

Field Efficacy of Different IPM Modules Against Brinjal Shoot and Fruit Borer (BSFB) and The Sucking Insect Pests of Brinjal

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Abstract

Field experiments carried out to evaluate the efficacy of some IPM modules against *Leucinodes orbonalis* Guene on brinjal at Keonjhar district of Odisha during 2009–10 and 2010–11 were also assessed for their efficacy against the sucking insect pests of brinjal. The results indicated that the IPM module comprising of soil application of cartap hydrochloride 4 G @ 1 kg a.i. ha⁻¹ at 2 weeks of transplanting, intercropping with coriander in 3:1 ratio, alternate foliar spray of indoxacarb 14.5 SC @ 1 ml l⁻¹ of water and rynaxypyr 20 SC @ 0.35 ml l⁻¹ of water at 10 days interval twice at vegetative stage and six times commencing from fruiting stage and regular collection and destruction of infested plant parts was found to be highly effective in minimizing the infestation of *L. orbonalis* and resulted in the highest mean fruit yield of 247.57 q ha⁻¹. Whereas, the IPM module consisting of soil application of vermicompost @ 5 t ha⁻¹, seedling root dip with solution of Azotobacter, Phosphorous solubilising bacteria and *Pseudomonas fluorescence*, raising maize as barrier crop, alternate application of deltamethrin 2.8 EC @ 1 ml l⁻¹ of water and spinosad 45 SC @ 0.35 ml l⁻¹ of water at 10 days interval twice at vegetative stage and six times commencing with fruiting stage, foliar application of boron @ 0.25% Borax (one at vegetative stage and other after flower initiation stage) and regular destruction of infested plant parts afforded maximum control of whiteflies and jassids in brinjal. All the IPM modules significantly brought down pest infestation in brinjal, whereas the maximum pest incidence was observed in the farmers' practice despite repeated application of insecticides.

1. Introduction

Brinjal *Solanum melongena* Linn. is one of the most common and popular vegetables grown in the subtropics and tropics and cultivated throughout the year. Heavy incidence of insect pests is one of the major contributing factors towards the low productivity of the crop. According to Patial and Mehta (2008), brinjal is mostly infested by 27 different insect pests (belonging to 8 orders and 20 families) and one mite species. Among these insect pests brinjal shoot and fruit borer (BSFB), *Leucinodes orbonalis* Guenee is predominant biotic factor contributing up to 20.7–88.7% loss in fruit yield in various parts of India (Haseeb et al., 2009). Various chemical insecticides have been recommended for the control of this pest and the farmers apply insecticides of different class of chemistry, their combination products and cocktail mixture 15 to 18 times during the cropping season without any appreciable increase in

yield. However, indiscriminate application of insecticides for the management of BSFB has resulted in the population build up of sucking pests like jassids (*Amrasca biguttula biguttula* Ishida) and whiteflies (*Bemisia tabaci* Genn.) in the brinjal growing areas which offers a new challenge to the farming community. In addition to the substantial negative effects on human health, crop eco-system and surrounding environment, such excessive use of pesticides increase the cost of production making brinjal cultivation expensive for the small and marginal farmers. As IPM can minimize the adverse effects of excessive application of insecticides, the present investigations were carried out to evaluate the efficacy of some IPM modules for the management of BSFB and to study their efficacy against the sucking insect pests like jassids and whiteflies.

