Up scaling and field validation of bio-rational based integrated management package against fruit fly of sweet gourd at Jessore region

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Abstract

Fruit fly is a devastating insect pest of cucurbitaceous vegetables especially in sweet gourd. Considering the alarming consequences of pesticide usage and residual effect on the environment, pragmatic programme is now needed to minimize the dependency on insecticides without hampering crop production. To explore options for achieving this, a replicated experiment was conducted at Regional Agricultural Research Station (RARS) of Bangladesh Agricultural Research Institute (BARI) during 2015-17 to evaluate crop performance with varying control measures against fruit fly of sweet gourd. Three management options were compared such as T_1: IPM package-1 (Sanitation + Sex pheromone traps), T_2: IPM package-2 (Sanitation + Sex pheromone traps with 3 times application of Spinosad @ 0.4 ml/L) and T_3: Farmers' practice (Spray of Thiamethoxam + Chlorantraniliprol (@ 0.5 ml/L). Among the approaches, IPM package-2 appeared to be most effective and showed comparatively lower fruit infestation and provided 34.85% higher yield over control. In case of marginal benefit cost ratio (MBCR), the highest value was also obtained from IPM package-2 (3.01) followed by IPM package-1 (2.48). Finally, it revealed that IPM package-2 is the best practice to control fruit fly of sweet gourd as well as better production.

Keywords: Sweet gourd, Fruit fly, IPM, Sex pheromone trap and Spinosad

Introduction

Bangladesh is the 3rd in global vegetable production remained in the lower position in intake. Farmers are getting huge profit from vegetable production which is changing their life. Sweet gourd **(***Cucubita maxima*) is a very popular vegetable under cucurbitaceae family, cultivated in 6.83% land area in Bangladesh (BBS, 2011). It is a good source of carbohydrate, vitamin A and C, and minerals. Currently, about 1.8 lakh metric ton *rabi* sweet gourd is being produced from an area of 17,255 hectare (ha) of land (BBS, 2015). Sweet gourd fruits are used in making curry and different sweet dishes. Ripe whole fruits can be preserved dry for several months.

Fruit fly (*Bactrocera cucurbitae*) is a destructive pest can attack 16 different types of cucurbit crops. It is very difficult to manage this pest by applying insecticides. The increasing use of synthetic insecticides has led to a number of problems such as development of resistance to insecticides in some insect pests, high insecticide residues, resurgence or increased infestation by some insect species due to the destruction of natural predators and parasitoids.

Integrated pest management (IPM), is popularizing among the farmers' of Bangladesh since last few years as well as the policy makers. Approaches of IPM, is thought to be the best and effective control measures in vegetable pest in many countries of the world as well as in Bangladesh. In fact, IPM is a holistic approach to crop production based on sound ecological management, termed as eco-friendly pest management. For this reasons, the present study was undertaken to validate and upscale IPM package for the control of fruit fly in sweet gourd crops and to produce toxic synthetic chemical pesticide free vegetables.

Materials and Methods

The experiment was conducted over two years (2015-17) in *rabi* season (November to April) at the experimental farm of the Regional Agricultural Research Station of Bangladesh Agricultural Research Institute at Jessore (23°11′ N, 89°14′ E and 16 m ASL). The experiment was laid out in a randomized complete block (RCB) design with three dispersed replications. The treatments were as follows: T_1: IPM package-1

(Sanitation + Sex pheromone traps), T_2: IPM package-2 (Sanitation + Sex pheromone traps with 3 times application of Spinosad @ 0.4 ml/L) and T_3: Farmers' practice, FP (Spray of Thiamethoxam + Chlorantraniliprol (@ 0.5 ml/L). The unit plot size was 6.0 m x 6.0 m with 2.0 m row to row and 2.0 m plant to plant distance. Sweet gourd seeds were planted on 26 and 23 November in 2015 and 2016, respectively. Seeds were planted in a pit (30 cm X 30 cm X 30 cm) with 3 seeds per pit. Total fertilizer application was 173,173,150, 98, 12 and 10 kg/ha of urea, triples super phosphate, muriate of potash, gypsum and borax, respectively. All the fertilizers except urea were applied in the pit at final land preparation. Urea was applied in 2 splits at 30 and 60 days after seeding (DAS), with hand weeding each year. The crop was harvested at full maturity in mid-April. Data were analyzed using MSTAT software and means were separated by LSD. Marginal Benefit Cost Ratio was calculated on the basis of prevailing market prices of the commodities.

