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Eco-friendly management of sucking insects and mite pests of yard long bean

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Abstract
The study was conducted in the research field of Sher-e-Bangla Agricultural University from March 2022 to June 2022. The experiment consisted of ten management packages, including T_1 = Blue sticky trap + Biomax 1.2 EC (Abamectin), T_2 = Blue sticky trap + Ecomec 1.8 EC (Abamectin), T_3 = Blue sticky trap + Biotrin (Matrin 0.5% AS), and T_4 = Yellow sticky trap + Biomax 1.2 EC (Abamectin). T_5= Yellow sticky trap + Ecomec 1.8 EC (Abamectin), T_6 = Yellow sticky trap + Biotrin (Matrin 0.5% AS), T_7= White sticky trap + Biomax 1.2 EC (Abamectin), T_8= White sticky trap + Ecomec 1.8 EC (Abamectin), T_9= White sticky trap + Biotrin (Matrin 0.5% AS), and T_{10}= untreated control. This experiment was laid out in a randomized complete block design (RCBD) with three replications. The lowest incidence of leafhoppers, aphids, whiteflies, and red mites was observed in the T_5 treatment. But thrips incidence was found lowest in the T_2 treatment. However, the lowest percent infestation of leaves (24.54%) at the vegetative stage and flower (15.39%) and pod infestation (14.10%) at the reproductive stage of yard long bean and also the highest number of pods (22.52 plant^{-1}) and yield (7.29 t ha^{-1}) was observed in the (T_5) treatment, which was followed by the (T_4) and (T_6) treatments, respectively. T_5 also showed the highest MBCR (9.91).

Keywords: Eco-friendly, management, yard long bean, organic farming, sustainable agriculture

Introduction
Yard long bean (*Vigna unguiculata*) is a nutritious green vegetable under the family of Fabaceae. Edible beans are a highly nutritious food, packed with protein, starch, minerals, and vitamins like folate, iron, potassium, and magnesium, as well as other important nutrients. Beans are low in total fat, salt, and cholesterol. Consuming a diet high in beans can enhance health by reducing the risk of heart disease, obesity, and several types of cancer due to their rich concentration of health-boosting nutrients. They are highly nutritious, boasting a significant amount of easily digestible protein in both the pods (23.5-26.3%) and the leaves (Ano and Ubochi 2008) [2]. It is also significant as a source of high-quality cattle fodder. It is also recognized for its contribution to residual nitrogen in soil (Leikam *et al*. 2007) [9]. Yard long beans are a nutritious vegetable, commonly cultivated during the kharif season, and are a good source of crucial vitamins. As a bean pod grows and develops, its seed tissues accumulate nutrients, especially protein and carbohydrates. Dry beans typically contain around 55–65% carbohydrates and 15–25% protein, along with notable amounts of iron and zinc (Mallillin *et al*. 2008) [11]. Dry beans are also a good source of B vitamins. When cooked, about 70–75% of the water-soluble vitamins in the beans are preserved (Celmeli *et al*. 2018) [6]. In the year 2020-2021, the crop occupied an area of 17680.08 hectares, and the production reached 33281.75 metric tons (BBS 2021) [3]. Farmers in Bangladesh continued using insecticides out of choice or experience because they either forgot or didn't care to follow the guidelines. The destructive effects of insecticides on people, animals, the environment, and helpful insects present a serious threat as a result. To solve this issue and safeguard both the environment and our way of life, eco-friendly management is required. One of the most efficient strategies for observing various insect species is the use of colored sticky traps **(**Bashir *et al*. 2014) [5]. Yellow sticky traps attract pests including whiteflies, aphids, leafhoppers, and leaf miners, while blue sticky traps mostly

draw thrips. Recently, a variety of chemicals containing biopesticides have offered an environmentally friendly substitute for conventional chemical pesticides, and these are highly successful in reducing insect pests of yard-long beans.

