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Bio-efficacy of new molecules against field bean pod borer, *Adisura atkinsoni* (Moore) on field bean, *Dolichos lablab*

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Abstract

The investigation on bio-efficacy of new molecules against field bean pod borer conducted at College of Sericulture, Chintamani during kharif 2021. The bio-efficacy of eight newer molecules was evaluated against field bean pod borer in field bean crop revealed that the treatment of Chlorantraniliprole 18.5 SC (78.95%) proved most effective followed by Spinosad 45 SC (75.36%). The next best highest mean larval reduction was recorded in Fenvalerate 20 EC (64.00%) followed by Indoxacarb 14.5 SC (63.32%), Emamectin benzoate 5 SG (61.92%) and Profenophos 50 EC (57.64%). The treatments with NSKE 5% (36.04%) and Azadirectin 1% (32.86%) found least effective treatments during season 2021-22.

Keywords: *A. atkinsoni,* Insecticides, treatments, yield loss

Introduction

The field bean was believed to be originated in Asia, but it is now grown for food throughout the world. The crop is cultivated in dry tropical parts of Asia, Africa, East and West Indies, South Central America and China. In India, it is being cultivated in Karnataka, Tamil Nadu, Andhra Pradesh, Kerala and Assam. Damage by insect pests is considered as one of the main impediments in stepping up the production of the crop. Govindan (1974) [13] recorded as many as 55 species of insects and a species of mite feeding on crop from seedling stage to harvest of the crop in Karnataka. Among them pod borers are considered to be most important and they appeared regularly causing crop loss to the tune of 80-100 percent (Katagihallimath and Siddappaji, 1962) [5]. Highest percent pod damage (26.79%) and seed damage (31.85%) in the untreated check due to pod borer complex in dolichos bean was reported by Rekha (2006) [8].

The pod borer complex of field bean included *Helicoverpa armigera* (Hubner), *Adisura atkinsoni* (Moore), *Maruca testulalis* (Geyer), *Etiella zinckenella* (Treitschke), *Sphenarches caffer* (Zeller), *Exalastis atomosa* (walshinghan), *Collasobruchus chinensis* (Linnaeus) and *Lampides boeticus* (Linnaeus) (Chakravarthy, 1977 and Govindhan, 1974) [1, 3]. Among all pod borers of field bean, field bean pod borer, *A. atkinsoni* is the dominant pod borer on local cultivar and persists on the crop from the beginning to the end (August to February) in Karnataka.

Since, the different pod borers infesting field bean crop, the insecticides spinosad (0.01%), Indoxacarb (0.01%) proved most effective against pod borer complex in Indian bean crop (Jat *et al.*, 2017) [5]. Chlorantraniliprole 18.5 SC, Spinosad 45SC and Emamectin benzoate found effective against pod borers (Rashmi *et al.*, 2020) [9]. The particular study pertaining to insecticides trial against field bean pod borer *A. atkinsoni* was lacking.

Use of chemicals is one of the most popular methods of pest control. In recent times a large number of insectcides are available in the market. The field efficacy of insecticide molecules against pod borer was studied to find out suitable insecticides.

Materials and Methods

The experiment was laid out in a simple Randomised Block design (RBD) with eight treatments (insecticides) including untreated control (Table 1), each replicated three times. Each plot measured 3 × 2.5 m with protection irrigation and recommended agronomic practices. The field bean HA4 variety was used for the experiment.

All the treatments were applied as foliar spray by using a knapsack sprayer with a spray volume of 450- 500 lit/ha. A total of two sprays were applied at 10 days interval starting from sufficient infestation observed.

Observations: For recording observations on pre and post treatment population from each plot 5 plants were selected, tagged and observations on pod borer population was recorded one day before (pre-streatment) and 1, 3, 7 and 10 days after application by counting number of pod borer per plant from each plot. The data was subjected to statistical analysis (ANOVA) after squareroot (√x+0.5) transformation and the treated means computed by Duncan's multiple range test (DMRT) at the probability level of p: 0.05. Percent reduction was compared out using the formula of Handerson and Tilton (1955) [4].

