Biorational based IPM module for the management of shoot and fruit Borer, *Leucinodes Orbonalis* in Brinjal

Abstract

The present Study was undertaken to evaluate the integrated pest management module against *L.orbonalis* in brinjal under field conditions. The brinjal fruit from Salem district is being exported to other states. Due to this huge demand, farmers tend to spray a greater number of pesticidal sprays to prevent slight damage or bore hole due to *L. orbonalis*. On the basis of damaged shoots and fruits individually, the brinjal shoot and fruit borer's impact on the crop was calculated. In order to assess the per cent shoot damage, the damaged shoots on five randomly selected tagged plants were counted as against total available shoots on the observed plants. In this study, *Kharif* and *Rabi* season recorded highest fruit yield of 288.71 and 307.50 quintals/ha and favorable cost benefit ratio of 1:2.07 and 1: 2.03 was recorded in IPM module plot respectively

Keywords: Biorational, shoot and fruit borer, Brinjal

Introduction

"Shoot and fruit borer, *Lucinodes orbonalis* Guene is important pest in brinjal cultivation. The severe infestation of *L.orbonalis* leads to yield reduction up to 20.70 to 88.70% in India" (Raju *et al*.,2007 and Haseeb *et al*.,2009). Most of the farmers depends on insecticides spray for the management of this shoot and fruit borer. Due to L. orbonalis' internal feeding behaviour, pesticide efficiency and efficacy are greatly diminished. Farmers typically use two to three insecticide applications per week to quickly eliminate the L. orbonalis infestation, however this practise leads to the development of insecticide resistance in the L. orbonalis. Additionally, the overuse and careless application of pesticides in the environment of the brinjal plant results in bioaccumulation, biomagnification, and rapid extinction of natural enemies, as well as disruptions of ecological balances. Brinjal is grown under drip irrigation in the Salem area of Tamil Nadu, India, with an average output of 90–120 tonnes/ha. Due to its nutritive value consisting of minerals like iron, phosphorus, calcium and vitamins like A, B and C. Unripe fruits are used primarily as a raw material in pickle making and excellent remedy for those suffering from liver complaint. The brinjal fruit from Salem district is being exported to other states. Due to this huge demand farmers tend to spray more number of pesticidal spray to prevent slight damage or bore hole due to *L.orbonalis.* The infested fruits become unfit for consumption due to loss of quality and hence lose their market value. In Salem district brinjal is cultivated in summer months using drip irrigation system. Hence it is subject to attack by sucking pest. Although insecticidal control is one of the major means used to combat insect pests in brinjal, many pesticides used are ineffective in providing this pest with a suitable level of control. Because brinjal is grown as a vegetable, using chemical insecticides will leave hazardous residues on the fruits. Therefore, using plant products, organic amendments, and pesticides with microbial origins could be unique ways to manage the pest. The role of integrated pest management in brinjal pest management has obvious advantages in terms of effectiveness, safety to non target organisms and cost of cultivation with special reference to plant protection cost. Combining several management strategies will allow for effective management of the shoot and fruit borer L. orbonalis. The present experiment was therefore carried out to assess the integrated pest control module against L. orbonalis in brinjal under field conditions, keeping the aforementioned issue in mind.

Materials and Methods

i. Experimental site

Evaluation of integrated pest management module were conducted during *Kharif* and *Rabi* seasons of 2016 - 17 in the 10 farmers field at Rakkipatty village of Salem district. In each season the integrated pest management module was evaluated in ten farmers' field. The experimental field was at 11.5615715˚N Latitude 78.0348587 ˚E Longitudes having an elevation of 400 feet from sea level under agro-ecological zone (AEZ) 30. The average minimum and maximum temperature were 3.7.3 ˚C and 28.4 ˚C and the average relative humidity was 79 %. The soil of the experimental field was moderately deep; loamy skeletal with pH 7.4 and medium in water holding capacity (21 – 50%)

ii. Plant Materials

The brinjal Hybrid turban was transplanted in the main field with the spacing of 150 cm x 60 cm

iii. Land Fertilization

The crop was supplemented with 25 MT of FYM and a total of 200:100:100 kg N: P2O5:K2O per ha. All the Phosphorus, potash and 25% of Nitrogen is applied as basal dose. Remaining 75% of N is applied in three equal split doses. Twenty days following transplantation, the first split dosage of N is administered. The second dose is administered soon before flowering begins, and the third dose after the first picking/harvesting.

iv. Experimental Design and Layout

Treatments in experiments were laid out in a Randomized Complete Block Design (RCBD) with 10 replications and 3 treatments. Three treatments *viz.*, IPM module, farmers practice and untreated control.

