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IMPACT OF SOME ECOFRIENDLY OPTIONS ON THE INCIDENCE AND DAMAGE POTENTIAL OF POD BORERS AND YIELD OF MUNGBEAN

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ABSTRACT

Study was carried out in the farmer's field at Sonakhali, Barguna sadar, Barguna district of Bangladesh during January to April 2017 to evaluate the impact of different ecofriendly treatments against pod borers of mungbean. Variety Barimung 6 was used as study material. Results revealed that the lowest mean number of pod borer (1.75 Plot^{-1} at 50 DAS & 2.50 plot^{-1} at 60 DAS), the highest percent of pod borer reduction (72.0% at 50 DAS & 72.22% at 60 DAS) over control, the lowest mean pod damaged (4.00 m^2 at 50 DAS & 6.50/m^2 at 60 DAS) and the highest percent of pod damage reduction (76.12% at 50 DAS & 74.25% at 60 DAS) over control were found in plots treated with Virtako 80 WG @ 0.15g L^{-1} of water. The highest yield (1075.00 kg ha^{-1}) and net return (Tk. 14425 ha^{-1}) were obtained from Virtako 80WG treated plot while the highest marginal benefit cost ratio (2.67) was obtained from Raise 20 SL treated plots. From this study Virtako 80 WG @ 0.15g L^{-1} of water was found to be the best option for the suppression of pod borers and produced maximum yield of mungbean. Raise 20 SL @ 3ml L^{-1} of water at 40 DAS gave the highest marginal benefit cost ratio. Hence it could be the best option as second choice to suppress pod borers in mungbean.

***Keywords*:** Ecofriendly options, benefit cost ratio, Pest incidence, *Vigna radiata.*

INTRODUCTION

Mungbean (*Vigna radiata* L. Wilezek) is one of the most important pulses crop belonging to the family Leguminosae grown in tropical and sub-tropical regions. The global mungbean growing area has increased during the last 20 years at an annual growth rate of 2.5% (Green and King 1992). The crop is also well known as green gram, golden gram, sonamung, mungbean but commonly called as 'Moog' in

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Bangladesh. Mungbean contributed 8.23 percent of the total pulse production in the country (BBS 2016). Mungbean contributed 6.5 percent of the total pulse production in the country. In Bangladesh mungbean is grown three times in a year, covering 38881 hectares with an average yield of 0.84 mt ha^{-1} (BBS 2016). Mungbean is an important source of protein and several essential micronutrients for both human and domestic animals. It contains 24.5% protein and 59.9% carbohydrate. It also contains 75 mg calcium; 8.5 mg iron and 49 mg B–carotene per 100 g of split dual (Bakr *et al*. 2004). The foliage and stem are also a good source of fodder for livestock as well as a green manure. Among pulses, mungbean is favoured for children and the elderly people because of its easy digestibility, low production of flatulence and flavor. Despite its importance, mungbean yields are greatly depressed by a complex of biotic and abiotic factors of which insect pests are the most important. Mungbean is attacked by a number of insect pests, which cause a heavy loss to the crop. Pod borer (*Maruca vitrata*) damages flowers, flower buds and developing or mature pods (Poehlman 1991). In Bangladesh, pod borers (*Maruca vitrata, Helicoverpa armigera* and *Euchrysops* spp.) often cause serious problem resulting in severe loss of the crop (Bakr 1998). For insect management, comprehensive program need to be developed for particular production areas that are designed to accommodate the seasonal changes in the insect population. Different control strategies are in practice in the field for the control of insect pests of mungbean, which mainly includes chemical insecticides and bio-control agents. The control of these insect pests in Bangladesh is principally carried out by the conventional use of insecticides. Some workers have tried to control these pests with varying degrees of success by frequent application of insecticides as foliar treatments (Chowdhury and Roy 1975). It is difficult to emphasize the effectiveness of particular synthetic insecticides out of many commercially available ones against a certain insect pest. Considering above facts the study was designed to find out the most effective ecofriend;y option(s) against pod borers of mungbean.