Percent reduction

$$= 1 - \left[\frac{Cb}{Ca} \times \frac{Ta}{Tb}\right] \times 100$$

Where,
Cb= control before treatment;
Ca= control after treatment
Ta= treatment after treatment;
Tb= treatment before treatment

Table 1: Treatment details

Treatment No.	Treatment details	Dosage
T_1	Indoxacarb 14.5 SC	0.70 ml/L
T_2	Profenophos 50 EC	2.00 ml/L
T_3	Spinosad 45 SC	0.15 ml/L
T_4	Emamectin benzoate 5 SG	0.40 gm/L
T_5	Fenvalerate 20 EC	0.50 ml/L
T_6	Chlorantraniliprole 18.5 SC	0.30 ml/L
T_7	NSKE 5%	-
T_8	Azadirectin 1%	2.00 ml/L
T_9	Untreated control	-

The yield of grains (Kg/plant) was then computed on acre/hectare basis and subjected to statistical analysis. The avoidable yield loss was worked out as suggested by Pradhan (1969) [7].

$$\text{Avoidable yield loss} = \frac{T-C}{T} \times 100$$

T- Yield from treated plot
C- Yield from control plot

Results and Discussion

First spray

The first spray of respective insecticides was carried out at flowering stage. The results from the Table 2 revealed that, the larval population in all the treatments were statistically uniform at one day before imposition of treatments as indicated by the non-significant differences among the treatments. However, one day after spraying, among the different treatments, the least larval population observed in Chlorantraniliprole 18.5 SC (1.00 larvae/plant) and Spinosad 45 SC (1.33 larvae/plant) followed by Emamectin benzoate 5 SG (2.00 larvae/ plant) which were statistically on par with each other. The next best treatment was Indoxacarb 14.5 SC (2.33 larvae/ plant) followed by Fenvalerate 20 EC (3.67 larvae/ plant). The rest treatments Profenophos 50 EC (4.00 larvae/ plant) and Azadirachtin 1% (4.67 Larvae/ plant) stood statistically on par with each other followed by NSKE 5% (5.33 larvae / plant). Untreated check reported significantly higher population of *A. atkinsoni* (7.33 larvae/ plant).

Table 2: Bio-efficacy of selected insecticide molecules against field bean pod borer, *Adisura atkinsoni* during year 2021-22 (First spray)

Treatments	Dosages	Pre treatment	I DAS	% reduction	3DAS	% reduction	7 DAS	% reduction	10 DAS	% reduction	Mean % reduction
Indoxacarb 14.5 SC	0.70 ml/l	7.66 (2.84)	2.33(1.68)d	66.8	2.00(1.58) c	74.92	1.33(1.34) bc	84.44	2.33(1.68) bc	78.52	76.17
Profenophos 50 EC	2.00 ml/l	8.33(2.96)	4.00(2.12) bc	47.59	2.33(1.68) c	73.14	2.33(1.68) b	76.02	4.00(2.12) b	66.09	65.71
Spinosad 45 SC	0.15 ml/l	7.00(2.73)	1.33(1.34) de	79.26	0.67(1.07) de	90.81	1.00(1.22) c	87.75	1.67(1.46) c	83.15	85.24
Emamectin benzoate 5 SG	0.40 gm/l	7.33 (2.78)	2.00(1.58) de	70.22	1.33(1.34) cde	82.57	1.33(1.34) bc	84.44	2.33(1.68) bc	77.56	78.69
Fenvalerate 20 EC	0.50 ml/l	8.00(2.91)	3.67(2.04) c	49.93	1.66(1.22) cd	80.07	1.33(1.34) bc	85.74	3.67(2.04) b	67.61	70.83
Chlorantraniliprole 18.5 SC	0.30 ml/l	5.33(2.41)	1.00(1.22) e	79.52	0.67(1.07) e	87.93	0.67(1.07) c	89.22	1.33(1.34) c	82.38	84.76
NSKE 5%		9.00(3.07)	5.33(2.41) b	35.36	5.33(2.41) b	43.12	8.67(3.03) a	17.4	10.33(3.29) a	18.96	26.49
Azadirectin 1%	2.00 ml/l	8.00(2.91)	4.67(2.27) bc	36.29	4.33(2.20) b	48.02	7.33(2.80) a	21.44	9.00(3.08) a	20.56	31.57
Untreated control		8.00(2.91)	7.33(2.80) a		8.33(2.97) a		9.33(3.13) a		11.33(3.44) a		
S.Em			0.13	0.25		0.2		0.31		0.4	
CD 5%			0.39	0.75		0.62		0.94		1.22	
CV			8.04	12.38		12.57		14.9		13.83	
F test			NS	**		**		**		**	