2. Materials and Methods

Field experiments were conducted during *kharif*, winter and



summer seasons of 2009–10 and 2010–11 in the instructional farm of Krishi Vigyan Kendra, Keonjhar, Odisha and three villages namely Basudevpur, Tikarpada and Bhalupali, belonging to medium elevation and medium rainfall Agro-ecological situations (AES) and each location was considered as one replication. The experiments were laid out separately in two distinct experimental blocks for bio-intensive and chemo-intensive modules with an isolation distance of 50 m from each other to avoid the effect of chemicals on pheromone efficiency and bioagent activity in the bio-intensive modules. Thirty days old seedlings of brinjal cv. Blue Star were transplanted in well prepared plots in the farmers' field and KVK instructional farm. The crop was grown with recommended agronomic package of practices and other standard intercultural operations to ensure optimum plant growth. Seven IPM modules were tested against

the farmers' practice of indiscriminate application of chemical pesticides and each module was considered as one treatment. The IPM modules tested for their efficacy are depicted in Table 1. All the IPM modules (treatments) were replicated four times in a randomized block design (RBD).

To estimate the comparative efficacy of the IPM modules, treatment and replication wise periodic observations on fruit damage and population level of sucking pests were recorded. The data on damaged and healthy fruits on weight basis were recorded at each picking and cumulative numbers of infested and healthy fruits from all the pickings during different crop seasons were considered to work out the per cent borer infestation. The population level of white fly and jassids were observed on randomly selected 10 plants, from 3 leaves of each plant at weekly interval. The mean population of these sucking

Table 1: IPM Modules tested against *L. orbonalis* during 2009–10 and 2010–11

Sl. No.	IPM modules	Details of IPM modules
1.	Module 1 (Bio-intensive)	Soil incorporation of neem cake at transplanting @ 150 kg ha ⁻¹ +Spraying of neemacin (1500 ppm azadirachtin) @ 3 ml l ⁻¹ of water at 10 days interval after 15 DAT till last harvest+installation of pheromone traps from 30 DAT @ 70 ha ⁻¹ +regular destruction of infested plant parts.
2.	Module 2 (Bio-intensive)	Soil incorporation of neem cake @ 150 kg ha ⁻¹ (50% at transplanting and 50% at 3 weeks after transplanting)+alternate spraying of neemacin (1500 ppm azadirachtin) @ 3 ml l ⁻¹ of water and Bt @ 2 g l ⁻¹ of water at 10 days interval twice at vegetative stage and six times commencing with fruiting stage+installation of pheromone traps from 30 DAT @ 70 ha ⁻¹ +regular destruction of infested plant parts.
3.	Module 3 (Bio-intensive)	Soil application of neem cake @ 150 kg ha ⁻¹ at 3 weeks after transplanting+foliar spray of 5% NSKE at 10 days interval from 15 DAT till last harvest+release of bio-agent <i>Trichogramma chilonis</i> @ 1 lakh ha ⁻¹ 4 times at 10 days interval+regular destruction of infested plant parts.
4.	Module 4	Application of Vermicompost @ 5 t ha ⁻¹ at transplanting and seedling root dip with solution of Azotobacter (25 ml l ⁻¹ of water), Phosphorous solubilising bacteria (PSB) (25 ml l ⁻¹ of water) and <i>Pseudomonas fluorescence</i> (3 g l ⁻¹ of water) for 1 hour+raising of barrier crop (2 rows of maize around the field)+alternate application of deltamethrin 2.8 EC @ 1 ml l ⁻¹ of water and spinosad 45 SC @ 0.35 ml l ⁻¹ of water at 10 days interval twice at vegetative stage and six times commencing with fruiting stage+foliar application of boron @ 0.25% Borax (one at vegetative stage and other after flower initiation stage)+regular destruction of infested plant parts.
5.	Module 5	Application of carbofuran 3 G @ 1 kg a.i. ha ⁻¹ at 2 weeks after transplanting+Spraying a mixture of cartap hydrochloride @ 1 g l ⁻¹ of water and diflubenzuron @ 0.5 g l ⁻¹ of water at 10 days interval twice at vegetative stage and six times commencing with fruiting stage+regular destruction of infested plant parts.
6.	Module 6	Soil application of fipronil 0.3 G @ 0.75 kg a.i. ha ⁻¹ at 2 weeks of transplanting+intercropping with cluster bean in 3:1 ratio (additive series)+Alternate foliar spray of thiodicarb 75 WP @ 1.5 g l ⁻¹ of water and flubendiamide 20 WG @ 0.4 g l ⁻¹ of water at 10 days interval twice at vegetative stage and six times commencing with fruiting stage+regular destruction of infested shoots and fruits.
7.	Module 7	Soil application of cartap hydrochloride 4 G @ 1 kg a.i. ha ⁻¹ at 2 weeks of transplanting+intercropping with coriander in 3:1 ratio (additive series)+alternate foliar spray of indoxacarb 14.5 SC @ 1 ml l ⁻¹ of water and rynaxypyr 20 SC @ 0.35 ml l ⁻¹ of water at 10 days interval twice at vegetative stage and six times commencing from fruiting stage+regular destruction of infested shoots and fruits.
8.	Farmers' practice	The farmers mostly relied on the chemicals like carbaryl, chloropyrifos, cypermethrin, fenvalarate, malathion, methomyl, monocrotophos, chloropyrifos+cypermethrin, phenthoate, profenophos+cypermethrin and on an average the farmers have gone for 15 rounds of spray during the crop growth period as per their own will.