MATERIALS AND METHODS

Study was carried out in the farmer's field at Sonakhali, Barguna sadar, Barguna district of Bangladesh during January to April 2017 to evaluate the effectiveness of different ecofriendly option(s) against pod borers of mungbean. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications (Gomez and Gomez 1984). The whole field was divided into 3 unit blocks representing

replications and each unit block was divided into 9 unit plots. The total number of plots was 27 and the size of the individual plot was 3m × 2.0m. The distance between unit plots was 0.75m and between blocks was 1m (Plate 1). The treatments were randomly assigned to the plots within a block. BARI Mung-6 was used as study material. The seeds were sown on the 1st February, 2017 at the rate of 20 kg ha^{-1}. The seeds were placed in the line continuously at a depth of 4-5cm and covered by loose soil with the help of hand. The spacing was 15 cm between rows and 10 cm between plants. Eight ecofriendly option(s) *viz*., T_1 = Use of Sex pheromone trap, T_2 = Use of White sticky trap (WST), T_3 = Spraying of Bioneem plus 1% EC @ 1ml L^{-1} of water at 40 DAS, T_4 =Spraying of Virtako 40 WG @ 0.15g L^{-1} of water at 40 DAS, T_5 = Spraying of Amithrin plus 3% WDG @ 1ml L^{-1} of water at 40 DAS, T_6 = Spraying of Ecomec @ 1ml L^{-1} of water at 40 DAS, T_7 = Spraying of Nitro 505 EC @ 1ml L^{-1} of water at 40 DAS, T_8 = Spraying of Raise 20 SL @ 3ml L^{-1} of water at 40 DAS and untreated control (water sprayed only). Insecticides were procured from Biotech division, Ispahani Agro Ltd. and local market. The spray solutions at the pre fixed concentration of the respective treatments were prepared in Knapsack sprayer by mixing with water as required just before spraying in the afternoon. The spray solutions thus prepared were sprayed in the assigned plots as per the treatment design. The spraying was always done in the afternoon to avoid bright sunlight. Caution was taken to avoid any drift of any spray mixture to the adjacent plots at the time of the spray. Intercultural operations were done as and when necessary to ensure normal growth and development of crops.

Data were collected and recorded at ten day's interval at different growth stages by direct counting early in the afternoon (4.0 – 6.0 pm). Plants within a meter square (1m × 1m) were selected randomly from each plot. Population of pod borer complex **(***Helicoverpa armigera* and *Maruca vitrata***)** was recorded at pod initiation to maturity stage. Pod borer complex (*Helicoverpa armigera* and *Maruca vitrata*) data were collected two times (50 DAS and 60 DAS) from vegetative to ripening stage. Matured pod was harvested two times (65 and 72 days after sowing, respectively), pod borer infested pods and healthy pods were recorded separately for each plot. Infested pod were collected randomly opened it longitudinally and damaged seeds were recorded. For collecting data on the percentage of pod borer infested pods, the number of infested pods and the total number of pods per square plants of each plot were counted at ripening stage and recorded. The data were

collected two times (65 DAS and 72 DAS) from pod development to harvest. The following formula was used for taking the infestation percentage:

$$\% \text{ pod infestation} = \frac{\text{Total number of infested pods per meter square}}{\text{Total number of pods per meter square}} \times 100$$

The yield of each plot was calculated and expressed as kg ha^{-1}.

The percent insect population reduction over control was calculated using the following formula (Khosla 1997).

$$\text{Percent population reduction over control} = \frac{X2 - X1}{X2} \times 100$$

Where, X_1= the mean of treated plots, X_2= the mean of untreated plots

Economic analysis of treatment: Economic analysis in terms of Benefit Cost Ratio (BCR) was analyzed on the basis of total expenditure of the respective management option along with the total return from that particular treatment. In this study BCR was analyzed for a hectare of land. For this analysis the following parameters were considered.

Treatment wise management cost/variable cost: This cost was calculated by adding all costs incurred for labours and inputs for each management option including untreated control during the entire cropping season. The plot yield (kg ha^{-1}) of each treatment was converted into ton ha^{-1} yield.

Gross Return (GR): The yield in terms of money was calculated by multiplying the total yield by the unit price of mungbean (Tk. 70 kg^{-1}).

Net Return (NR): The net return was calculated by subtracting treatment wise management cost from gross return.

Adjustment of Net Return (ANR): The ANR was determined by subtracting the net return for a particular management treatment from the net return with control plot. Finally, BCR for each management option was calculated by using the following formula described by Elias and Karim (1984):

$$\text{Benefit Cost Ratio (BCR)} = \frac{\text{Net return}}{\text{Total insecticide cost}}$$

Statistical analysis: The collected data were statistically analyzed following the analysis of variance (ANOVA) using WASP program and the mean differences were adjudged by CD (critical difference) values.