Materials and Methods

The experiment was conducted from March 2022 to June 2022 in the central farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka-1207. The yard long bean (Kagornatoki variety) seeds were used in the experiment which obtained from Bangladesh Agricultural Development Corporation (BADC), Dhaka. Ten treatments were used in the experiment such as T_1 = Blue sticky trap + Biomax 1.2 EC (Abamectin), T_2 = Blue sticky trap + Ecomec 1.8 EC (Abamectin), T_3 = Blue sticky trap + Biotrin (Matrin 0.5% AS), T_4 = Yellow sticky trap + Biomax 1.2 EC (Abamectin). T_5= Yellow sticky trap + Ecomec 1.8 EC (Abamectin), T_6 = Yellow sticky trap + Biotrin (Matrin 0.5% AS), T_7= White sticky trap + Biomax 1.2 EC (Abamectin), T_8= White sticky trap + Ecomec 1.8 EC (Abamectin), T_9= White sticky trap + Biotrin (Matrin 0.5% AS), and T_{10}= untreated control. The experiment was conducted using a Randomized Complete Block Design (RCBD) with three replications. The unit plot size was 2.2 m x 1.8 m with a distance maintained between two blocks and two plots were 1.0 m and 0.5 m, respectively. Manures and fertilizers were applied such as cowdung, @ 7 kg, urea 7 kg, TSP 9 kg and MoP 11kg ha^{-1}. Intercultural operations are maintained by Irrigation, Weeding, Staking, Installation of colored sticky traps etc.

Data were collected at seven days interval during the period of the experiment as following No. of sucking pests i.e. aphid, jassid, whitefly, thrips, mite /5 leaves,No. of aphids /5 pods,Total no. of leaves / plant,No. of infested leaves /plant,Total no. of flowers/ plant,Total no. of pods /plant, No. of healthy pods/ plant,No. of infested pods /plant ,Percent infestation of pod ,Yield data (t/ha). The marginal benefit cost ratio (MBCR) was calculated using the recent market prices of yard long bean. In the statistical analysis, the data for various characteristics were subjected analysis of variance (Anova) using statistical software Statistix-10. The mean values of all the characters were calculated and the Mean Differences were compared by TUKEY'S test at 5% level of significance.

Results and Discussion

Incidence of sucking insects and mites on leaves of yard long bean

The efficiency of various management strategies combining colored sticky traps with biopesticides showed significant variations in controlling sucking insects and red mite incidence per 5 leaves during the vegetative stage of yard-long bean, compared to the untreated control, as indicated in (Table 1). T_5 treatment was found very effective to control leafhoppers, aphids, whiteflies, and red mite pests. The lowest number of leafhoppers, aphids, whiteflies, and mites (4.43, 1.90, 1.49, and 3.66, respectively) per 5 leaves was observed in the T_5 treatment, followed by the T_4, T_6, and T_8 treatments. In contrast, the untreated control plot (T_{10}) exhibited the highest incidence of leafhopper, aphid, whitefly, and red mite pests (8.86, 6.73, 4.66, and 7.81, respectively) per 5 leaves, respectively, which was followed by T_3, T_1, and T_2 treatments (Table 1), respectively.

Table 1: Effects of colored traps integrating with biopesticides on the incidence of sucking insects and mites of yard long bean

Treatments	Number of leaf hopper/ 5 leaves	Number of aphid/ 5 leaves	Number of whitefly/ 5 leaves	Number of red mite/ 5 leaves
T_1	5. 43 b	3.52 c	2.29 b	4.90 b
T_2	5.38 b	3.47 c	2.14 bc	4.78 b
T_3	5.57 b	4.71 b	2.33 b	4.94 b
T_4	4.57 b	2.14ef	1.62 de	3.94 cd
T_5	4.43 b	1.90 f	1.49 e	3.66 d
T_6	4.95 b	2.38 ef	1.67 de	3.99 cd
T_7	5.08 b	2.80 de	1.92 bcde	4.47 bc
T_8	5.05 b	2.48 ef	1.73 cde	4.33 bcd
T_9	5.12 b	3.24 cd	2.05 bcd	4.62 bc
T_{10}	8.86 a	6.73 a	4.66 a	7.81 a
CD	1.31	0.67	0.45	0.78
CV%	8.24	6.85	7.09	5.65

At the 0.05 level of probability, means with similar letters in a column are statistically identical, whereas those with dissimilar letters differ considerably.

