Research Paper :

Pigeonpea pod borer complex management

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SUMMARY

The pigeonpea [*Cajanus cajan* (Linn.)] crop is found to be badly affected by pod borer complex and becoming serious problem. The pod borer complex comprises *Helicoverpa armigera, Exelastis atomosa* and *Melanagromyza obtusa*, which are responsible to cause direct damage to pods and grains resulting into, not only the grain yield loss but fodder too. This research makes an efforts to find out the suitable management modules, comprising the low cost and eco-safe technologies, to manage this problem at the initiation point to avoid the damage keeping environmental harmony as synthetic pesticides has been found hazardous. The investigated results indicate that the "biointensive module" comprising seed treatment of *Trichoderma* @ 4 g/kg seed followed by spraying of Neem seed extract 5% at bud initiation stage followed by spraying of Spinosad 45 SC @ 0.01 per cent at 15 days after bud initiation stage, found most effective in reducing larval population green pod damage by pod borer complex and recorded highest yield and ICBR; followed by IPM module *i.e.* collection and destruction of last year residues, ploughing of soil in April, selection of resistant variety, increased seed rate by 20 per cent, seed treatment with *Trichoderma* @ 4 g/kg seed, spraying NSE 5 per cent at bud initiation stage, spraying of NSE 5 per cent at 5 % fruiting bodies damage level and spraying of HaNPV 250 LE/ha for *H. armigera* if observed and low cost technology module, consisting of deep ploughing in April, mechanical collection of larvae, use of moderately pest resistant variety *i.e.* Asha, increased seed rate by 20 per cent, seed treatment with *Trichoderma* @ 4 g/kg seeds and spraying of NSE 5 per cent at bud initiation stage and 15 days after bud initiation stage. All these three modules recorded lower larval population of pod borers; reduced green pod damage and higher ICBR and net profit too.

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Pod borer complex is a major problem in pigeonpea production. About 250 species of insects belongings to 8 orders and 61 families found to attack on pigeonpea. Among these only few are economically important as pest *viz*., Tur plume moth, *Exelastis atomosa* (Walsh), *Helicoverpa armigera* (Hubner) and Tur Pod fly, *Melanagromyza obtusa* (mall) collectively referred as "Pod borer complex" (Lal, 1998; Patil *et al*., 1990). This pod borer complex recorded economical damage at various places ranging 30 to 100 per cent (Adgokar *et al.,* 1993; Sarode and Sarnaik, 1996). As result we have to import pulses from other countries by investing a huge amount, in addition to direct loss to cultivators

Cultivators main thrust has been towards application of synthetic insecticides, but with their indiscriminate and excessive use on diverse crops, we are facing many diversified and complex problems including development of resistance to insecticides in insects (Rao *et al.,* 2000), resurgence of secondary pests, disturbances to natural ecosystem and beneficial fauna, environmental pollution etc. It has therefore; become necessary to develop a module based alternative pest management technology which is ecofriendly, biosafe; economically viable and socially acceptable to combat the pest menace to reduce import and to increase the cultivator's net profit.

MATERIALS AND METHODS

A well planned field experiments was conducted on experimental field of Department of Entomology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (Maharashtra, India) in *Kharif* 2009, to come out with effective pod borer complex management modules, using a Randomized Block Design consisting of five treatment modules and four replications. Each individual plot was of the size 4.8 X 4.8 m. The modules tested were, M1-as an Insecticide module *i.e.* spraying of Endosulfan 35 EC @ 0.07 per cent at bud initiation stage followed by spraying of Indoxacarb 14.5 SC @ 0.01 per cent at 15 days after bud initiation stage, followed by spraying of Triazophos 35 per cent + Deltamethrin 1 per cent @ 0.09 per cent at 30 days after bud initiation stage; M2- The Biointensive module (includes seed treatment of Trichoderma @ 4 g/kg seed followed by spraying of Neem seed extract 5 per cent at bud initiation stage followed by spraying of Spinosad 45 SC @ 0.01 per cent at 15 days after bud initiation stage); M3- An IPM module (includes collection and destruction of last year residues, ploughing in April, selection of wilt and moderately pest resistant variety *i.e.* Asha, increased seed rate by 20 per cent. Seed treatment with *Trichoderma* @ 4 g /kg of seed, spraying of NSE 5 per cent at bud initiation stage, Spraying of NSE 5 per cent at 5 % fruiting bodies damage level and spraying of HaNPV 250 LE/ha for *H. armigera* if needed); and M4- as Low cost technology module (which includes, Deep ploughing in April, mechanical collection of larvae, use of moderately pest resistant variety *i.e.* Asha, increased seed rate by 20 per cent, seed treatment with *Trichoderma* @ 4 g/kg seeds and spraying of NSE 5 per cent at bud initiation stage and 15 days after bud initiation stage) along with M5- as an untreated control.