** Significance at 5%
Figures in parenthesis are √x+0.5 transformed values.
DAS- days after spray

Three days after spraying, the least larval population was observed in Spinosad 45 SC (0.67larvae/ plant) and Chlorantraniliprole 18.5 SC (0.67 larvae/plant) and stood statistically on par with each other. The larval population of Emamectin benzoate 5 SG (1.33 larvae/plant) and Fenvalerate 20 EC (1.66 larvae/plant) found statistically on par with each other. The Indoxacarb 14.5 SC treatment reported larval population of 2.00 larvae per plant was statistically on par with Profenophos 50 EC (2.33 larvae/ plant). The other treatments NSKE 5% (5.33 larvae/ plant) and Azadirectin 1% (4.33 larvae/ plant) stood on par with each other. Whereas, significantly higher population of 8.33 larvae per plant was recorded in untreated check (Table 2).

Seven days after spraying, the lowest population of 0.67 larvae per plant was recorded in Chlorantraniliprole 18.5 SC followed by Spinosad 45 SC (1.00 larvae/plant),which were statically on par with each other. The next best treatments were Indoxacarb 14.5 SC (1.33 larvae/ plant), Emamectin benzoate 5 SG (1.33 larvae/plant) and Fenvalerate 20 EC (1.33 larave/plant) stood statistically on par with each other. The rest treatments NSKE 5% (8.66 larvae/plant) and Azadirectin 1% (7.33 larvae/plant) stood statistically on par with untreated check (9.33 larvae/plant) (Table 2).

Ten days after spraying, Chlorantraniliprole 18.5 SC showed lowest larval population of 1.33 larvae per plant followed by Spinosad 45 SC (1.67 larvae/plant), which were statistically on par with each other. Indoxacarb 14.5 SC of 2.33 larvae/ plant stood statistically on par with Emamectin benzoate 5 SG of 2.33 larvae/ plant. The treatments of Fenvalerate 20 EC (3.67 larvae/ plant) stood statistically on par with Profenophos 50 EC (4.00 larvae/ plant). However, treatments with NSKE 5%, Azadirectin 1% and untreated check were statistically on par with each other and recorded larval population of 10.33, 9.00 and 11.33 larvae/plant, respectively (Table 2).

With regard to percent reduction in larval population, the maximum reduction at one day after spraying was observed in Chlorantraniliprole 18.5 SC (79.52%) and Spinosad 45 SC (79.26%). The maximum larval population reduction at three days after spraying was observed in Spinosad 45 SC (90.81%) followed by Chlorantraniliprole 18.5 SC (87.93%). The maximum larval reduction at seven days after treatment was observed in Chlorantraniliprole 18.5 SC (89.22%) followed by Spinosad 45 SC (87.75%). Ten days after spraying, the highest larval population reduction of 83.12 percent was recorded in Spinosad 45 SC followed by Chlorantraniliprole 18.5 SC (82.38%), as shown in Table 2.