pests from all the observations was considered for statistical analysis after necessary data transformation.

3. Results and Discussion

The comparative effectiveness of different IPM modules against the fruit infestation caused by BSFB during 2009–10 (pooled mean of three seasons experiment) (Table 2) indicated

that all the IPM modules minimized the fruit infestation to a substantial level. Among the IPM modules, significantly superior control of fruit infestation was achieved in the module M_7 with a minimum fruit damage of 6.83% (on weight basis) followed by M_4 (7.33% fruit damage), M_6 (7.48% fruit damage) and M_5 (11.0%). The modules M_4 and M_6 had statistically similar efficacy in suppressing the fruit infestation in brinjal.

Table 2: Effect of different IPM modules on fruit damage by BSFB (2009–10 and 2010–11)

IPM modules	Percent fruit damage (weight basis) - 2009–10				Percent fruit damage (weight basis) - 2010–11				Pooled mean (2009–10 & 2010–11)
	<i>Kharif</i>	<i>Rabi</i>	Summer	Pooled mean	<i>Kharif</i>	<i>Rabi</i>	Summer	Pooled mean	
M_1	19.11 (4.37)	16.89 (4.11)	21.55 (4.64)	19.18 (4.38)	17.36 (4.17)	14.59 (3.82)	20.57 (4.53)	17.51 (4.18)	18.34 (4.28)
M_2	15.34 (3.92)	12.54 (3.54)	16.04 (4.00)	14.64 (3.83)	13.63 (3.69)	11.50 (3.39)	17.12 (4.14)	14.08 (3.75)	14.36 (3.79)
M_3	15.88 (3.98)	13.29 (3.64)	16.86 (4.11)	15.34 (3.92)	14.10 (3.75)	11.97 (3.46)	17.44 (4.18)	14.50 (3.81)	14.92 (3.86)
M_4	7.51 (2.74)	6.22 (2.49)	8.26 (2.87)	7.33 (2.71)	6.85 (2.62)	5.45 (2.33)	8.36 (2.89)	6.89 (2.62)	7.11 (2.67)
M_5	11.28 (3.36)	9.88 (3.14)	11.86 (3.44)	11.00 (3.32)	10.18 (3.19)	8.50 (2.91)	12.33 (3.51)	10.34 (3.21)	10.67 (3.27)
M_6	7.54 (2.74)	6.51 (2.55)	8.40 (2.90)	7.48 (2.74)	6.57 (2.56)	5.03 (2.23)	8.10 (2.84)	6.56 (2.56)	7.02 (2.65)
M_7	6.92 (2.63)	5.73 (2.39)	7.84 (2.80)	6.83 (2.61)	6.18 (2.48)	4.74 (2.17)	7.61 (2.76)	6.18 (2.48)	6.50 (2.55)
FP	26.48 (5.15)	22.38 (4.73)	31.85 (5.64)	26.90 (5.19)	24.64 (4.96)	19.81 (4.45)	30.69 (5.54)	25.04 (5.00)	25.97 (5.10)
SEm±	0.05	0.06	0.05	0.02	0.06	0.07	0.05	0.04	0.02
CD ($p=0.05$)	0.16	0.19	0.15	0.07	0.17	0.21	0.16	0.11	0.10