[T_1=Blue sticky trap plus Biomax 1.2EC (Abamectin) at 1 milliliter L-1 of water; T_2= blue sticky trap plus Ecomec 1.8 EC (Abamectin) at 1 milliliter L-1 of water; T_3=blue sticky trap plus Biotrin (Matrin 0.5% AS) at 1.4 milliliter L-1 of water; T_4 = Yellow sticky trap + Biomax 1.2EC (Abamectin) @ 1 ml L-1 of water; T_5 = Yellow sticky trap + Ecomec 1.8EC (Abamectin) @ 1 ml L-1 of water, T_6 = Yellow sticky trap + Biotrin (Matrin 0.5% AS) @ 1.4 ml L-1 of water, and 0.5 ml L-1 of water T_7=White sticky trap plus Biomax 1.2 EC (Abamectin) at 0.5 ml L-1 of water; T_8= White sticky trap plus ecomec 1.8 EC (Abamectin) at 0.5 ml L-1 of water and T_9=white sticky trap with Biotrin (Matrin 0.5% AS) at 1 ml L-1 of water ; and T_{10}=untreated control].

Incidence of aphids and thrips on flowers of yard long bean

The effectiveness of several management strategies that combined biopesticides and colored sticky traps showed notable differences in reducing the prevalence of aphids and thrips per five blooms during the flowering stage of yard-long bean, compared to the untreated control, as shown in Table 2. The lowest number of aphids (3.43) per 5 flowers was observed in the T_5 treatment. In contrast, the treatment (T_2) was observed to be highly effective in suppressing thrips populations. The lowest number of thrips (5.38) per 5 flowers was found in the T_2 treatment, comprising T_1 (5.95 per 5 flowers) and T_3 (6.19 per 5 flowers). On the contrary,

the highest incidence of thrips (12.16) per 5 flowers was observed in untreated control (T_{10}) plots. Sultana (2020) [14] observed that the greatest reduction in aphid population was achieved with Abamectin (79.02%), followed by Spinosad (73.95%) and Neem oil (69.22%) treatments on bean flowers.

Table 2: Effects of colored traps integrating with bio-pesticides on the incidence of aphids and thrips on flowers of yard long bean

Treatments	Number of aphid/ 5 flowers	Number of thrips/ 5 flowers
T_1	5.00bc	5.95 de
T_2	4.90bcd	5.38 e
T_3	5.19 b	6.19 cde
T_4	4.09 de	6.81 bcd
T_5	3.43 e	6.38 bcde
T_6	4.29 cd	6.76 bcd
T_7	4.52 bcd	7.29bc
T_8	4.48 bcd	6.95bcd
T_9	4.76 bcd	7.62 b
T_{10}	9.57 a	12.16 a
CD	0.85	1.25
CV%	5.79	5.98

At the 0.05 level of probability, means with similar letters in a column are statistically identical, whereas those with dissimilar letters differ considerably.

[T_1=Blue sticky trap plus Biomax 1.2EC (Abamectin) at 1 milliliter L-1 of water; T_2= blue sticky trap plus Ecomec 1.8 EC (Abamectin) at 1 milliliter L-1 of water; T_3=blue sticky trap plus Biotrin (Matrin 0.5% AS) at 1.4 milliliter L-1 of water; T_4 = Yellow sticky trap + Biomax 1.2EC (Abamectin) @ 1 ml L-1 of water; T_5 = Yellow sticky trap + Ecomec 1.8EC (Abamectin) @ 1 ml L-1 of water, T_6 = Yellow sticky trap + Biotrin (Matrin 0.5% AS) @ 1.4 ml L-1 of water, and 0.5 ml L-1 of water T_7=White sticky trap plus Biomax 1.2 EC (Abamectin) at 0.5 ml L-1 of water; T_8= White sticky trap plus ecomec 1.8 EC (Abamectin) at 0.5 ml L-1 of water and T_9=white sticky trap with Biotrin (Matrin 0.5% AS) at 1 ml L-1 of water ; and T_{10}=untreated control].

Incidence of aphids on pods of yard long bean

The lowest number of aphid (3.93) per 5 pods in (T_5) treatment comprising by T_4 (4.05), and T_6 (4.11) treatments respectively. On the contrary, the untreated control plots (T_{10}) showed the highest incidence of aphid (12.82) per 5 pods followed by T_3, T_1 and T_2 treatments (Figure 1). Uddin (2013) [17] reported that aphid are known to heavily infest yard long beans. Hossain *et al*. (2022) [7] suggested that aphid on beans can be monitored and suppressed by yellow sticky traps and biopesticides.