Second spray

The results pertaining to the efficacy of insecticides on *A. atkinsoni* larval population on one, three, seven and ten days after second treatment are given in Table 3. Since the second spray was taken up at ten days after first spray, the larval population of *A. atkinsoni* on one day before second spray was the same as of the larval population at ten days after first spray. Though there was a significant difference between the treatments at ten days after first spray, the larval population within the treatments had exceeded the economic injury level. Hence, the second spray was taken up to lower the population below the economic injury level.

One day after spraying, all the insecticidal treatments were significantly superior over untreated check. The least larval population recorded with Chlorantaniliprole 18.5 SC (0.33 larvae/plant) followed by Spinosad 45 SC (0.67 larvae/plant) and Emamectin benzoate 5 SG (1.00 larvae/plant), which were stood statistically on par with each other. Indoxacarb 14.5 SC (1.33 larvae/plant) found statistically on par with Fenvalerate 20 EC (1.33 larvae/plant) followed by Profenophos (2.33 larvae/plant). The other treatments NSKE of 4.67 larvae per plant stood statistically on par with Azadirachtin of 5.33 larvae per plant. Significantly higher population recorded in untreated check (12.00larvae/plant) compared to all other treatments (Table 3).

Table 3: Bio-efficacy of selected insecticide molecules against field bean pod borer, *Adisura atkinsoni* during year 2021-22 (Second spray)

Treatments	Dosages	Pre-treatment	I DAS	% reduction	3DAS	% reduction	7 DAS	% reduction	10 DAS	% reduction	Mean% reduction
Indoxacarb 14.5 SC	0.70 ml/l	2.33(1.68)^{bc}	1.33(1.34)^{cd}	46.11	1.00(1.22)^{cde}	63.52	1.00(1.22)^{cd}	65.27	2.00(1.58)^{cd}	27.04	50.49
Profenophos 50 EC	2.00 ml/l	4.00(2.12)^{b}	2.33(1.68)^{c}	45	2.00(1.58)^{c}	57.5	2.00(1.58)^{c}	59.54	3.00(1.87)^{c}	36.25	49.57
Spinosad 45 SC	0.15 ml/l	1.67(1.46)^{c}	0.67(1.05)^{de}	62.12	0.33(0.88)^{e}	83.2	0.67(1.05)^{d}	67.53	1.00(1.17)^{de}	49.1	65.49
Emamectin benzoate 5 SG	0.40 gm/l	2.33(1.68)^{bc}	1.00(1.22)^{de}	59.48	1.00(1.17)^{de}	63.52	2.00(1.58)^{c}	30.53	2.00(1.56)^{cd}	27.04	45.14
Fenvalerate 20 EC	0.50 ml/l	3.67(2.04)^{b}	1.33(1.34)^{cd}	65.78	1.33(1.34)^{cd}	69.2	1.67(1.46)^{c}	63.17	3.00(1.87)^{c}	30.52	57.17
Chlorantraniliprole 18.5 SC	0.30 ml/l	1.33(1.34)^{c}	0.33(0.88)^{e}	76.57	0.33(0.88)^{e}	78.91	0.33(0.88)^{d}	79.92	0.67(1.05)^{e}	57.18	73.15
NSKE 5%		9.00(3.08)^{a}	4.67(2.27)^{b}	51.01	5.33(2.40)^{b}	49.66	6.67(2.68)^{b}	40.02	8.33(2.97)^{b}	21.33	40.51
Azadirectin 1%	2.00 ml/l	10.33(3.29)^{a}	5.33(2.40)^{b}	51.28	6.33(2.61)^{b}	47.92	8.00(2.91)^{b}	37.33	9.67(3.19)^{b}	20.43	39.24
Untreated control		11.33(3.44)^{a}	12.00(3.53)^{a}		13.33(3.72)^{a}		14.00(3.81)^{a}		13.33(3.71)^{a}		
S.Em			0.4	0.24		0.23		0.35		0.34	
CD 5%			1.22	0.74		0.7		1.06		1.04	
CV			13.83	13.78		12.73		3.44		13.19	
F test			**	**		**		**		**	

****** Significance at 5%

Figures in parenthesis are √x+0.5 transformed values.