Results and Discussion

Effect on fruit infestation

The lowest percent of fruit infestation was recorded in IPM package-2 (10.62% in 2015-16 and 10.67% in 2016-17) whereas Farmers practiced plot had the highest infestation (20.04% in 2015-16 and 18.67% in 2016-17). The reduction of fruit infestation over Farmer practice was higher in IPM package-2 (47% in 2015-16 and 42.85% in 2016-17) than that of IPM package-1 (37.62% in 2015-16 and 39.31% in 2016-17) over Farmers practice (Table 1). The reason of fruit fly control in IPM package was due to minimize the growth rate of insect by attacking male insect into the trap, resulted poor sexual production as well as decrease the insect population.

Effect on yield

Yield varied significantly among the treatments. The highest marketable yield (40.85 t/ha in 2015-16 and 41.47 t/ha in 2016-17) was recorded from IPM package-2 followed by IPM package 1 (33.92 t/ha in 2015-16 and 37.24 t/ha in 2016-17) whereas the lowest in Farmers' practice (26.61 t/ha and 27.64 t/ha in 2016-17)). Yield increased over Farmers practice in IPM package-2 (34.85 in 2015-16 and 33.34 in 2016-17) was higher than that of IPM package-1 (21.55 in 2015-16 and 25.78 in 2016-17) (Table 1).

Economic performance

Economic analysis was presented in Table 2. The average (mean of 2 years) highest gross return (617250 Tk/ha) and net return (551249 Tk/ha) was found in IPM package-2 followed by IPM package-1 (gross return: 533700 Tk/ha and net return: 481697 Tk/ha) and the lowest in Farmers' practice (gross return: 406800 Tk/ha and net return: 352847 Tk/ha). In case of Marginal Benefit Cost Ratio, the highest value was alas obtained from IPM package-2 (3.01) against 2.48 in IPM package-1.

In the study, IPM package-2 had the lowest infestation, offered higher yield and economic return than other treatments. In the treatment, Spinosad along with sanitation and sex pheromone trap was used to control fruit fly infesting fruit fly. Sanitation reduced fruit fly incidence by destroying source of infestation. Sex pheromone trap also reduced the pest by capturing adult moth before mating. Spinosad, an insecticide derived from metabolites from the soil bacterium, *Saccharopolyspora spinosa*, has been classified as an environmentally and toxicologically reduced risked insecticide. The effectiveness of Spinosad has been claimed by a good number of researchers which clearly supports the findings of present investigation. Harris and Maclean (1999) conducted field trials in commercial cabbage & cauliflower and reported that Spinosad gave a high level of control of diamondback moth (*Plutella xylostella*), white butterfly (*Pieris rapae*) and leaf miner (*Scaptomyza* sp.). According to Raymond & Clifford (2000) and Jones *et al*. (2005) Spinosad was effective against immature and adult stage of western flower thrips.

Conclusion

Considering the above discussion, it can be concluded that IPM package-2 may be an effective practice for sweet gourd growers at Jessore region to obtain higher economic yield.

Table 1. Effect of IPM package on fruit infestation and yield of sweet gourd against cucurbit fruit fly at RARS, Jessore during 2015-17

Treatment	Fruit infestation (%)		Infestation reduction over FP (%)		Yield (t/ha)		Yield increased over FP (%)	
	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17
T_1	12.50	11.33	37.62	39.31	33.92	37.24	21.55	25.78
T_2	10.62	10.67	47.00	42.85	40.85	41.47	34.85	33.34
T_3	20.04	18.67	-	-	26.61	27.64	-	-
CV (%)	25.16	25.16	-	-	13.09	13.09	-	-
LSD (0.05)	6.78	5.91	-	-	2.65	3.64	-	-

Table 2. Economic analysis of different management tactic against fruit fly of sweet gourd at RARS, Jessore during 2015-17 (mean of two years)

Treatments	Yield (t/ha)	Gross return (Tk/ha)	Cost of treatments (Tk/ha)	Net return (Tk/ha)	Adjusted Net return (Tk/ha)	MBCR
T_1	35.58	533700	52003	481697	128850	2.48
T_2	41.15	617250	66001	551249	198402	3.01
T_3	27.12	406800	53953	352847	-	-

Note: Price of sweet gourd @ Tk. 15 per kg, sex pheromone trap @ Tk. 3300/ ha, volume flexi 300 S.C (Thiamethoxam + Chlorantraniliprol)@ Tk. 7000/L, Success 2.5 S.C (Spinosad) @ Tk. 2600/L, Two labours/spray/ha @ Tk. 300/labour/day, spray volume required 500 L/ha. and Treatments:

T_1: IPM package-1= Sanitation + Sex pheromone traps
T_2: IPM package-2= Sanitation + Sex pheromone traps with 3 times application of Spinosad @ 0.4 ml/L
T_3: Farmers' practice = Spray of Thiamethoxam + Chlorantraniliprol (@ 0.5 ml/L)

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