (EG 7841) + SNPV was found to be more effective in reducing the head damage at late season. Like other planting dates, higher percent reduction of head infestation over control was observed in mass trapping+ Bt (EG 7841) + SNPV treated plots (46.62%) and the lowest percent reduction of head infestation over control was observed in Cypermethrin 10 EC treated plots (farmer's practice) at late planting (19 January) (13.63%) (Table 4). Cabbage performance was consistent with the rate of pest infestation, with increased cabbage yield as pest infestation decreased and vice versa. The significantly lowest head infestation and the highest yield was observed from 1st planting compared to 2nd and 3rd planting. Similarly, the lowest head infestation and the highest yield were recorded in the pheromone mass tarpping + Bt+ SNPV treated plots. Low yield in the control is consistent with a high pest infestation, which corresponds to high head damage of cabbage. In the interaction effect of treatments and dates of planting, the number of healthy head ranged from 48.81 to 68.45 (Table 5) and negatively correlated with planting dates (r= -0.819) and cabbage infestation ranged from 2.70 to 21.51 and positively correlated with planting dates (r= 0.837) and treatments (r= 0.396) which was significant ($p<0.01$) across planting dates, treatments and their interactions (Fig. 1) and the infested head of cabbage was significantly reduced by the interaction of treatment and planting dates of the leaf eating caterpillar of the cabbage.

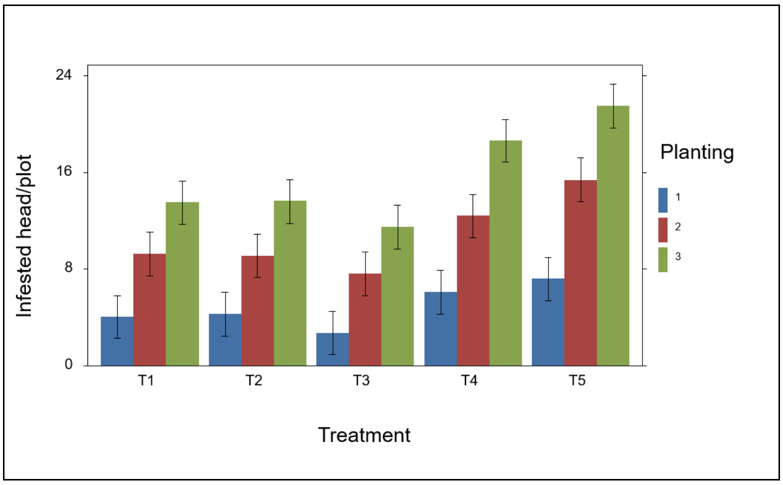

Fig 1. Impact of planting dates (2 November 2014, 13 December 2014 and 19 January 2015) and treatments (T_1 = Hand picking + Pheromone for mass trapping *S. litura* and *P. xylostella*, T_2= Pheromone for mass trapping *S. litura* and *P. xylostella*+ spraying Bt, T_3= Pheromone for mass trapping *S. litura* and *P.xylostella*+ spraying Bt + spraying SNPV, T_4= Farmer's practices: Spraying of Cypermethrin (Ripcord) 10 EC and T_5= untreated Control) on infested head/plot mean values within treatments and planting dates are significantly different ($P < 0.05$).

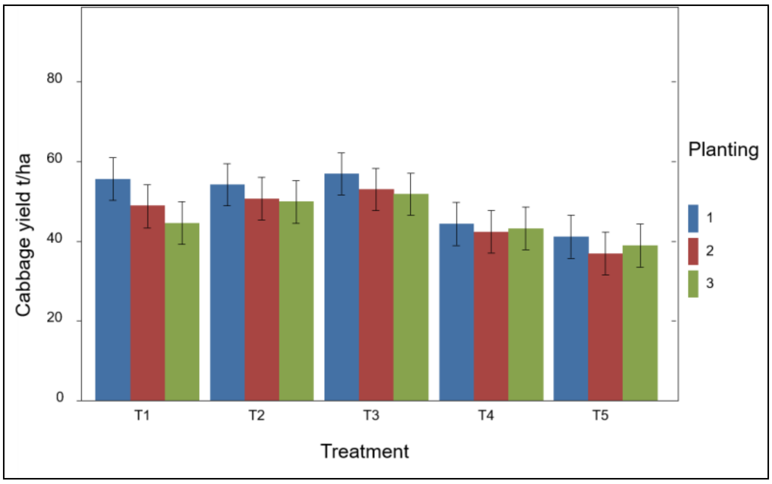

Fig 2. Impact of planting dates (2 November 2014, 13 December 2014 and 19 January 2015) and treatments (T_1 = Hand picking + Pheromone for mass trapping *S. litura* and *P. xylostella*, T_2= Pheromone for mass trapping *S. litura* and *P. xylostella*+ spraying Bt, T_3= Pheromone for mass trapping *S. litura* and *P.xylostella*+ spraying Bt + spraying SNPV, T_4= Farmer's practices: Spraying of Cypermethrin (Ripcord) 10 EC and T_5= untreated Control) on cabbage yield (t ha^{-1}), mean values within treatments and planting dates are significantly different ($P < 0.05$).