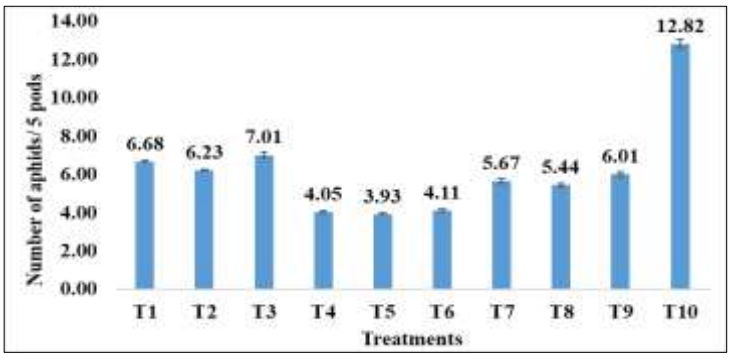

Fig 1: Number of aphids on pods of yard long bean in different treatments.

[T_1=Blue sticky trap plus Biomax 1.2EC (Abamectin) at 1 milliliter L-1 of water; T_2= blue sticky trap plus Ecomec 1.8 EC (Abamectin) at 1 milliliter L-1 of water; T_3=blue sticky trap plus Biotrin (Matrin 0.5% AS) at 1.4 milliliter L-1 of water; T_4 = Yellow sticky trap + Biomax 1.2EC (Abamectin) @ 1 ml L-1 of water; T_5 = Yellow sticky trap + Ecomec 1.8EC (Abamectin) @ 1 ml L-1 of water, T_6 = Yellow sticky trap + Biotrin (Matrin 0.5% AS) @ 1.4 ml L-1 of water, and 0.5 ml L-1 of water T_7=White sticky trap plus Biomax 1.2 EC (Abamectin) at 0.5 ml L-1 of water; T_8= White sticky trap plus ecomec 1.8 EC (Abamectin) at 0.5 ml L-1 of water and T_9=white sticky trap with Biotrin (Matrin 0.5% AS) at 1 ml L-1 of water ; and T_{10}=untreated control].

Percent leaf infestation by sucking insects and red mites on yard long bean

The significant variations observed in the effectiveness of various management tactics, particularly those integrated with colored sticky traps along with biopesticides, compared to the untreated control, emphasize the importance of implementing effective pest management strategies to reduce leaf infestation by sucking insects and red mites during the vegetative stage of yard-long beans, as illustrated in Table 3. The highest number of total leaves per plant (108.57) but the lowest percent of leaf infestation (24.54%) in the T_5 treatment, comprising T_4, T_6, and T_8 treatments. The (T_5) treatment reduced the highest percent (47.72%) of leaf infestation. On the other hand, the lowest number of total leaves per plant (82.40), but the highest percent of leaf infestation (46.94%), was observed in untreated control (T_{10}) plots, which was followed by T_3, T_1, and T_2 treatments, respectively (Table 3). The lowest number of infested leaves/plants was found in T_5 (26.60).

Table 3: Effects of coloured sticky traps integrating with biopesticides on yard long bean leaf infestation by sucking insects and red mites

Treatments	Number of total leaves/plants	Number of infested leaves/plants	% infested leaves/plant	% infestation reduction of leaves
T_1	86.83 cde	31.02 b	35.73b	23.88
T_2	87.47 cde	30.96 b	35.39 b	24.60
T_3	85.68 de	31.26 b	36.50 b	22.24
T_4	106.50 a	27.89 bc	26.18 cd	44.22
T_5	108.57 a	26.60 c	24.54 d	47.72
T_6	101.87 ab	28.22 bc	27.71 cd	40.96
T_7	95.30 bcd	29.70 bc	31.29 bc	33.34
T_8	96.20 bc	29.43 bc	30.62 bcd	34.76
T_9	94.70 bcd	29.93bc	31.67 bc	32.53
T_{10}	82.40 e	38.67 a	46.94 a	-
CD	9.63	4.27	6.22	-
CV%	3.48	4.81	6.50	-

At the 0.05 level of probability, means with similar letters in a column are statistically identical, whereas those with dissimilar letters differ considerably.