Methods of observation:

Helicoverpa armigera and Exelastis atomosa larval count per plant:

From each plot, five plants were selected randomly as representative of the overall plant population of each plot. Three twigs of three sides of each selected plant were tagged for recording weekly observations. The three twigs total count was considered as per plant count. The number of *H. armigera* and *E. atomosa* larvae were counted weekly from bud initiation stage to pod maturity stage *i.e.* after completions of module applications. Finally observations were statistically analysed and drawn the conclusion.

Pod damage by lepidopteran pests:

The total pods and pods having damage holes of Lepidopteran pests from three twigs of each selected plant were counted and percent pod damage was worked out.

Pod damage by Melanagromyza obtusa:

Per plot, fifty green pods excluding border rows were collected and by splitting the pods, the pod damage by *M. obtusa* were counted and per cent pod damage was worked out. The same method was used for pod damage at harvest.

Grain yield:

The module wise grain yields per plot were recorded and on that basis yields per hectare were calculated.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been presented under following heads:

Effect on larval population of *H. armigera:*

Each of the module tested was proved significantly superior over untreated control (Table 1). However, the highest efficiency to manage *Helicoverpa* larval population was achieved with bio-intensive module recording only the population of 1.72/plant followed by the insecticide module with 1.88 larvae /plant and both modules proved statistically similar. While IPM module and low cost technology module being statistically at par proved next effective in recording the larval population of 2.70 and 3.10 per plant, respectively. The biointensive module, not only proved effective to reduced the population of *Helicoverpa armigera* but also recorded higher natural enemies (Table 4) and emerged as ecofriendly and

Table 1 : Effect on larval population of *H. armigera* and *E. atomosa*

Sr. No.	Modules	Average number of *H. armigera* larvae per plant	Average number of *E. atomosa* larvae per plant
1.	M_1- Insecticide module	1.88 (1.37)	2.95 (1.71)
2.	M_2- Bio-intensive module	1.72 (1.31)	2.54 (1.59)
3.	M_3- IPM Module	2.70 (1.64)	4.37 (2.09)
4.	M_4- Low cost technology module	3.10 (1.76)	6.13 (2.47)
5.	M_5-Untreated control	4.52 (2.12)	7.27 (2.69)
	'F' test	Sig.	Sig.
	S.E. (m)	0.07	0.16
	C.D. (P=0.05)	0.21	0.47

Table 2 : Effect on green pod damage

Sr. No.	Modules	Percent green pod damage by lepidopteron pests	Per cent green pod damage by *M. obtusa*	Percent green pod damage by pod borer complex
1.	M_1- Insecticide module	18.90 (25.77)	21.00 (27.28)	16.7 (24.12)
2.	M_2- Bio-intensive module	14.8 (22.63)	16.00 (23.58)	10.4 (18.81)
3.	M_3- IPM module	21.8 (27.83)	27.2 (31.44)	19.5 (26.21)
4.	M_4- Low cost technology module	28.4 (32.20)	30.90 (33.77)	24.75 (29.82)
5.	M_5-Untreated control	35.9 (36.81)	38.3 (38.23)	29.2 (32.71)
	'F' test	Sig.	Sig.	Sig.
	S.E. (m) $\pm$	0.92	0.58	0.61
	C.D. (P=0.05)	2.29	1.49	1.72

economical (Table 5). Even though the insecticide module proved effective in reducing the pest population, its input cost is higher and hence found uneconomical, while IPM module proved to be not only economical but ecofriendly too. Baviskar *et al.,* (2002) reported the efficacy of NSE 5 % against *H. armigera*. While the effectiveness of HaNPV 250 LE in managing larval population is also reported by Bhatt and Patel (2002); Srinivasa and Sridhan (2008) which supports these findings.

Effect on the larval population of *Exelastis atomosa:*

The data presented in (Table1) indicated that the bio-intensive module proved to be the most effective in reducing the larval population of *E. atomosa* to 2.54/plant followed by an equally effective insecticide module which reduced the larval population to 2.95 /plant. Where as the IPM module with 4.37 larvae/plant was found next effective. However the low cost technology was not found effective to reduce larval population as it recorded 6.13 larvae/plant but was superior over untreated control.

Thakare and Sarode (2003) also reported the NSE 5 % + half dose of Endosulfan as a effective treatment in managing the larval population of *E. atomosa.* While Baviskar *et al.* (2002) reported the positive efficacy of NSE 5 % against *E. atomosa.*

Effect on green pod damage by lepidopteron pests (*H. armigera* and *E. atomosa*):

All the pest management modules have recorded significantly superior results (Table 2) over untreated control. The biointensive module was found most effective in minimizing the green pod damage to 14.8 per cent and was significantly superior over all other modules followed by insecticide module (18.9 %) and IPM modules (21.8 %) in reducing the green pod damage, the later two treatments were statistically equally effective. While, the low cost technology module found inferior as compared to other modules and recorded higher pod damage (28.4 %) but significantly superior over untreated control which recorded highest (35.9 %) pod damage by lepidopteron pests.