Table 6. Effect of planting date (A) and bio rationals (B) on yield (t ha^{-1}) of two leaf eating caterpillars of cabbage (Mean ± SD)

A Treatments	Planting dates		
	1st planting, 2 November	2nd planting, 13 December	3rd planting, 19 January
Hand picking + Pheromone mass trapping + Bt (EG 7841)	55.56 ± 1.86ab	48.79 ±1.40e	44.46 ±2.84f
Pheromone mass trapping + Bt (EG 7841)	54.13 ±1.86abc	50.61 ±2.05cde	49.85 ±1.34de
Pheromone mass trapping + Bt (EG 7841) + SNPV	56.86 ±3.82a	52.94 ±1.61bcd	51.75 ±2.56cde
Cypermethrin 10 EC (Ripcord) (Farmer's practice)	44.33 ±1.80f	42.38 ±1.95fg	43.13 ±1.27f
Untreated control	41.13 ±2.87fg	36.97 ±2.72h	38.90 ±2.82gh

B Planting dates	Treatments				
	Hand picking+Pheromone mass trapping + Bt (EG 7841)	Pheromone mass trapping + Bt (EG 7841)	Pheromone mass trapping + Bt (EG 7841) + SNPV	Cypermethrin 10 EC (Ripcord) (Farmer's practice)	Untreated control
1st planting, 2 November	55.56 ± 1.86ab	54.13 ±1.86abc	56.86 ±3.82a	44.33 ±1.80f	41.13 ±2.87fg
2nd planting, 13 December	48.79 ±1.40e	50.61 ±2.05cde	52.94 ±1.61bcd	42.38 ±1.95fg	36.97 ±2.72h
3rd planting, 19 January	44.46 ±2.84f	49.85 ±1.34de	51.75 ±2.56cde	43.13 ±1.27f	38.90 ±2.82gh

All bio-rational management approaches produced significant quantity of marketable yield and decreased the quantity of infested yield compared to untreated control plot in three planting dates of cabbage. Significantly the highest marketable yield was found from pheromone mass trapping + Bt (EG 7841) + SNPV treated plot (56.86 t ha^{-1}) with the interaction of 1st planting followed by 2nd and 3rd planting 52.94 t ha^{-1} and 51.75 t ha^{-1} respectively. The second highest yield of healthy head was recorded in hand picking + pheromone mass trapping +

Bt (EG 7841) (55.56 t ha^{-1}) treated plot and this was followed by pheromone mass trapping + Bt (EG 7841) (54.13 t ha^{-1}) treated plots compared to farmers practice and untreated control (Table 6). In the interaction effect of planting dates and biorationals on yield t ha^{-1} showed cabbage yield ranged from 36.97 to 56.86 that negatively correlated with dates of planting (r= -0.308) and treatments (r= -0.657) and their interactions (Fig. 2). The highest benefit cost ratio of 4.32 was obtained from the treatment with pheromone mass trapping + Bt (EG 7841) + SNPV and the second highest benefit cost ratio of 4.09 was calculated from the plot treated with hand picking + pheromone mass trapping + Bt (EG 7841) followed by pheromone mass trapping + Bt (EG 7841) treated plot (3.81). The lowest benefit cost ratio of 2.26 was found in the treatment with cypermethrin10 EC (Farmer's practice) (Table 7).

For above biorational management, the bacterial treatments (Bt) in combination with SNPV and mass trapping gave excellent protection against *S. litura* and *P. xylostella* damage of cabbage. Apart from management of the *S. litura* and *P. xylostella*, the yield increase of healthy cabbage was remarkable. Rapid leaf damage caused by the leaf-eating caterpillar resulting marked yield reduction resulted in the untreated control plants. Vanlaldiki *et al.* (2013) found that Dipel (Bt) treated plots had the lowest larval population (0.21 $plant^{-l}$) of DBM and had maximum yield compared to the untreated control plots. Effectiveness of Dipel (Bt) against DBM was consistently found by a number of other researchers (Leibee and Savage, 1992; Seal, 1995; Asokan *et al.*, 1996). Moreover delfin, another Bt product along with dipel is also another biocontrol agent which was superior to other insecticides for the control of the larval population of diamondback moth (Malathi and Sriramulu, 2000; Kalra and Sharma, 2000; Biradar and Dhanorkar, 2001; Elzen and James, 2002). Several earlier researchers have also recorded effective control of diamondback moth with substantial yield increase in cabbage with the use of Bt and neem products (Monnerat *et al*., 2000; Shankar and Raju 2002; Javaid *et al*., 2000; Loganathan *et al*., 2000 and Biradar and Dhanorkar, 2001).

In the present findings, we did not find *Pieris brassicae* another leaf eating caterpillar during the study period, among all the approaches, the pheromone mass trapping for *S. litura* and *P. xylostella*+ spraying Bt + spraying SNPV can be effectively used to manage two leaf eating caterpillars of cabbage. All the biorational management approaches produced significanty higher quantity of marketable yield and decreased the quantity of infested yield compared to untreated control. Furthermore, the combined efficacy can be enhanced by evaluating their pathogenicity without causing damage to non-target organisms. The population of leaf eating caterpillars of cabbage at the time of elarly planting is much less. Thus, it does not require too much spraying to suppress the leaf eating caterpillar of cabbage at November planting in Bangladesh.

Table 7. Marketable yield (t ha^{-1}) and benefit cost analysis (BCR) of different treatment for suppressing leaf eating caterpillars of cabbage in three planting dates

Treatments	Marketable yield (ton ha^{-1})	Gross return (Tk ha^{-1})	Cost of treatment (Tk ha^{-1})	Net return (Tk ha^{-1})	Adjusted net return	Marketable BCR
Hand picking+Pheromone mass trapping + Bt (EG 7841)	55.56a	555600.00	28339	527261	115961	4.09
Pheromone mass trapping + Bt (EG 7841)	54.13a	541300.00	27039	514261	102961	3.81
Pheromone mass trapping + Bt (EG 7841) + SNPV	56.86a	568600.00	29553	539047	127747	4.32
Cypermethrin 10 EC (Ripcord) (Farmer's practice)	44.33b	443300.00	9805	433495	22195	2.26
Untreated control	41.13b	411300.00	0.00	411300	0.00	-
CV (%)	5.67	-	-	-	-	-

Market value of cabbage was 20 Tk

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