[T_1=Blue sticky trap plus Biomax 1.2EC (Abamectin) at 1 milliliter L-1 of water; T_2= blue sticky trap plus Ecomec 1.8 EC (Abamectin) at 1 milliliter L-1 of water; T_3=blue sticky trap plus Biotrin (Matrin 0.5% AS) at 1.4 milliliter L-1 of water; T_4 = Yellow sticky trap + Biomax 1.2EC (Abamectin) @ 1 ml L-1 of water; T_5 = Yellow sticky trap + Ecomec 1.8EC (Abamectin) @ 1 ml L-1 of water, T_6 = Yellow sticky trap + Biotrin (Matrin 0.5% AS) @ 1.4 ml L-1 of water, and 0.5 ml L-1 of water T_7=White sticky trap plus Biomax 1.2 EC (Abamectin) at 0.5 ml L-1 of water; T_8= White sticky trap plus ecomec 1.8 EC (Abamectin) at 0.5 ml L-1 of water and T_9=white sticky trap with Biotrin (Matrin 0.5% AS) at 1 ml L-1 of water ; and T_{10}=untreated control].

Flower number and percent flower infestation by sucking insects on yard long bean

Table 4 shows that, when compared to the untreated control, there were notable differences in the efficacy of several control strategies that used colored sticky traps with biopesticides to manage sucking pests, such as aphids and thrips, during the blooming stage of yard-long beans. The T5 treatment had the greatest number of flowers overall (27.72) per plant but the lowest percentage of floral infestation (15.39%). This treatment included T_4 and T_6 treatments. The T_5 treatment also reduced the maximum flower infestation (73.22%). In contrast, the lowest number of total flowers per plant (22.87), but the untreated control (T_{10}) plots exhibited the highest percent of flower infestation (57.47%), which was followed by T_3, T_1, and T_9 treatments, respectively. The T_9 treatment reduced the lowest percent of leaf infestation (49.64%) (Table 4). Sani (2017) reported that the legume flower thrips was the most significant pest of leguminous vegetables, which can be effectively controlled by using biopesticides as alternatives to synthetic chemical insecticides.

Table 4: Effects of coloured sticky traps integrating with biopesticides on flower infestation of yard long bean by sucking insects

Treatments	Number of total flowers/plants	Number of infested flowers/plants	% infested flowers/plant	% infestation reduction of flowers
T_1	25.45 ab	8.07 bc	31.71 bc	44.82
T_2	25.56 ab	7.77 bc	30.40bc	47.10
T_3	25.27 ab	8.33 b	32.97 b	42.63
T_4	26.50 ab	5.07 e	19.10 ef	66.76
T_5	27.72 a	4.27 e	15.39 f	73.22
T_6	26.36 ab	5.31 e	20.37def	64.56
T_7	26.07 ab	7.13 cd	27.40 bcd	52.32
T_8	26.31 ab	6.43 d	24.62 cde	57.10
T_9	25.77 ab	7.45 bcd	28.94bc	49.64
T_{10}	22.87 b	13.10 a	57.47 a	-
CD	4.46	1.05	7.35	-
CV%	5.92	4.91	8.71	

At the 0.05 level of probability, means with similar letters in a column are statistically identical, whereas those with dissimilar letters differ considerably.

[T_1=Blue sticky trap plus Biomax 1.2EC (Abamectin) at 1 milliliter L-1 of water; T_2= blue sticky trap plus Ecomec 1.8 EC (Abamectin) at 1 milliliter L-1 of water; T_3=blue sticky trap plus Biotrin (Matrin 0.5% AS) at 1.4 milliliter L-1 of water; T_4 = Yellow sticky trap + Biomax 1.2EC (Abamectin) @ 1 ml L-1 of water; T_5 = Yellow sticky trap + Ecomec 1.8EC (Abamectin) @ 1 ml L-1 of water, T_6 = Yellow sticky trap + Biotrin (Matrin 0.5% AS) @ 1.4 ml L-1 of water, and 0.5 ml L-1 of water T_7=White sticky trap plus Biomax 1.2 EC (Abamectin) at 0.5 ml L-1 of water; T_8= White sticky trap plus ecomec 1.8 EC (Abamectin) at 0.5 ml L-1 of water and T_9=white sticky trap with Biotrin (Matrin 0.5% AS) at 1 ml L-1 of water ; and T_{10}=untreated control.].