*Figures in the parentheses are the $\sqrt{x+0.5}$ transformed values), FP: farmers' practice

On the contrary, the highest fruit damage was observed in farmers' practice (26.90% infested fruits on weight basis) despite of repeated application of insecticides. The bio-intensive modules were also offered good control of the BSFB (14.64 to 19.18% fruit damage) over farmers' practice and but found to be less effective than the other modules. During 2010–11 (pooled mean of three seasons' data) (Table 2), the module M_7 retained its superiority by recording the lowest fruit damage of 6.18% (on weight basis) closely followed by M_6 (6.56% fruit damage) and both the modules were statistically comparable with each other. The module M_4 (6.89% fruit damage) and M_5 (10.34%) followed in order of their efficacy. Among the bio-intensive modules the module M_2 registered the lowest fruit damage of 14.08% followed by M_3 (14.50% fruit damage) and M_1 (17.51% fruit damage), whereas maximum fruit infestation was observed in the farmers' practice (25.04% fruit damage). The pooled mean value of the results of both the years of experiment (2009–10 and 2010–11) indicated

that IPM modules M_7 , M_6 and M_4 significantly suppressed the fruit infestation in brinjal with only 6.50, 7.02 and 7.11% fruit damage, respectively as against 25.97% fruit damage in the farmers' practice of indiscriminate application of insecticides. These three IPM modules established themselves as the most effective IPM modules against brinjal shoot and fruit borer during the entire period of investigation. The bio-intensive modules also found to be significantly better than the farmers' practice (14.36% in M_2 to 18.34% fruit damage in M_1) and reduced the borer incidence through an eco-friendly manner.

The results of the investigation are in close conformity with the findings of Kalawate and Dethe (2012), who opined that Spinosad was found to be the most effective against BSFB and afforded moderate control of jassid, whitefly and aphid. Dutta et al. (2011) revealed that installation of 65 pheromone traps per hectare reduced the shoot and fruit damage to 58.39 and 38.17% respectively. Elanchezhyan et al. (2008) observed that when brinjal intercropped with cluster bean at 4:1 ratio



the incidence of *Leucinodes orbonalis* Gueene was very much minimized with 51.94% reduction in fruit damage by weight basis over the brinjal pure crop. Saimandir and Gopal (2009) also substantiated the findings by reporting that application of indoxacarb 14.5% SC at 75 and 150 g a.i. ha⁻¹ was highly effective in minimizing the fruit infestation in brinjal. Misra (2008) also reported that rynaxypyr and flubendiamide gave 87–90% reduction in eggplant fruit damage. Sharma and Sinha (2009) also concluded that brinjal border cropped with maize baby corn along with two foliar sprays of spinosad @ 75 g a.i. ha⁻¹ was very effective in minimizing the fruit borer incidence 4.93% on weight basis compared to 13.92% fruit damage in the untreated control. The findings are also supported by the results of Prasad et al., 2010 who reported that brinjal when intercropped with coriander in 3:1 ratio reduced fruit damage by 55.54 and 63.97%, respectively during 2003 and 2004. The efficacy of bio-intensive IPM modules was also mentioned by Mandal et al. (2009) who reported that bio-intensive

IPM module (Installation of sex pheromone trap+clipping of infested shoots and discarding of damaged fruits+spraying of azadirachtin 0.15%) reduced the fruit damage to 15.80% (63.48% reduction over control).