DAS-days after spray

Three days after spraying, the least larval population recorded in Chlorantraniliprole 18.5 SC (0.33 larvae/plant) and Spinosad 45 SC (0.33 larvae/plant) found statistically on par with each other. Indoxacarb14.5 SC (1.00 larvae/plant) was statistically on par with Emamectin benzoate 5 SG (1.00 larvae/plant), Fenvalerate 20 EC (1.33 larave/plant) and Profenophos 50 EC (2.00 larvae/plant). The rest treatments NSKE of 5.33 larvae per plant stood statistically on par with

Azadirachtin of 6.33 larvae/plant. However, untreated check recorded with 13.33 larvae/plant, which was significantly higher larval population compared to other treatments (Table 3).

Seven days after spraying, the least larval population was recorded in Chlorantraniliprole 18.5 SC (0.33 larvae/plant) was statistically on par with Spinosad 45 SC (0.67 larvae/plant). Indoxacarb 14.5 SC (1.00 larvae/plant) found statistically on par with Fenvalerate 20 EC (1.67 larvae/plant). Profenophos 50 EC (2.00 larvae/ plant) and Emamectin benzoate 5 SG (2.00 larvae/plant). Whereas, NSKE (6.67 larvae/plant) stood statistically on par with Azadirachtin (8.00 larvae/plant). Untreated check reported significantly higher population of *A. atkinsoni* (14.00 larvae/plant) (Table 3)

Ten days after spraying, Chlorantraniliprole 18.5 SC reported lowest larval population of 0.67 larvae per plant was statistically on par with Spinosad 45 SC (1.00 larvae/plant). The next best treatments Indoxacarb 14.5 SC (2.00 larvae/plant) and Emamectin benzoate 5 SG (2.00 larvae/plant) were statistically on par with each other. Profenophos 50 EC (3.00 larvae/plant) Fenvalerate 20 EC (3.00 larvae/plant) stood statistically on par with each other. Larval population of NSKE 5% of 8.33 found statistically on par with Azadirachtin 1% treatment with 9.66 larvae per plant. Whereas, significantly highest population was recorded in untreated check (13.33 larvae/plant) (Table 3).

With regard to percent reduction in larval population, the highest larval reduction of 76.57 percent was reported in Chlorantaniliprole 18.5 SC followed by Fenvalerate 20 EC and Spinosad 45 SC with 65.78 and 62.12 percent, respectively. At three days after spraying the maximum larval population reduction was observed in Spinosad 45 SC (83.20%) followed by Chlorantaniliprole 18.5 SC (78.91%). Whereas, the highest larval population reduction at seven and ten days after spraying was observed in Chlorantaniliprole 18.5 SC (79.92 and 57.18%) followed by Spinosad 45 SC (67.53 and 49.10%), respectively as represented in Table 3.

Mean percent larval reduction from two sprays during 2021-22

The highest mean larval reduction during 2020-22 was observed in Chlorantraniliprole 18.5 SC of 78.95 percent followed by Spinosad 45 SC (75.36%). The next best highest mean larval reduction was recorded in Fenvalerate 20 EC (64.00%) followed by Indoxacarb 14.5 SC (63.32%), Emamectin benzoate 5 SG (61.92%) and Profenophos 50 EC (57.64%) and The least mean larval reduction of 36.04 and 32.86 percent was noticed in NSKE 5% and Azadirachtin 1%, respectively as shown in Table 4.

At the end of second spray during 2021-22, the insecticides in decreasing order of their efficacy against *A. atkinsoni* were Chlorantraniliprole 18.5 SC > Spinosad 45 SC > Fenvalerate 20 EC > Indoxacarb 14.5 SC > Emamectin benzoate 5 SG > Profenophos 50 EC > NSKE 5%> Azadirectin 1%.