Yield of yard long bean

The highest yield of yard long bean (7.29 t per ha) was observed in (T_5) treatment comprising by T_4 (7.12 t per ha), and T_6 (7.03 t per ha) treatments. On the contrary, the lowest yield (5.13 t per ha) was observed in untreated control (T_{10}) plots which was followed by T_3 and T_1 treatments (Figure 2). In contrast, Rashid *et al.* (2022) [12] indicated that the highest yield was achieved through the combined application of Fimrite and Biotrin integrated with blue sticky trap to control thrips and mites on another crop chilli.

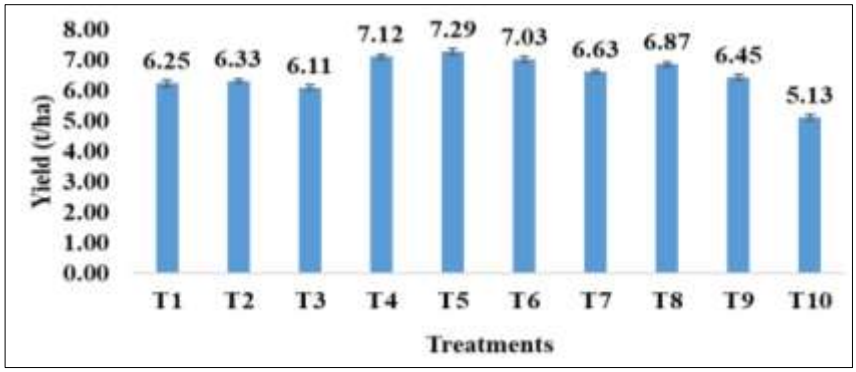

Fig 2: Yield of yard long bean in different treatments.

T_1=Blue sticky trap plus Biomax 1.2EC (Abamectin) at 1 milliliter L-1 of water; T_2= blue sticky trap plus Ecomec 1.8 EC (Abamectin) at 1 milliliter L-1 of water; T_3=blue sticky trap plus Biotrin (Matrin 0.5% AS) at 1.4 milliliter L-1 of water; T_4 = Yellow sticky trap + Biomax 1.2EC (Abamectin) @ 1 ml L-1 of water; T_5 = Yellow sticky trap + Ecomec 1.8EC (Abamectin) @ 1 ml L-1 of water, T_6 = Yellow sticky trap + Biotrin (Matrin 0.5% AS) @ 1.4 ml L-1 of water, and 0.5 ml L-1 of water T_7=White sticky trap plus Biomax 1.2 EC (Abamectin) at 0.5 ml L-1 of water; T_8= White sticky trap plus ecomec 1.8 EC (Abamectin) at 0.5 ml L-1 of water and T_9=white sticky trap with Biotrin (Matrin 0.5% AS) at 1 ml L-1 of water ; and T_{10}=untreated control.

Marginal benefit-cost ratio (MBCR) in yard long bean production

The net profit and marginal benefit cost ratio in the case of yard long bean production are illustrated in (Table 5). The net return and marginal benefit cost ratio fluctuated based on the expense of biopesticide applications. The highest net return (Tk. 98100.00 per ha) was recorded from the T_5 treated plots, followed by the T_4 (Tk. 83300.00) and T_6 (Tk. 81050.00) treatments. The highest marginal benefit (MBCR 9.91) came from (T_5) treated plots, but due to higher costs, the MBCR of Biomax 1.2 EC (Abamectin) goes down to Biotrin. The second highest benefit (MBCR 7.79) was obtained from the (T_8) treated plots, which were followed by (T_6) (MBCR 5.81) and (T_4) (MBCR 5.14), respectively. The lowest MBCR (2.46) was found in the (T_1) treatment, followed by the (T_3) and (T_7) treatments, in which the MBCR was found to be 2.51 and 3.63, respectively.