The population of whiteflies in brinjal was suppressed in all the IPM plots compared to farmers' practice and a significant difference in their population was observed among the different modules under study (Table 3). The pooled mean value during 2009–10 indicated that among the IPM modules, M₄ afforded maximum control of whiteflies with an average of 0.7 flies/3 leaves followed by M₇ (1.01 flies/3 leaves), M₆ (1.03 flies/3 leaves) and M₅ (1.17 flies/3 leaves). In contrast the bio-intensive IPM modules afforded a moderate control of whiteflies (1.55 to 1.85 flies/3 leaves) compared to 2.87 in farmers' practice. During 2010–11 all the IPM modules retained their order of efficacy similar to 2009–10 with the lowest white fly population per three leaves (0.71) in M₄ and that of highest (2.95) in the farmers' practice. The pooled

Table 3: Effect of different IPM modules on population level of whitefly* (2009–10 and 2010–11)

IPM Modules	No./3 leaves plant ⁻¹ (2009–10)				No./3 leaves plant ⁻¹ (2010–11)				Pooled mean (2009–10 & 2010–11)
	Kharif	Rabi	Summer	Pooled mean	Kharif	Rabi	Summer	Pooled mean	
M ₁	1.38 (1.37)	2.09 (1.61)	1.19 (1.30)	1.55 (1.43)	1.70 (1.48)	1.94 (1.56)	1.02 (1.23)	1.55 (1.43)	1.55 (1.25)
M ₂	1.59 (1.44)	2.56 (1.75)	1.42 (1.38)	1.85 (1.53)	1.96 (1.57)	2.38 (1.70)	1.16 (1.29)	1.83 (1.53)	1.84 (1.36)
M ₃	1.32 (1.35)	2.14 (1.62)	1.21 (1.31)	1.55 (1.43)	1.74 (1.49)	2.07 (1.60)	1.04 (1.24)	1.61 (1.45)	1.58 (1.26)
M ₄	0.70 (1.09)	0.92 (1.19)	0.49 (0.99)	0.70 (1.10)	0.74 (1.11)	0.96 (1.21)	0.43 (0.96)	0.71 (1.10)	0.71 (0.84)
M ₅	1.04 (1.24)	1.57 (1.44)	0.92 (1.19)	1.17 (1.29)	1.13 (1.27)	1.52 (1.42)	0.84 (1.15)	1.16 (1.29)	1.17 (1.08)
M ₆	0.97 (1.21)	1.35 (1.36)	0.77 (1.12)	1.03 (1.23)	0.98 (1.21)	1.42 (1.38)	0.52 (1.01)	0.97 (1.21)	1.00 (1.00)
M ₇	0.93 (1.20)	1.30 (1.34)	0.80 (1.14)	1.01 (1.23)	1.03 (1.23)	1.03 (1.23)	0.74 (1.11)	0.93 (1.19)	0.97 (0.98)
FP	2.78 (1.81)	3.67 (2.04)	2.16 (1.63)	2.87 (1.83)	3.02 (1.88)	3.88 (2.09)	1.96 (1.57)	2.95 (1.86)	2.91 (1.71)
SEm±	0.03	0.05	0.03	0.03	0.04	0.04	0.03	0.02	0.02
CD (p=0.05)	0.09	0.14	0.08	0.07	0.10	0.12	0.09	0.06	0.05

*Average no. of white flies 3 leaves⁻¹ plant⁻¹ (Figures in the parentheses are the $\sqrt{x+0.5}$ transformed values); FP: farmers' practice

analysis of two years data indicated the superiority of M₄ in the control of white flies (0.71 flies/3 leaves) followed by M₇ (0.97), M₆ (1.0), M₅ (1.17). The bio-intensive modules also offered a moderate control of white flies (1.55 to 1.84 flies/3 leaves) compared to 2.91 in farmers' practice.

