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Yield Loss Estimation and Economic Injury Level for Pod Borers of Field Bean (*Lablab perpureus* L.)

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Abstract

A field experiment was conducted during *kharif* of 2006 to assess the extent of losses caused by pod borers in field bean and to work out the economic injury levels of pod borers. The results indicated that the extent of damage by pod borers was minimum (16.30 and 19.58% for seed and pod respectively) with the supervisory pest control treatment which received three sprays of indoxacarb 14.5 SC applied at 0.75 ml/ liter based on EIL, which also recorded the highest green pod yield of (42.50 q/ha), followed by treatment which was applied with three sprays of indoxacarb (41.37 q/ha). Plots covered with nylon nets recorded the pod and seed damage to an extent of 18.77 and 22.75% respectively with green pod yield of (37.70 q/ha) as compared to untreated check (19.81 q/ha). Per cent yield losses due to pod borers was found to be 53.38 in untreated check compared to supervisory control. Additional yield of 22.69 q/ha can be obtained in supervisory control compared to untreated check. The economic injury level of pod borers in field bean was found to be 0.46 larvae.

Key words : Economic injury level, Pod borers, Field bean, Indoxacarb.

Field bean *Lablab perpureus* (L.) is one of the most important dual purpose pulse crop grown in Karnataka both for its vegetable and seed purposes. Pod borers are the major pests of field bean. The larvae of *Helicoverpa armigera* (Hubner), *Adisura atkinsoni* (Moore), *Maruca testulalis* (Geyer), *Etiella zinckenella* (Treitschke), *Cydia ptychora* (Meyrick), *Exelastis atomosa* (Walshinghan), *Sphenarches caffer* (Zeller) and *Lampides boeticus* (Linnaeus) cause great loss to the crop by boring and infesting the reproductive organs like flowers, flower buds, green and mature pods. Even the undamaged seeds inside the infested pods were found to be unfit for consumption due to excretory pallets of the insects present inside the pod causing about 50% pod infestation. Timing of insecticide spray especially in pulses is of paramount importance to get higher yield. Studies conducted to assess the effect of supervisory spray of insecticide to control pod borers based on ETL is lacking. Existing literature also revealed that in spite of its serious nature, no detailed work had been done so far regarding the crop loss estimation and EIL of pod borer complex on any crop. Hence, the present investigation was undertaken.

Methods

A field experiment was conducted at college of agriculture, Navile, Shimoga, Karnataka during *kharif* of 2006 to study the effect of insecticide application based on ETL and blanket application at certain intervals on the yield potential of field bean. Experiment consists of six treatments involving various sprays of indoxacarb a novel insecticide to control lepidopteran pests compared with supervisory spray and untreated control. The experiment was laid out in a randomised block design with three replications. Assessment of loss in yield due to pod borer infestation in field bean was estimated by protecting the crop at different stages of growth. All the recommended package of practices (1) was followed for raising the crop except plant protection measures.

In treatment no. 2 the plots were covered with nylon net immediately after the sowing. In supervisory control, spraying with indoxacarb was sprayed at 0.75 ml per liter based on EIL. For other treatments sprays were given on 45, 55 and 65 DAS depending on number of sprays. When the crop matured, the pods were harvested plot wise three times and the

total pod yield was reported. The per cent pod damage was worked out separately for seeds and for pods at each harvest and the mean per cent damage to seeds and pods was reported. Pod borer population was observed at three times after each spray depending on the treatments. The data on percent pod borer damage was subjected to square root transformation before subjecting to analysis of variance as suggested by Gomez and Gomez (2).

The probable loss due to pod borers was computed by comparing the yields obtained from different plots which were exposed to varied levels of insecticide application and nylon net cover against the treatment, which was protected throughout the crop growth period by using the insecticide and nylon net. For determination of economic injury level (EIL) the parameters like pest density level, cost of plant protection, yield per plot and the average market price of the produce were considered. The EIL was computed by using the procedure given by Stone and Pedigo (3) which was modified by Ogunlan and Pedigo (4).

$$\text{Gain threshold} = \frac{\text{Cost of plant protection measures (Rs/ha)}}{\text{Market price of the produce (Rs./q)}}$$

$$\text{Economic injury level (EIL)} = \frac{\text{Gain threshold}}{\text{Regression coefficient}}$$

The cost of pest control included the chemical cost (indoxacarb) and its application cost including labor charges. The cost of indoxacarb taken at Rs 3,790/liter and the market price of produce was taken at Rs 1,000/q.

Results and Discussion

Number of Pod Borer Larvae per Plant

The treatment with nylon net recorded significantly lower number of larvae per plant (Table 1) after first spray (1.80) as compared to untreated check (9.30). The nylon net covered treatment was followed by supervisory application of insecticide (5.14), three sprays given at 45, 55 and 65 DAS (5.50) and two sprays of insecticide at 45 and 55 DAS (5.65). These treatments recorded significantly lower population of pod borers as compared to untreated check. After the second spray least larval population of 1.25 and 1.54/plant were recorded in supervisory control and in three and two times sprayed plots. Similar trend was also observed with respect the larval population recorded after third spray.