Table 5: Impact of colored traps combined with biopesticides on yard-long bean production's net return and marginal benefit cost ratio (MBCR)

Treatments	Yield (t/ha)	Addl. Yield over control (t/ha)	Addl. Return over control (Tk/ha)	Cost of pest management (Tk/ha)	Net return (Tk/ha)	MBCR
T_1	6.25	1.12	56000.00	16200	39800.00	2.46
T_2	6.33	1.20	60000.00	9900	50100.00	5.06
T_3	6.11	0.98	49000.00	13950	35050.00	2.51
T_4	7.12	1.99	99500.00	16200	83300.00	5.14
T_5	7.29	2.16	108000.00	9900	98100.00	9.91
T_6	7.03	1.90	95000.00	13950	81050.00	5.81
T_7	6.63	1.50	75000.00	16200	58800.00	3.63
T_8	6.87	1.74	87000.00	9900	77100.00	7.79
T_9	6.45	1.32	66000.00	13950	52050.00	3.73
T_{10}	5.13	-	-	-	-	-

At the 0.05 level of probability, means with similar letters in a column are statistically identical, whereas those with dissimilar letters differ considerably.

T_1=Blue sticky trap plus Biomax 1.2EC (Abamectin) at 1 milliliter L-1 of water; T_2= blue sticky trap plus Ecomec 1.8 EC (Abamectin) at 1 milliliter L-1 of water; T_3=blue sticky trap plus Biotrin (Matrin 0.5% AS) at 1.4 milliliter L-1 of water; T_4 = Yellow sticky trap + Biomax 1.2EC (Abamectin) @ 1 ml L-1 of water; T_5 = Yellow sticky trap + Ecomec 1.8EC (Abamectin) @ 1 ml L-1 of water, T_6 = Yellow sticky trap + Biotrin (Matrin 0.5% AS) @ 1.4 ml L-1 of water, and 0.5 ml L-1 of water T_7=White sticky trap plus Biomax 1.2 EC (Abamectin) at 0.5 ml L-1 of water; T_8= White sticky trap plus ecomec 1.8 EC (Abamectin) at 0.5 ml L-1 of water and T_9=white sticky trap with Biotrin (Matrin 0.5% AS) at 1 ml L-1 of water ; and T_{10}=untreated control.

Biomax 1.2 EC (Abamectin) /spray = Tk. 3200 /500 ml/ha, Ecomec 1.8 EC (Abamectin) /spray = Tk. 1100/500 ml/ha, Biotrin 0.5% AS/spray = Tk. 2450/700 ml/ha, 3 times sprayed /ha, 2 labors needed for per ha per spray, Labour wage for spraying pesticides = Tk. 500/day/labour (8 hours day), Trap (blue, yellow, white) = Tk. 40/ trap. Av. market price of edible yard long bean pod = Tk.50/kg.

Conclusion

The findings showed that in the case of the incidence of sucking insects and mites on the leaves of yard-long beans, the lowest number of leafhoppers, aphids, whiteflies, and mites was observed in the yellow sticky trap + Ecomec 1.8 EC (Abamectin) (T_5) treatment, followed by T_4 and T_6 treatments. On the contrary, the highest incidence of leafhopper, aphid, whitefly, and red mite pests was observed in untreated control (T_{10}) plots, which were followed by T_3,

$T_{1,}$ and T_2 treatments, respectively. In case of incidence of aphids and thrips on flowers of yard-long bean, the lowest number of aphids was observed in the T_5 treatment, followed by T_4 and T_6 treatments. On the contrary, the highest incidence of aphids was found in untreated control (T_{10}) plots, which was followed by T_3, $T_{1,}$ and T_2 treatments. The highest number of total leaves, total flowers, and pods per plant was observed in the T_5 treatment, followed by the T_4, $T_{6,}$ T_8, and T_7 treatments, respectively. On the contrary, the lowest number of total leaves, pods per plant, and leaf infestation was observed in untreated control (T_{10}) plots, which was followed by T_3, $T_{1,}$ and T_2 treatments, respectively. The highest yield of yard long bean (7.29 t per ha) was found in the T_5 treatment, followed by the T_4 (7.12 t per ha) and T_6 (7.03 t per ha) treatments. Conversely, the lowest yield (5.13 per ha) was found in the untreated control (T_{10}) plots. So T_5 treatment showed the best combination regarding the cost of production as well as a higher yield**.**

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