In present findings Chlorantraniliprole 18.5 SC was most effective against field bean pod borer, *A. atkinsoni*. These observations were in aggrement with findings of Rashmi *et al*. (2020) [9], who observed Chlorantraniliprole 18.5 SC was most effective against all pod borers followed by Emamectin benzoate 5 SG and Spinosad 45 SC. According to findings of Dalwadi *et al*. (2009) [2], least incidence of pod borer was observed in NSKE treated plots, which was in agreement with present findings.

Table 4: Bio-efficacy of selected insecticide molecules against field bean pod borer, *Adisura atkinsoni* during year 2021-22 (Mean 2 sprays)

Treatments	Dosages	First spray						Second spray						
		Pre treatment	I DAS	3 DAS	7 DAS	10 DAS	% reduction	Pre treatment	I DAS	3DAS	7 DAS	10 DAS	% reduction	Mean% reduction
Indoxacarb 14.5 SC	0.70 ml/l	7.66 (2.84)	2.33 (1.68)^{d}	2.00 (1.58)^{c}	1.33 (1.34)^{bc}	2.33 (1.68)^{bc}	76.17	2.33 (1.68)^{bc}	1.33 (1.34)^{cd}	1.00 (1.22)^{cde}	1.00 (1.22)^{cd}	2.00 (1.58)^{cd}	50.49	63.32
Profenophos 50 EC	2.00 ml/l	8.33 (2.96)	4.00 (2.12)^{bc}	2.33 (1.68)^{c}	2.33 (1.68)^{b}	4.00 (2.12)^{b}	65.71	4.00 (2.12)^{b}	2.33 (1.68)^{c}	2.00 (1.58)^{c}	2.00 (1.58)^{c}	3.00 (1.87)^{c}	49.57	57.64
Spinosad 45 SC	0.15 ml/l	7.00 (2.73)	1.33 (1.34)^{de}	0.67 (1.07)^{de}	1.00 (1.22)^{c}	1.67 (1.46)^{c}	85.24	1.67 (1.46)^{c}	0.67 (1.05)^{de}	0.33 (0.88)^{e}	0.67 (1.05)^{d}	1.00 (1.17)^{de}	65.49	75.36
Emamectin benzoate 5 SG	0.40 gm/l	7.33 (2.78)	2.00 (1.58)^{de}	1.33 (1.34)^{cde}	1.33 (1.34)^{bc}	2.33 (1.68)^{bc}	78.69	2.33 (1.68)^{bc}	1.00 (1.22)^{de}	1.00 (1.17)^{de}	2.00 (1.58)^{c}	2.00 (1.56)^{cd}	45.14	61.92
Fenvalerate 20 EC	0.50 ml/l	8.00 (2.91)	3.67 (2.04)^{c}	1.66 (1.22)^{cd}	1.33 (1.34)^{bc}	3.67 (2.04)^{b}	70.83	3.67 (2.04)^{b}	1.33 (1.34)^{cd}	1.33(1.34)^{cd}	1.67 (1.46)^{c}	3.00 (1.87)^{c}	57.17	64.00
Chlorantraniliprole 18.5 SC	0.30 ml/l	5.33 (2.41)	1.00 (1.22)^{e}	0.67 (1.07)^{e}	0.67 (1.07)^{c}	1.33 (1.34)^{c}	84.76	1.33 (1.34)^{c}	0.33 (0.88)^{e}	0.33(0.88)^{e}	0.33 (0.88)^{d}	0.67 (1.05)^{e}	73.15	78.95
NSKE 5%	-	8.00 (2.91)	4.67 (2.27)^{bc}	4.33 (2.20)^{b}	7.33 (2.80)^{a}	9.00 (3.08)^{a}	31.57	9.00 (3.08)^{a}	4.67 (2.27)^{b}	5.33(2.40)^{b}	6.67 (2.68)^{b}	8.33 (2.97)^{b}	40.51	36.04
Azadirectin 1%	2.00 ml/l	9.00 (3.07)	5.33 (2.41)^{b}	5.33 (2.41)^{b}	8.67 (3.03)^{a}	10.33 (3.29)^{a}	26.49	10.33 (3.29)^{a}	5.33 (2.40)^{b}	6.33(2.61)^{b}	8.00 (2.91)^{b}	9.67 (3.19)^{b}	39.24	32.86
Untreated control	-	8.00 (2.91)	7.33 (2.80)^{a}	8.33 (2.97)^{a}	9.33 (3.13)^{a}	11.33 (3.44)^{a}		11.33 (3.44)^{a}	12.00 (3.53)^{a}	13.33(3.72)^{a}	14.00 (3.81)^{a}	13.33 (3.71)^{a}		