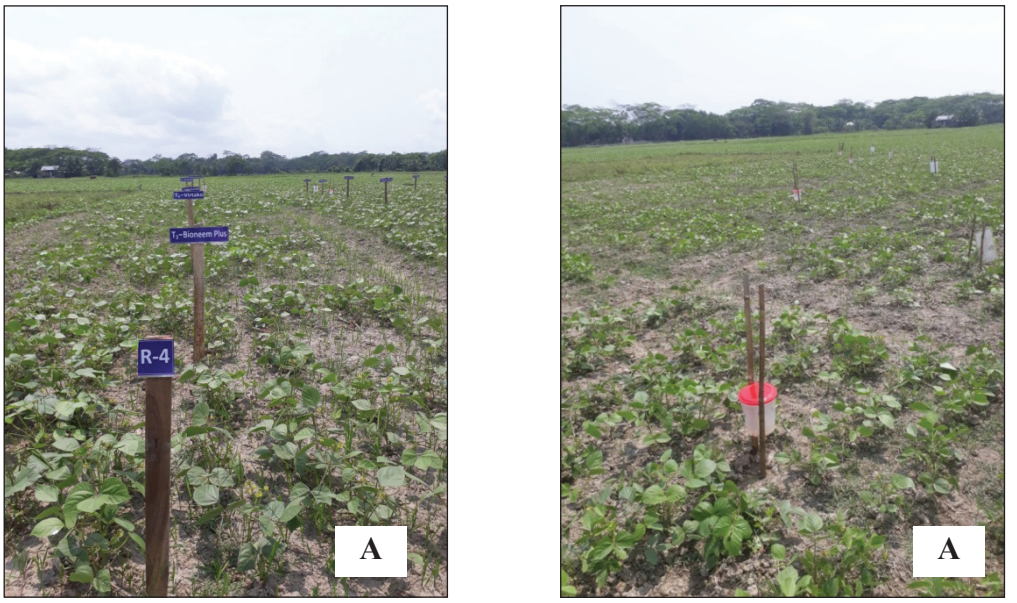


Plate 1: Pictorial views of experimental plots (A&B)

RESULTS AND DISCUSSION

Effect of different IPM components on the incidence of pod borer attacking mungbean at 50 DAS: The effect of different management options on pod borer population and pod infestations are presented in Table 1. At 55 DAS, the number of pod borer per plot varied significantly and ranged from 1.75 to 6.25 plot^{-1}. The lowest mean number of pod borer (1.75 plot^{-1}) was observed in Virtako 40 WG treated plots, which was statistically similar to Nitro 505 EC (2.0 plot^{-1}) and White sticky trap (2.0 plot^{-1}), followed by Bioneem plus (2.50 plot^{-1}), Sex pheromone trap (2.75 plot^{-1}), Raise 20 SL (3.0 plot^{-1}), Ecomec (3.25 plot^{-1}) and Amithrin plus 3% WDG (3.50 plot^{-1}). The significantly highest mean number of pod borer was observed in untreated control plots (6.25 plot^{-1}) which were statistically different from all other options. Accordingly, the highest percentage of pod borer population reduction (72.0%) was found in Virtako 40 WG treated plots over control followed by Nitro 505 EC (68.00%), White sticky trap (64.00%), Bioneem plus (60.00%), Sex

pheromone trap (56.00%), Raise 20 SL (52.0%), Ecomec (48.00%) and Amithrin plus 3% WDG (44.00%). In case of pod infestation, it varied significantly and ranged from 4.0 to 16.75 plot^{-1}. Significantly the lowest mean pod damaged (4.0 plot^{-1}) was observed in Virtako 40 WG treated plots followed by Sex pheromone trap (5.50 plot^{-1}), Nitro 505 EC (6.75 plot^{-1}), Amithrin plus 3% WDG (7.0 plot^{-1}), Raise 20 SL (7.50 plot^{-1}), Ecomec (10.50 plot^{-1}), Bioneem plus (12.25 plot^{-1}) and White sticky trap (14.25 plot^{-1}), which was statistically similar to Nitro 505 EC Raise 20 SL and Amithrin plus 3% WDG. Significantly the highest mean number of pod borer population was observed in untreated control plots (16.75). Accordingly, the highest percentage of pod borer damaged reduction (76.12%) was found in Virtako 40 WG treated plots followed by Sex pheromone trap (67.16%), Amithrin plus 3% WDG (58.21%), Raise 20 SL (55.22%) and Nitro 505 EC (59.70%). While the lowest was in White sticky trap (14.92%) followed by Bioneem plus (26.86%) and Ecomec (37.31%) (Table 1).

