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Original Research Article

Management of Shoot and Fruit Borer for Enhancing Productivity and Profitability of Brinjal in Koshi Region of Bihar

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A B S T R A C T

An on farm trial was conducted on management of shoot and fruit borer for enhancing productivity and profitability of brinjal (*Solanum melongena* Linn.) in koshi region of Bihar during two consecutive year 2015-16 and 2016-17. The field experiment was conducted at farmers field with six replication in Randomized Block Design which consisting of four treatments [T1-farmers practice (Dimethoate 30 EC @ 2 ml./lit, T2-Trizophos + Deltamethrin @ 2 ml./lit, T3- Emaimectin Benzoate 50% SG @ 0.4gm/lit, and T4-Spinosad 45 SC @ 0.5gm/lit]. Result of the experiment showed that different insecticidal treatments had significant effect on management of shoot and fruit borer in brinjal. Significantly maximum healthy fruit yield (302.5 and 255.75 qh^{-1}) was recorded with the application of spinosad 45 SC @ 0.5 ml/lit due to minimum shoot damage (16.74 and16.65%) and fruit damage (21.10 and 21.12 %) as compared to control. Whereas, minimum healthy fruit yield (188.18 and 180.20 qh^{-1}) was found under control because of maximum shoot damage (37.95 and 38.25%) and fruit damage (39.45 and 40.15%) during both the years. Different shoot and fruit borer management treatments caused marked variation on profitability of brinjal. spinosad treated plot gave the highest B: C ratio (4.01 and 4.06) which showed significantly superior over control (2.52 and 2.88) 2015-16 and 2016-17, respectively.

Keywords

Brinjal, Shoot and fruit borer, Productivity and profitability

Introduction

Brinjal, (*Solanum melongena* Linn.) is mainly cultivated on small family's farm and is a source of cash income for resource-poor farmers. The brinjal production in India has to be increased to meet the requirements of our growing population (Dwivedi *et al.*, 2003) but this cash earning crop is damaged by more than 36 insect pests from nursery to harvest (Reghupathy *et al.*, 1997). Among these, shoot and fruit borer (*Leucinodes orbonalis*) caused serious problem in brinjal crop round the year. Its larvae feed inside eggplant and making the fruit unmarketable and unfit for consumption. The young larvae of the pest bore into petioles and midribs of large leaves and tender shoots causing shoot tips to wilt and later they bore into flower buds and fruits. Spinosad is a bacterial waste product derived from the actinomycetes (*Saccharopolyspora spinosa*) and is effective in suppressing borer population at fruiting stage. Sparks *et al.*, (1995). Emamectin benzoate is a white or yellow powder insecticide produced by the bacterium *Streptomyces avermitilis* and has contact mode of action (Birah *et al.*, 2008) which exhibit toxicity for lepidopterous pests, and several other pests. Injudicious

application of insecticides was preferred by farmers of koshi region in Bihar to protect their brinjal crop from the attack of shoot and fruit borer. Losses of brinjal from this insect ranged from 50-70%. (Srinivasan; 2008). Therefore, it is essential to develop a rational approach to promote sustainability and reduce the number of insect and doses of hazardous chemicals. Keeping all point under consideration, the present experiment was undertaken.

Materials and Methods

An on farm trial (OFT) was conducted on management of shoot and fruit borer for enhancing productivity and profitability of brinjal (*Solanum melongena* Linn.) in koshi region of Bihar during two consecutive year 2015-16 and 2016-17. The field experiment was conducted at farmers field of Musapur village under supervision of krishi vigyan Kendra, Katihar with six replication in Randomized Block Design which consisting of four treatments [T_1-farmers practice (Dimethoate 30 EC @ 2 ml./lit, T_2-Trizophos + Deltamethrin @ 2 ml./lit, T_3-Emaimectin Benzoate 50% SG @ 0.4gm/lit, and T_4- Spinosad 45 SC @ 0.5gm/lit]. Seeds of brinjal cultivar-Pusa purple cluster were sown in raised bed in second week September during both the year and thirty days old seedlings were transplanted in October month at spacing 60 cm between rows and 75 cm between plants. Total four sprays were taken up in each year at the interval of 20 days. The treatments were imposed from 20 days after transplanting by using hand operated knapsack sprayer to ensure good coverage on and under surface of the leaves also. Pest damage was assessed at 14th days after spraying as pre-count for the subsequent spraying. The shoot and fruits borer infestation was recorded on number basis from the randomly selected five plants each plot. The fruit were finally harvested in third week of February. Market values of healthy fruit were Rs. 850 and Rs.1050 q^{-1} during 2015-16 and 2016-17, respectively.