T1 IPM Module Components

i. Spraying of neem oil 3 % @ 2.5ml/lit
ii. Placing of *L.orbonalis* pheromone trap @ 4 numbers/acre from 30 DAT
iii. Release of egg parasitoid *Trichogramma chilonis* @ 1.25 lakhs/Ha at weekly
iv. intervals from 30 DAP
v. Spraying of *Bacillus thuringiensis* @ 2g/lit when eggs and neonate larvae of
vi. *L.orbonalis* observed
vii. Spraying of flubendiamide 20 WG @ 375 g/750 lit when fruit damage exceeds 5%

T2 Farmers' Practice components

i. Spraying of thiomethaxam 25 WDG @ 0.5 g/lit twice at weekly intervals
ii. Spraying of chlorantraniliprole 18.5 SC @ 0.3 ml/lit twice at weekly intervals
iii. Spraying of profenophos 50 EC @ 2 ml/lit weekly intervals)

T3 untreated control.

v. Data recorded

Crop damage caused by brinjal shoot and fruit borer was measured on the basis of damaged shoot and fruits separately. In order to assess the per cent shoot damage, the damaged shoots on five randomly selected tagged plants were counted against total available shoots on the observed plants. The fruit damage was recorded during each harvest and expressed as percentage of damaged fruits to the total fruits harvested. The yield was worked out based on the healthy fruits harvested. The economics of IPM module, farmers practice and untreated control were computed on the basis of current labor cost, cost of inputs and average market rate of brinjal fruits.

Results

Field trial was laid out in large plots during *Kharif* 2016 - 17 and *Rabi* 2016 - 17 to evaluate the IPM module in comparison with farmers practice and untreated control against *L.orbonalis.*

Population dynamics of shoot and fruit borer and natural enemies during *Kharif* season 2016-17

The post treatment mean population of *L.orbonalis* shoot damage (3.63%), fruit damage (2.21%) was low in IPM module plots as compared to untreated control and farmers practice plots (28.15 and 9.82% shoot damage; 47.50 and 15.40 % fruit damage by *L.orbonalis* in untreated control and farmers practice plot respectively) Higher number of predators coccenellids (15.20 numbers/plant) and C*hrysoperla* (8.10 numbers/plant) recorded in untreated control plots followed by IPM module plot (coccinellids 9.11 numbers/plant and *Chrysoperla* 1.11 numbers/plant) while lowest population of predators (coccinellids 1.11 numbers/plant and nil population of *Chrysoperla*) was recorded in farmers practice plots. The IPM module plot had the highest fruit output, 288.71 quintals/ha, with a favourable cost-benefit ratio of 1:2.07, while farmers' practises had the lowest fruit yield, 201 quintals/ha, with a cost-benefit ratio of 1:1.34 during the Kharif season. **Population dynamics of shoot and fruit borer and natural enemies during *Rabi* season 2016-17**

During *Rabi* season the post treatment damage due to *L.orbonalis* shoot damage (4.10%), fruit damage (3.10 %) was low in IPM module plot as compared to untreated control and farmers practice (35.20% and 11.50% shoot damage: 52.10% and 19.50% fruit damage by *L.orbonalis* in untreated control and farmers practice plots respectively). Higher number of predators coccinellids (18.60 number/plant) and *Chrysoperla* (11.90 numbers/plant) was recorded in untreated control plots followed by IPM plots (coccinellids 10.20 numbers/plant and *Chrysoperla* 9.50 numbers/plant) while lowest population of coccinellids 2.50 numbers/plant and *Chrysoperla* 1.20 numbers/plant was recorded in farmers practice plots. The IPM module plot had the highest fruit output of 307.50 q/ha with a good cost benefit ratio of 1: 2.03.

Incidence of shoot and fruit damage by *L orbonalis* in different treatments

The incidence of shoot damage due to *L orbonalis* ranged between 3.63 to 28.15 % in *Kharif* season as compared to 4.10 to 35.20 in *Rabi* season. The mean shoot damage in IPM module plot, farmers practice and untreated control of 2.217 %, 15.40% and 47.50% respectively during *Kharif* season. The mean fruit damage in IPM module plot, farmers practice and untreated control is 3.10%, 19.50 % and 52.10% respectively during *Rabi* season. In *Kharif* and *Rabi* season lowest shoot and fruit damage of 3.63%, 2.21% and 4.10%, 3.10% respectively was recorded in IPM module plot.