Table 1. Efficacy of ecofriendly options on the incidence of pod borer attacking mungbean at 50 DAS

Ecofriendly options	Number of pod borer plot^{-1}	Reduction of pod borer over control (%)	Pod infestation by pod borer/ m^2	Reduction of pod infestation over control (%)
Sex pheromone trap	2.75 cdf	56.00	5.50 bc	67.16
White sticky trap (WST)	5.25 b	64.00	14.25 b	14.92
Bioneem plus 1% EC @ 1ml L^{-1} of water	4.50 bc	28.00	12.25 c	26.86
Virtako 40 WG @ 0.15g L^{-1} of water	1.75 g	72.00	4.00 f	76.12
Amithrin plus 3% WDG@ 1ml L^{-1} of water	3.50 cd	44.00	7.00 d	58.21
Ecomec1ml L^{-1} of water	3.25 cd	48.00	10.50 e	37.31
Nitro 505 EC @ 1ml L^{-1} of water	2.00 fg	68.00	6.75 d	59.70
Raise 20 SL@ 3ml L^{-1} of water	3.00 bcd	52.00	7.50 d	55.22
Untreated control	6.25 a	-	16.75 a	-
Level of significance	**	-	**	-
CV (%)	15.44	-	10.27	-

** Significant at 1 % level. Means within column followed by the same letter are not significantly different from one another by CD (critical difference) values. Values are average of three replications.

Effect of different treatments on the incidence of pod borer attacking mungbean at 60 DAS: The effect of different treatments on pod bore population and pod infestations are presented in Table 2. At 60 DAS, the number of pod borer varied significantly and ranged from 2.50 to 9.00. The lowest mean number of pod borer (2.50 plot^{-1}) was observed in Virtako 40 WG treated plots followed by Sex pheromone trap (3.50 plot^{-1}), Amithrin plus 3% WDG (3.75 plot^{-1}), Bioneem plus (4.00 plot^{-1}), Nitro 505 EC (4.00 plot^{-1}), Raise 20 SL (4.75 plot^{-1}), Ecomec (6.50 plot^{-1}) and White sticky trap (7.50 plot^{-1}). The highest mean number of pod borer was observed in untreated control plots (9.00 plot^{-1}) which were statistically different from other treatments. Accordingly the highest percentage of pod borer reduction (72.22%) was found in Virtako 40 WG treated plots over control followed by Sex pheromone trap (61.00%), Amithrin plus 3% WDG (58.33%), Bioneem plus (55.56%), Nitro 505 EC (55.56%), Raise 20 SL (52.0%), Ecomec (50.00%) and White sticky trap (16.67%). In case of pod damaged, number of pod damaged also varied significantly and ranged from 6.50 to 11.25. Lowest mean pod damaged (6.50) was observed in Virtako 40 WG followed by Nitro 505 EC (7.75), Sex pheromone trap (9.25), Amithrin plus 3% WDG (9.50), Raise 20 SL (10.50), Ecomec (16.25), Bioneem plus (19.00) and White sticky trap (22.25). The highest pod damage was observed in untreated control plots (25.25) which were statistically different from other treatments. Accordingly, the highest percentage of pod damaged reduction over control (74.25%) was found in Virtako 40 WG treated plots followed by Nitro 505 EC (69.31%), Sex pheromone trap (63.37%), Amithrin plus 3% WDG (60.40%) and Raise 20 SL (55.45%). While the lowest percentage of pod damaged was in White sticky trap (11.88%) followed by Bioneem plus (24.75%) and Ecomec (35.64%).