Results and Discussion

Shoot and fruit damage

The data pertaining to the shoot damage of brinjal (Table 1) due to different treatment revealed significant differences. The shoot damage of the brinjal varied from 16.74 to 37.95 % and 16.65 to 38.25% during 2015-16 and 2016-17, respectively due to induction of the bio-insecticide and chemicals. Maximum shoot damage (37.95 and 38.25%) was recorded under controlled plot where as minimum damage (16.74% and 16.65%) was observed in spinosad 45SC @ 0.5ml./lit treated plot during first and second year, respectively. It was also observed that shoot damage percentage as a result of spinosad application was significantly superior to other treatments. Because application of Spinosad alters the function of nicotinic and GABA-gated ion channels in a manner consistent with the observed neuronal excitation. This was in close conformity with the findings of Salgado 1998 and Saha *et al.*(2014).

The analysed data on table 1 revealed that there was a significant difference between the treatments. Fruit damage percentage in the plot induced by all the bio-insecticide and chemicals was ranged from 21.01 to 39.45% in 2015-16 and 21.12 to 40.15% in 2016-17. Fruit damage were found maximum (39.45% and 40.15%) in farmers practices where as it was minimum(21.01 and 21.12) in spinosed treated plot during both the year, respectively. A similar result was also reported by Adiroubane and Raghuraman(2008).

Total and marketable yield

Analysed data on total yield of brinjal as a result of different treatment have been presented in table 2. The yield of the trialed plot as induced by all the bio-insecticide and chemicals were varied from 310.80 to 383.06 q ha^{-1} and 290.50 to 372.05 q ha^{-1}. Maximum yield (383.06 and 372.05 q ha^{-1}) were recorded in Spinosad 45 SC treated plot where as minimum yield (310.80 and 290.50 q ha^{-1} under controlled plot, respectively in 2015-16 and 2016-17. It was also found that application of Spinosad 45 SC @ 0.5gm/lit showed significantly superior to other treatments. This may be due to healthy shoot of brinjal as a result of mode of action of spinosad which is associated with excitation of the insect nervous system. Result of the experiment was in close conformity with the findings of Sparks *et al*. (1995) and Saha *et al. (*2014).

The analysis of data on total marketable yield (Table 2) revealed that there was a significant difference was obsred due to different insecticidal treatments. The marketable yield of the brinjal from 108.18 to 302.51 q ha^{-1} in 2015-16 and 180.20 to 255.75 q ha^{-1} in 2016-17. The similar findings were also reported by Sparks *et al*. (1995) and Srinivasan,(2009).

Table.1 Shoot and fruit borer as influenced by different insecticidal treatments

Treatments	**Shoot damage (%)**		**Fruit damage (%)**	
	1st year	**2nd year**	**1st year**	**2nd year**
T_1-farmers practice (Dimethoate 30 EC @ 2 ml./lit	37.95	38.25	39.45	40.15
T_2-Trizophos + Deltamethrin @ 2ml./lit	18.43	20.10	26.13	23.43
T_3- Emaimectin Benzoate 50% SG @ 0.4gm/lit	19.35	18.97	23.91	24.12
T_4- Spinosad 45 SC @ 0.5gm/lit	16.74	16.65	21.01	21.12
C.D. (P=0.05)	2.67	1.15	2.8	1.22
C.V.	9.38	4.37	8.23	4.26