During 2009–10 a significantly lower population of jassids was observed in all the IPM plots compared to the farmers' practice (Table 4). The cumulative mean population of jassids was

found to be lowest in M₄ (5.36 jassids/3 leaves) followed by M₇ (6.02), M₆ (6.38) and M₅ (6.90) indicating the effectiveness of the IPM modules in reducing the leafhopper population. However, farmers practice recorded significantly highest jassids population of 13.21/3 leaves. The pooled mean value of jassid population during 2010–11 indicated the superiority of the IPM module M₆ in minimizing the jassid incidence in brinjal with 4.83 jassids/3 leaves. The other modules in order



Table 4: Effect of different IPM modules on population level of jassid * (2009–10 and 2010–11)

IPM modules	No./3 leaves plant ⁻¹ (2009–10)				No./3 leaves plant ⁻¹ (2010–11)				Pooled mean (2009–10 & 2010–11)
	<i>Kharif</i>	<i>Rabi</i>	Summer	Pooled mean	<i>Kharif</i>	<i>Rabi</i>	Summer	Pooled mean	
M ₁	10.04 (3.25)	8.47 (2.99)	6.94 (2.72)	8.48 (3.00)	7.56 (2.84)	7.16 (2.77)	8.02 (2.92)	7.58 (2.84)	8.03 (2.83)
M ₂	10.85 (3.37)	9.35 (3.14)	7.43 (2.81)	9.21 (3.12)	8.35 (2.97)	7.92 (2.90)	8.80 (3.05)	8.36 (2.98)	8.78 (2.96)
M ₃	9.90 (3.22)	8.19 (2.94)	7.08 (2.75)	8.39 (2.98)	7.40 (2.80)	7.38 (2.81)	7.71 (2.86)	7.50 (2.83)	7.94 (2.82)
M ₄	6.15 (2.57)	5.08 (2.36)	4.85 (2.31)	5.36 (2.42)	5.03 (2.35)	4.87 (2.31)	4.96 (2.33)	4.95 (2.33)	5.15 (2.27)
M ₅	8.35 (2.97)	6.40 (2.62)	5.95 (2.54)	6.90 (2.72)	5.91 (2.53)	5.71 (2.49)	5.95 (2.54)	5.86 (2.52)	6.38 (2.52)
M ₆	7.65 (2.85)	6.13 (2.57)	5.38 (2.42)	6.38 (2.62)	4.83 (2.30)	5.03 (2.35)	4.64 (2.26)	4.83 (2.31)	5.61 (2.37)
M ₇	7.30 (2.79)	5.65 (2.48)	5.10 (2.36)	6.02 (2.55)	5.48 (2.44)	4.53 (2.24)	5.48 (2.44)	5.16 (2.38)	5.59 (2.36)
FP	15.68 (4.02)	12.65 (3.62)	11.30 (3.43)	13.21 (3.70)	13.63 (3.76)	10.91 (3.37)	11.78 (3.50)	12.11 (3.55)	12.66 (3.56)
SEm±	0.08	0.07	0.07	0.05	0.08	0.06	0.06	0.04	0.04
CD (<i>p</i> =0.05)	0.24	0.21	0.21	0.15	0.22	0.18	0.18	0.13	0.12

*Average no. of jassids 3 leaves⁻¹ plant⁻¹ (Figures in the parentheses are the $\sqrt{x+0.5}$ transformed values); FP: farmers' practice

of their efficacy against jassids were M₄, M₇ and M₅ with 4.95, 5.16 and 5.86 jassids/3 leaves, respectively. The analysis of pooled data of 2009–10 and 2010–11 revealed that all the modules were superior to the farmers' practice and the module M₄ was the most effective with significantly lowest jassid population of 5.15/3 leaves.

The above findings are in accordance with the findings of Sinha and Vishwa (2011) who opined that indoxacarb @ 70 g a.i. ha⁻¹ was very effective in managing the population of sucking pests.