Effect of different ecofriendly options on pod infestation, seed damage and yield of mungbean: Application of different ecofriendly options influenced the pod borer infestation, seed damage due to pod borer and yield of mungbean over control. The highest yield (1075 kg ha^{-1}) and percent increase over control (36.50%) was recorded in Virtako 40 WG treated plots followed by Nitro 505 EC (945.50 kg ha^{-1} & 20.63%), Amithrin plus 3% WDG (935.0 kg ha^{-1} & 18.73%), Raise 20 SL (922.0 kg ha^{-1} & 18.14%), Ecomec (912.50 kg ha^{-1} & 15.87%), while the lowest was found in untreated control (472.50kg ha^{-1}) followed by Sex pheromone trap (845.0 & 7.30%), White sticky trap (862.50 kg ha^{-1} & 9.52%) and Bioneem plus

Table 2. Effectiveness of different ecofriendly options on the incidence of pod borer attacking mungbean at 60 DAS

Ecofriendly options	Number of Pod borer plot^{-1}	Reduction of pod borer over control (%)	Pod infestation by pod borer/ m^2	Reduction of pod infestation over control (%)
Sex pheromone trap	3.50 e	61.11	9.25 f	63.37
White sticky trap	7.50 b	16.67	22.25 b	11.88
Bioneem plus 1% EC @ 1ml L^{-1} of water	5.75 de	55.56	19.00 c	24.75
Virtako 40 WG @ 0.15g L^{-1} of water	2.50 f	72.22	6.50 h	74.25
Amithrin plus 3% WDG @ 1ml L^{-1} of water	3.75 e	58.33	9.50 f	62.38
Ecomec1ml L^{-1} of water	6.50 c	27.78	16.25 d	35.64
Nitro 505 EC @1ml L^{-1} of water	4.00 de	55.56	7.75 g	69.31
Raise 20 SL @ 3ml L^{-1} of water	4.75 d	47.22	10.50 e	58.41
Untreated control	9.00 a	-	25.25 a	-
Level of significance	**	-	**	-
CV (%)	13.56	-	4.05	-

**Significant at 1 % level. Means within column followed by the same letter are not significantly different from one another by CD (critical difference) values. Values are average of three replications.

(892.50 kg ha^{-1} & 12.06%, respectively). Thus the order of used options efficiency in increasing yield (kg ha^{-1}) of mungbean over control was Virtako 40 WG> Nitro 505 EC> Amithrin plus 3% WDG> Raise 20 SL> Ecomec> Bioneem plus> White sticky trap> Sex pheromone trap> untreated control (Tables 3, 4).

The effect of different ecofriendly options on percent pod damage, seed damage and yield of mungbean are presented in Tables 3, 4. The percent pod damage varied significantly and it ranged from 3.50 to 29.25. Significantly the lowest percent pod damage (3.50 plot^{-1}) was observed in Virtako 40 WG treated plots, which was statistically identical to that of Nitro 505 EC (4.75 plot^{-1}), followed by Sex pheromone trap (7.0 plot^{-1}), Amithrin plus 3% WDG (10.50 plot^{-1}), Raise 20 SL (12.50 plot^{-1}), Bioneem plus (17.25 plot^{-1}), Ecomec (20.0 plot^{-1}) and White sticky trap (25.75 plot^{-1}). The significantly highest percentage of pod damaged was observed in untreated

Table 3. Effect of different ecofriendly options on pod borer infestation, seed damage and yield of mungbean

Ecofriendly options	Pod infestation/ m^2 (%)	Pod infestation reduction over control (%)	Seed damage / infested pod (%)	Seed damage reduction over control (%)	Yield (kg ha^{-1})	Yield increased over control (%)
Sex pheromone trap	7.00 f	76.06	13.25 g	69.71	845.00 f	7.30
White sticky trap	25.75 b	11.76	32.75 c	25.14	862.50 ef	9.52
Bioneem plus 1% EC @ 1ml L^{-1} of water	17.25 b	41.08	35.25 b	19.43	882.50d ef	12.06
Virtako 40 WG @ 0.15g L^{-1} of water	3.50 g	88.03	6.25 i	85.71	1075.00 a	36.50
Amithrin plus 3% WDG @ 1ml L^{-1} of water	10.50e	64.10	25.50 d	41.71	935.00 cd	18.73
Ecomec1ml L^{-1} of water	20.00 c	31.62	21.25 e	51.43	912.50 de	15.87
Nitro 505 EC @ 1ml L^{-1} of water	4.75 fg	83.76	9.50 h	78.29	945.50 b	20.63
Raise 20 SL @ 3ml L^{-1} of water	12.50 de	56.49	16.25 f	62.86	922.50 c	17.14
Untreated control	29.25 a	-	43.75 a	-	787.50 g	-
Level of significance	**	-	**	-	**	-
CV (%)	13.22	-	7.21	-	4.07	-