The effectiveness of NSE 5 per cent in reducing the green pod damage in pigeonpea by lepidopteron pests has also been reported by Nath *et al.* (2008). IPM modules including the treatments of NSE 5 per cent, HaNPV 250 LE and Endosulfan 35 EC found effective in reducing the pod damage by lepidopteron pests by Srinivasan and Sridhar, (2008) and Katole *et al.* (1999).

Effect on green pod damage by *M. obtusa:*

The significant reduction was found (Table 2) in per cent green pod damage due to *M. obtusa* on pigeonpea by all the pest management modules over untreated control. However, the bio-intensive module was emerged as the most effective module and statistically significant over all other modules in recording minimum pod damage (16.00 %) by followed by an insecticide module and IPM module which also recorded lower pod damage of 21.00 and 27.2 per cent. However, the low cost technology module has not shown any encouraging results since pod damage was relatively higher *i.e.* 30.9 per cent but still has given better results as compared to untreated control which recorded 38.3 per cent green pod damage.

Effect on green pod damage by pod borer complex:

The per cent green pod damage by pod borer complex *i.e.* collective damage of *H. armigera, E. atomosa* and *M. obtusa* presented in Table 2 revealed that all pest management modules were found significantly superior over untreated control. Among the four modules, the bio-intensive module recorded minimum green pod damage (10.4 %) and proved most effective and was significantly superior over all other modules, followed by insecticide module, IPM module and low cost technology module which recorded 16.7, 19.5 and 24.75 per cent pod damage, respectively. Where as each of the modules in sequence was significantly superior over other. Maximum green pod damage (29.2 %) was noticed in untreated control.

The effectiveness of NSE 5 per cent against pod borer complex was reported by Nath *et al.*(2008). Reduction in the pod damage of pigeonpea due to pod borer complex by application of Spinosad 45 SC has been reported by Bhoyar *et al.* (2004); Singh *et al.* (2008). Srinivasan and Sridhar (2008) tested the effectiveness of IPM module including treatments of NSE 5 per cent, HaNPV 250 LE and Endosulfan 35 EC@ 0.07 per cent against the pod damage by pod borer complex.

Effect on grain yield of pigeonpea:

All the pest management modules were significantly superior over untreated control in increasing grain yields (Table 3) . The bio-intensive module recorded the highest grain yield of 14.72 qt/ha followed by insecticide module which recorded 14.01 qt/ha and both modules were statistically at par. The next effective modules were IPM module and low cost technology module that recorded the yield of 11.84 q/ha and 10.92 q/ha, respectively as compared to untreated control which recorded lowest (8.26 q/ha) grain yield. From this it can be concluded that, there was significant increased in yield of pigeonpea in all plant protection modules over the untreated control. While among the four modules, yield recorded in the bio-intensive module and insecticide module was higher over other modules, that is because of less pod damage by pod borers due to the effective and timely pest management which not only helped to reduce the larval population, pod damage but also wilt in pigeonpea. Even though there was comparatively more larval population and pod damage in the IPM module and low cost technology module than insecticidal module, but the CIBR were higher than insecticide module *i.e.* 10.23 and 8.60 against 8.18 in insecticide module and also were effective in increasing the yield due to the application of NSE 5 %, HaNPV 250 LE and might be due seed treatment of *Trichoderma* as they reduce the wilt and produce growth regulating factors that increase the yield and plant biomass. Hence, the bio-intensive module followed by IPM module and low cost technology module are proved to be the best alternatives to insecticides to get maximum net profit with an additional advantage of pesticides free grains and pollution free environment.

Table 3 : Effect on yield and ICBR

Sr. No.	Modules	Grain yield (q/ha)	ICBR
1.	M_1- Insecticide module	14.01 (3.22)	8.18
2.	M_2- Bio-intensive module	14.72 (3.38)	14.40
3.	M_3- IPM module	11.84 (2.72)	10.23
4.	M_4- Low cost technology module	10.92 (2.51)	8.60
5.	M_5-Untreated control	8.26 (1.90)	
	'F' test	Sig.	
	S.E. (m) $\pm$	0.648	
	C.D. (P=0.05)	1.82	

Earlier workers like, Theradimani and Hepziba, (2003) also recorded increased yield due to seed treatment of *Trichoderma* sp. in sunflower. Windham *et al.* (1986) reported that *Trichoderma* sp. produces growth regulating factors that increases the plant biomass. Kokate (1999); and Ousley (1994) reported the increased vigour index due to the *Trichoderma* species. Singh *et al.* (1998) and Monoco *et al.* (1998) reported the effecacy of *Trichoderma* sp. against both *F. oxysporum* and *Rhizoctonia bataticola* which also supports these results.

Conclusion:

From the above results, it is concluded that bio-intensive module and IPM module were quite safer for the multiplication of natural enemies and found effective in reducing the larval population, pod damage and in increasing the grain yield and ICBR of pigeonpea. Hence farmers can adopt these two modules as an alternative to insecticides as economical, environmentally safe, easy to use and socially acceptable too.

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