Sardana et al. (2009), observed that IPM practice consisting of soil application of neem cake, foliar application of 5% NSKE, release of egg parasitoid *T. brasiliensis*, clipping of damaged shoots and destruction of infested fruits, installation of pheromone trap, delta traps and bird perches and need based application of imidacloprid 17.8 SL @ 0.5 ml l⁻¹ water significantly minimized the leaf hoppers and aphids in brinjal.

It is evidenced from the findings that (Table 5) the lower pest incidence in the IPM plots contributed to higher fruit yield

Table 5: Effect of different IPM modules on fruit yield of Brinjal (q ha⁻¹) during 2009–10 and 2010–11

IPM modules	2009–10				2010–11				Pooled mean (2009–10 & 2010–11)
	<i>Kharif</i>	<i>Rabi</i>	Summer	Pooled mean	<i>Kharif</i>	<i>Rabi</i>	Summer	Pooled mean	
M ₁	213.25	227.24	197.16	212.55	217.42	235.13	203.29	218.61	215.58
M ₂	224.08	239.44	211.36	224.96	227.54	243.55	214.12	228.40	226.68
M ₃	223.26	238.78	210.52	224.19	226.51	242.60	213.16	227.42	225.80
M ₄	244.91	263.20	227.97	245.36	247.39	266.33	227.87	247.19	246.28
M ₅	235.27	255.12	220.95	237.11	238.64	258.64	221.60	239.63	238.37
M ₆	244.26	262.59	227.21	244.69	247.92	267.61	229.02	248.18	246.44
M ₇	245.79	264.17	228.62	246.19	248.60	268.47	229.75	248.94	247.57
FP	187.70	195.42	171.88	185.00	191.08	199.40	176.93	189.14	187.07
SEm±	0.65	0.59	0.68	0.35	0.66	0.73	0.77	0.39	0.27
CD (<i>p</i> =0.05)	1.92	1.73	2.01	1.03	1.94	2.14	2.25	1.15	0.80

FP: farmers' practice

in brinjal. The pooled mean value over the three seasons of 2009–10 revealed that the module M_7 registered the highest total fruit yield of 246.19 q ha⁻¹ and was statistically comparable with M_4 (245.36 q ha⁻¹). Fruit yield of 244.69 q ha⁻¹ obtained from M_6 was next in order and statistically on par with M_4 . The bio-intensive modules also recorded better fruit yield ranging from 212.55 q ha⁻¹ in M_1 to 224.96 q ha⁻¹ in M_2 and were superior to farmers' practice (185.00 q ha⁻¹). The pooled analysis of data on fruit yield of all the seasons of 2010–11 also evidently proved the superiority of the module M_7 over the rest of the treatments as it registered the highest fruit yield of 248.94. The module M_6 was found to be the next better IPM option (fruit yield of 248.18) and was statistically similar with M_7 . The module M_4 was also found to be effective in increasing the fruit yield (247.19 q ha⁻¹) in brinjal and was on par with the module M_6 . In the bio-intensive IPM modules the total yield ranged from 218.61 q ha⁻¹ in M_1 to 228.40 q ha⁻¹ in M_2 . The pooled mean data of both the years of investigation indicated the higher efficacy of IPM modules in increasing the fruit yield in brinjal crop (247.57 q ha⁻¹ in M_7 to 215.58 q ha⁻¹ in M_1) over the farmers' practice (187.07 q ha⁻¹) of repeated application of insecticides.

4. Conclusion

Soil application of cartap hydrochloride 4 G @ 1 kg a.i. ha⁻¹ at 2 weeks of transplanting, Intercropping with coriander in 3:1 ratio, Alternate foliar spray of indoxacarb 14.5 SC @ 1 ml l⁻¹ of water and rynaxypyr 20 SC @ 0.35 ml l⁻¹ of water at 10 days interval twice at vegetative stage and six times were also found to be highly effective in suppressing the infestation of shoot and fruit borer and the population of sucking insect pests infesting brinjal

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