Discussion

“The IPM components *viz.*, application of neem cake, installation of pheromone traps, clipping of infested shoots and fruits, spraying of neem oil reduced the shoot infestation to 1.89 and 1.79% and the fruit infestation to 13.07 and 6.56% for summer and *kharif* seasons respectively” (Rath and Bijayeeny Dash, 2005). “The NSKE @ 5ml/l along with cultural practices increased the marketable yield of brinjal” (Sharma *et al.*, 2012). Shanmugam *et al* ., 2015 revealed that "the biointensive approach comprises of seedling treatment with imidacloprid 200SL, soil incorporation of neem cake, placing of yellow sticky trap, spraying of neem soap, collection and destruction of infested shoots and fruits, placing of sex pheromone trap and release of *T chilonis* along with need based application of biopesticides Bt (or) emamectin benzoate (or) chlorantraniliprole 18.5 SC reduced the shoot and fruit damage of 9.06 and 16.53 % in *Kharif* and 9.46 and 15.06 % in *Rabi* season respectively with favorable benefit cost ratio of 9.14 and 9.10 during *Kharif* and *Rabi* season respectively". Dutta *et al.*, (2011) revealed that "installation of 65 pheromone traps per hectare reduced the shoot and fruit damage to 58.39 to 38.17% respectively. In present study *Kharif* and *Rabi* season recorded highest fruit yield of 288.71 and 307.50 quintals/ha and favourable cost benefit ratio of 1:2.07 and 1: 2.03 was recorded in IPM module plot respectively". The present investigations are similar with the findings of (Rath and Bijayeeny Dash, 2005 and Shanmugam *et al.*, 2015 who reported that IPM components reduced the brinjal shoot and fruit infestation of *L orbonalis* in *Kharif and Rabi* seasons.

Conclusion

The incidence of shoot and fruit damage due to *L orbonalis* recorded lowest infestation in *Kharif* season and highest in *Rabi* season. The mean shoot and fruit damage was lowest in IPM module plot during *Kharif* and *Rabi* season. Highest fruit yield of 288.71 and 201 quintals/ha with favorable cost benefit ratio of 1:2.07 and 1: 2.03 was recorded from IPM module plot during *Kharif* and *Rabi* seasons respectively. It has been concluded that IPM module application in brinjal has an advantage in terms of effectiveness, safety to non-target organisms and cost of cultivation with special reference to plant protection cost.

Table 1. Population dynamics of shoot and fruit borer during *Kharif* 2016 - 17

Insect pests (Mean population)	**IPM module**		**Farmers practice**		**Untreated control**	
Kharif 2016-17	PTC	Post treatment count	PTC	Post treatment count	PTC	Post treatmen t count
Soot and fruit borer shoot damage percentage	5.70	3.63	4.30	9.82	5.10	28.15
Soot and fruit borer fruit damage percentage;	6.40	2.21	8.10	15.40	10.40	47.50
Population of coccinellid beetle	4.00	9.11	3.40	1.11	3.90	15.20
Population of *Chrysoperla*	2.40	3.20	2.00	0.00	1.40	8.10
Yield quintals/ha	288.71		201		120	
Cost of cultivation (Rs/ha)	139350		149525		115000	
Gross return (Rs/ha)	288750		201000		120000	
Net return (Rs/ha)	149400		51475		5000	
B:C ratio	1:2.07		1:1.34		1:0.552	

Table 1. Population dynamics of shoot and fruit borer during *Rabi* 2016 - 17

Insect pests (Mean population)	**IPM module**		**Farmers practice**		**Untreated control**	
Rabi 2016-17	PTC	Post treatment count	PTC	Post treatment count	PTC	Post treatmen t count
Soot and fruit borer shoot damage percentage	7.90	4.10	8.20	11.50	7.60	35.20
Soot and fruit borer fruit damage percentage;	7.90	3.10	7.20	19.50	8.20	52.10
Population of coccinellid beetle	5.00	10.20	6.20	2.50	5.90	18.60
Population of *Chrysoperla*	6.20	9.50	5.20	1.20	5.20	11.90
Yield quintals/ha	307.50		195.50		98	
Cost of cultivation (Rs/ha)	151250		153750		110000	
Gross return (Rs/ha)	307500		197500		98000	
Net return (Rs/ha)	156250		43750		12000	
B:C ratio	1:2.03		1:1.28		1:0.89	

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