**Significant at 1% level. Means within column followed by the same letter are not significantly different from one another by CD (critical difference) values. Values are average of three replications.

control plots (29.25 $plot^{-1}$) which were statistically different from all other options. Accordingly, the highest percentage pod damaged reduction (88.03%) was found in Virtako 40 WG treated plots over control followed by Nitro 505 EC (83.76%), Sex pheromone trap (76.06%), Amithrin plus 3% WDG (64.11%), Raise 20 SL (56.49%), Ecomec (31.62%), White sticky trap (11.76%) and Bioneem plus (41.08%).

The percent damage seed was also varied significantly and ranged from 6.25 to 43.75/infested pod. Significantly the lowest percent seed damaged (6.25/ infested pod) was observed in Virtako 40 WG treated plots followed by Nitro 505 EC (9.50/ infested pod), Sex pheromone trap (13.25/ infested pod), Raise 20 SL (16.25/infested pod), Ecomec (21.25/infested pod), Amithrin plus 3% WDG (25.50/infested pod), White sticky trap (32.75/infested pod) and Bioneem plus (35.25/infested pod). The

Table 4. Effect of different ecofriendly options on net return and marginal benefit cost ratio in mungbean

Ecofriendly options	Yield (kg ha^{-1})	Addl. yield over control (kg ha^{-1})	Addl. Income over control (Tk ha^{-1})	Cost of insecticide appl. (Tk ha^{-1})	Net income (Tk ha^{-1})	Marginal benefit cost ratio
Sex pheromone trap	845.00 f	57.50	4095	2620	1475	1.56
White sticky trap	862.50 ef	75	5250	2700	2502	1.94
Bioneem plus 1% EC @ 1ml L^{-1} of water	882.5 def	95	6650	5754	896	1.16
Virtako 40 WG @ 0.15g L^{-1} of water	1075.00 a	287.50	20125	5700	14425	3.53
Amithrin plus 3% WDG @ 1ml L^{-1} of water	935.00 cd	148	10360	3664	6696	2.83
Ecomec1ml L^{-1} of water	912.50 de	125	8750	4932	3818	1.77
Nitro 505 EC @ 1ml L^{-1} of water	945.50 b	158	11060	2800	8260	2.95
Raise 20 SL @ 3ml L^{-1} of water	922.500 c	135	9450	2800	6650	2.37
Untreated control	787.50 g	-	-	-	-	-
Level of significance	**	-	-	-	-	-
CV (%)	4.07	-	-	-	-	-

**Significant at 1 % level. Means within column followed by the same letter are not significantly different from one another by CD (critical difference) values. Values are average of three replications.

highest percentage of seed damage was observed in untreated control plots (43.75/ infested pod) which were statistically different from all other treatments. Accordingly, the highest percentage of seed damaged reduction over control (85.71%) was found in Virtako 40 WG treated plots followed by Nitro 505 EC (78.29%), Sex pheromone trap (69.71%), Raise 20 SL (62.86%), Ecomec (51.43%). Amithrin plus 3% WDG (41.71%), White sticky trap (24.14%) and Bioneem plus (19.43%).

Net return and marginal benefit cost ratio (MBCR): Net return and marginal benefit cost ratio are presented in Table 4. The net return and marginal benefit cost ratio was varied depending on the cost of treatment application. The highest net return (Tk. 14425 ha^{-1}) was obtained from Virtako 40 WG treated plots followed by Nitro 505 EC (Tk. 8260 ha^{-1}), Amithrin plus 3% WDG (Tk. 6696 ha^{-1}), Raise

20 SL (Tk. 6650 ha^{-1}), Ecomec (Tk. 3818 ha^{-1}), White sticky trap (Tk. 2502 ha^{-1}), Sex pheromone trap (Tk. 1475 ha^{-1}) and Bioneem plus (Tk. 896 ha^{-1}). The highest marginal benefit cost ratio (MBCR 3.63) was obtained from treated plots Virtako 40 WG followed by Raise 20 SL (MBCR 2.95), Nitro 505 EC (MBCR 2.95), Amithrin plus 3% WDG (MBCR 2.83), White sticky trap (MBCR 1.94), Ecomec (MBCR 1.77), Sex pheromone trap (MBCR 1.56) and Bioneem plus (MBCR 1.16). This was mainly due to incurring costs of these treatments.