Pod Borer Damage

Pod borer complex damage to the field bean was assessed separately for pods and seeds at successive harvests and the mean over harvests was reported. The mean per cent damage to seeds and pods was significantly lower in supervisory control as well as in the plots which was sprayed three times with indoxacarb as compared to untreated control. The pod borer damage observed in these two treatments are comparable to the ones recorded with the plots covered with nylon nets. On an average, the percent

Table 1. Pod borer population in field bean as influenced by supervisory and blanket control measures. Figures in parentheses are squire root transformed values.

Treatment	Mean No. of pod borer larvae/plant		
	After 1st spray	After 2nd spray	After 3rd spray
Untreated check	9.30 (3.11)	10.80 (3.18)	11.38 (3.43)
Cover with nylon net	1.80 (1.49)	2.02 (1.57)	0.60 (1.00)
One spray at 45 DAS	5.77 (2.47)	5.92 (2.52)	9.18 (3.10)
Two sprays at 45 and 55 DAS	5.65 (2.42)	2.36 (1.60)	1.08 (1.23)
Three sprays at 45, 55 and 65 DAS	5.50 (2.41)	2.10 (1.54)	0.30 (0.85)
Supervisory control based on EIL	5.14 (2.32)	1.20 (1.25)	0.11 (0.76)
SE ±	0.10	0.09	0.09
CD at 5%	0.33	0.28	0.30
CV%	9.33	9.64	11.53

Table 2. Mean pod borer damage, green pod yield and yield loss of field bean as influenced by supervisory and blanket control measures. Figures in parentheses are square root transformed values.

	Mean pod borer damage (%)		Total green pod yield (q/ha)	Loss in yield over supervisory control (%)	Additional yield over control (q/ha)
	Pod damage	Seed damage			
Untreated check	44.62 (6.68)	33.09 (5.75)	19.81	53.38	-
Cover with nylon net	10.41 (3.23)	15.95 (3.99)	37.70	11.29	17.89
One spray at 45 DAS	27.98 (5.29)	19.96 (4.47)	27.10	36.23	7.29
Two sprays at 45 and 55 DAS	13.64 (3.69)	16.64 (4.08)	36.65	13.76	16.84
Three sprays at 45, 55 and 65 DAS	9.35 (3.06)	12.77 (3.57)	41.37	2.65	21.56
Supervisory control based on EIL	8.42 (2.90)	11.64 (3.41)	42.50	-	22.69
SE ±	1.00	0.99	1.16		
CD at 5%	3.02	2.28	3.50		
CV (%)	7.57	6.05	6.77		

reduction in pod borer damage was to an extent of 81% of pods and 67% of seeds due to supervisory control as compared to untreated check (Table 2).

Green Pod Yield

Significantly higher green pod yield was recorded in the supervisory control plots as compared to untreated check (Table 2). However, the yield levels of supervisory control was at par with he three blanket spray of indoxacarb. Similar trend was observed irrespective of the pickings. More than 53% loss in green pod yield was observed in untreated check as compared to supervisory control (Table 2). The plot covered with nylon net reduced the extent of yield loss to an extent of 11.29%. Whereas, three sprays of the chemical was as good as supervisory control which also received three sprays but on needy days. The present results on the number of applications are similar to Dina (5) who concluded that three applications made during flowering to pod maturation phase gave effective protection to pod against pod borers of cowpea. Similar results were also obtained by Kobayashi (6) who opined that two or three effective applications of insecticides gave 50–70% control of all soybean seed pests. Narendra Reddy et al. (7) reported that two to three sprays of fenvalerate at 0.02% was most effective against pod borer complex in pigeonpea.

Economic Injury Level (EIL) for Pod Borers

The economic injury level for pod borer complex in field bean was calculated as 0.44 larvae per plant by regressing the pod yield against number of pod borers per plant (Y=56.63-11.15 x, $r^2 = 0.93$). These results are in conformity with the findings of the threshold for the pod borer, *Helicoverpa armigera* on soybean was five larvae per meter row length (8). Gaztoni et al. (9) opined that action level for insect control on soybean pod borer was 10 larvae per meter row length.

Economic Injury level for *H. armigera* has been worked out in several crops like pigeonpea (0.60 larvae/plant) by Venkataiah et al. (10) ; safflower (0.67 larvae/plant) by Venkata Rajesh (11). While, the EIL for soybean pod borer, C. ptychora was 1.16 larvae per plant as reported by Amarnath, (12). The economic injury on threshold is flexible and many vary from areas, crop varieties, cost of the produce and even between two adjoining fields depending upon specific agronomic practices Smith and Reynolds (13).

Conclusion

Based on this study it can be concluded that pod borer complex of field bean can be effectively controlled by need based application of indoxacarb as compared to blindly spraying the crop at regular intervals.

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