Figures in parenthesis are $\sqrt{x+0.5}$ transformed values.
DAS-days after spray

Yield loss estimation

The grain yield (q/ha) was recorded during season 2021-22 and was represented in Table 5. The maximum yield during season 2021-22 was noticed in Chlorantraniliprole 18.5 SC (6.80 q/ha) followed by Spinosad 45 SC (6.44 q/ha) and Fenvalerate 20 EC (6.17 q/ha). The next highest yield observed in Indoxacarb 14.5 SC (5.82 q/ha) followed by Profenophos 50 EC (5.56 q/ha) and Emamectin benzoate 5 SG (5.41 q/ha). The grain yield of Azadirectin 1% and NSKE 5% was 4.70 and 4.36 q/ha, respectively. The least grain yield was observed in untreated control (2.40 q/ha) as given in Table 5.

Table 5: Effect of insecticide treatments on field bean grain production

Season 2021-22			
Sl. No	**Insecticides**	**yield (q/ha)**	**Avoidable yield loss (%)**
1	Indoxacarb 14.5 SC	5.82	58.78 c
2	Profenophos 50 EC	5.56	56.80 cd
3	Spinosad 45SC	6.44	62.76 b
4	Emamectin benzoate 5 SG	5.41	55.67 d
5	Fenvalerate 20 EC	6.17	61.15 b
6	Chlorantraniliprole 18.5 SC	6.80	64.71 a
7	NSKE 5%	4.36	44.90 f
8	Azadirectin 1%	4.70	49.06 e
9	Untreated control	24.01	-
S.Em		0.16	
CD 5%		0.48	
CV		7.01	

The maximum avoidable yield loss percent during season 2021-22 was noticed in Chlorantraniliprole 18.5 SC (64.71%) followed by Spinosad 45 SC (62.76%) and Fenvalerate 20 EC (61.15%). The next highest avoidable yield loss percent was recorded in Indoxacarb 14.5 SC (58.78%) followed by Profenophos 50 EC (56.80%) and Emamectin benzoate 5 SG (55.67%). The avoidable yield loss percent of Azadirectin 1% and NSKE 5% was 44.90 and 49.06 percent, respectively as shown in Table 5.

The efficacy of insecticides in reduction of larval population was given in decreasing order *viz*., Chlorantraniliprole 18.5 SC > Spinosad 45 SC > Fenvalerate 20 EC > Indoxacarb 14.5 SC > Emamectin benzoate 5 SG > Profenophos 50 EC > NSKE 5%> Azadirectin 1% during 2021-22. However, the insecticides Azadirectin 1% and NSKE 5% observed with least larval reduction compared to other insecticides.

Conclusion

The overall efficacy of insecticides revealed that, under field (in-vivo) condition both Chlorantraniliprole 18.5 SC and Spinosad 45 SC were found effective against pod borer during 2021-22, respectively. Hence, Chlorantraniliprole 18.5 SC and Spinosad 45 SC treatment application control the field bean pod borer population under field conditions.

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