Table.2 Total and Marketable yield of brinjal as influenced by different insecticidal treatments

Treatments	**Total yield (q ha^{-1})**		**Marketable yield (q ha^{-1})**	
	1st year	**2nd year**	**1st year**	**2nd year**
T_1-farmers practice (Dimethoate 30 EC @ 2 ml./lit	310.80	290.50	188.18	180.20
T_2-Trizophos + Deltamethrin @ 2ml./lit	336.93	324.15	248.89	221.10
T_3- Emaimectin Benzoate 50% SG @ 0.4gm/lit	351.75	342.45	267.64	238.12
T_4- Spinosad 45 SC @ 0.5gm/lit	383.06	372.05	302.51	255.75
C.D. (P=0.05)	32.96	31.87	21.55	15.44
C.V.	7.8	7.59	6.95	6.98

Table.3 Production cost and Gross return of brinjal as influenced by different insecticidal treatments

Treatments	Production cost (Rs q^{-1} of brinjal)		Gross return (Rs ha^{-1})	
	1st year	2nd year	1st year	2nd year
T_1-farmers practice (Dimethoate 30 EC @ 2 ml./lit	337	364	159953	189210
T_2-Trizophos + Deltamethrin @ 2ml./lit	255	301	211565	232155
T_3- Emaimectin Benzoate 50% SG @ 0.4gm/lit	237	275	227511	250026
T_4- Spinosad 45 SC @ 0.5gm/lit	212	259	257125	268537

Table.4 Net return and B:C ratio of brinjal as influenced by different insecticidal treatments

Treatments	Net return (Rs ha^{-1})		B:C ratio	
	1st year	2nd year	1st year	2nd year
T_1-farmers practice (Dimethoate 30 EC @ 2 ml./lit	96452	123609	2.52	2.88
T_2-Trizophos + Deltamethrin @ 2ml./lit	148215	165505	3.34	3.48
T_3- Emaimectin Benzoate 50% SG @ 0.4gm/lit	164110	184619	3.59	3.82
T_4- Spinosad 45 SC @ 0.5gm/lit	192924	202326	4.01	4.06

Profitability

Production cost and gross return

The data presentated in table 3 showed that maximum cost of cultivation (Rs.337 and 364 per quantal of brinjal) was observed in controlled plot (farmer practices) whereas, minimum cost of cultivation (Rs. 212 and 259 per quantal of brinjal) was observed in spinosad treated plot during both years, respectively.. This was due to highest yield achieved in this plot as a result of minimum fruit and shoot damaged by borer. The Gross monetary returns (GMR) of brinjal were influenced by different insecticidal treatments (Table 3). Among these, the highest GMR (Rs. 257185 and 268537 ha^{-1}) was recorded under spinosad treated plot and proved significantly superior over control (Rs. 159953 and 189210 ha^{-1}) during both years, respectively. It might be because of more fruit yield.

Net income and B: C ratio

Net income was also affected by different insecticidal treatments (Table 4). The lowest NMR was recorded under Control plot (Rs. 96452 and 123609 ha^{-1}) among the insecticidal treatments. However, application of Spinosad 45 SC @ 0.5gm/lit gave maximum net monetary returns (Rs. 192924 and 202326 ha^{-1}) during first and second year of experimentation, respectively. The higher NMR under this treatment was due to lower cost of cultivation per quintal of brinjal and more fruit yields. Data on B: C ratio revealed that different insecticidal treatments influence the B: C ratio of brinjal. The B: C ratio varied from 2.52 to 4.01 in first year and 2.88 to 4.06 in second year. It was

maximum (4.01 and 4.06) in spinosad treated plot) and minimum (2.52 and 2.88) in control plot during 2015-16 and 2016-17, respectively.

Based on the result of two years own farm trial, it may be concluded that application of Spinosad 45 SC @ 0.5gm/lit is suitable for enhancing productivity and profitability of brinjal in koshi region of Bihar

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