Since Raise 20 SL provided the highest MBCR as well as moderate level of insect pests infestation. Spraying of Virtako 40 WG was found to be very promising for the management of pod borer of mungbean.

Relationship between pod infestation and yield: A negative relationship between percent pod infestation and total yield was found which indicated that there was progressive fall in the yield with the increase of pod infestation. A linear regression was fitted between pod borer infestation and total yield (Fig. 1). The correlation coefficient (r) was 0.59 and the contribution of the regression (R^2 = 0.353, when Y = - 7.8158x + 602.75) was 35.30 %.

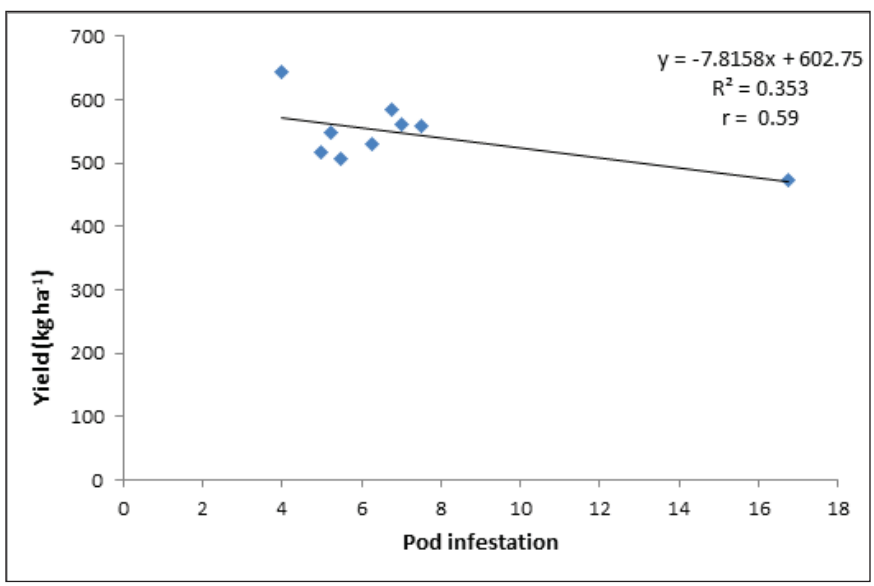


Fig. 1. Relationship between pod borer infestation and yield of mungbean obtained from different ecofriendly options.

These results agree with the reports of several researchers. Islam *et el.* (2019) found that the lowest population of gram pod borer and legume pod borer was found in Voliam flexi 300SC treated plot which showed maximum percent reduction of these pests. The lowest percent pod infestation by pod borers was observed by Voliam flexi 300SC @ 0.5 ml L^{-1} of water. Bioneem plus showed the intermediate results considering all the parameters. The maximum yield (1254.50 kg ha-1) and the highest marginal benefit cost ratio (MBCR) (6.68) were obtained from Voliam flexi 300SC. Considering effectiveness and marginal benefit cost ratio, Voliam flexi 300SC was more effective among treatments for controlling thrips and pod borers of mungbean followed by Nitro 505EC. Pod borers are normally a major coastal/sub-coastal mungbean pest, but last year, damaging numbers were reported as far west as Surat on the western Darling Downs. Pod borer pressure was so severe in some areas that a number of crops were sprayed 3-4 times. This repeated spraying also raised questions about pesticide efficacy against this pest (Factsheet 2012). Jahangir Shah *et al.* (2007) who reported that pods plant^{-1} and seed yield kg ha^{-1} varied significantly among different insecticides. Out of all the insecticides used in this study, Imidacloprid treated plots had notably the highest yield of (1563 kg ha^{-1}) while the lowest seed yield (1056 kg ha^{-1}) was obtained from the control plots where no insecticide was applied. According to Rahman (1989) spraying of Fenitrothion 0.1% at the flowering stage and the second spray either at an interval of 15 days or at podding offered the highest cost-benefit ratio. The marginal benefit cost ratio varied among different treatments which was supported by the findings of Hossain *et al.* (2004).

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