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Comparative Efficacy of Various Insecticides to Control Gram Pod Borer (*Helicoverpa armigera* Hubner) on Chickpea

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Abstract: Effects of five insecticides i.e. Chlorpyrifos, (2500 ml ha⁻¹), Endosulfan (2500 ml ha⁻¹), Indoxycarb (425 ml ha⁻¹), Profenophos (2500 ml ha⁻¹) and Spinosad (200 ml ha⁻¹) alongwith untreated check against gram pod borer (*Helicoverpa armigera* Hubner) were investigated during Rabi season, 2001-2002. Chickpea variety Bittle-98 was used as a test variety. The plots were sprayed at pod formation stage followed 2nd spray after 15 days. Results revealed that a varying degree of control was achieved in different insecticidal treatments in terms of decreased pest population and pod damage resulting in increased seed yield. Among the various insecticides tested, Spinosad (Tracer) and Indoxycarb (Steward) were highly effective against gram pod borer while Endosulfan was found to be the least effective insecticide.

Key words: Chickpea, gram pod borer, pod damage, insecticides, seed yield

Introduction

Gram pod borer (*Helicoverpa armigera* Hubner), Cutworm (*Agrotis ypsilon*) and whitefly (*Bemisia tabaci* Gennad) attack the chickpea (*Cicer arietinum* L.) crop. Among these insect species, *Helicoverpa armigera* Hubner) is the most serious pest of chickpea and other crop plants all over the world (Patankar *et al.*, 2001). In server cases, it causes about 75-90 % losses in seed yield (Lal, 1996). He pointed out that gram pod borer damaged leaves, tender shoots, apical tips, floral buds and the pods.

Chemical control is still an important and the most effective tool of pest management. However, intelligent use of insecticides is dire need of the day. The discriminate use of insecticides results in increased resistance of insecticides against insects with the passage of time and creates the problem of environmental pollution. Proper hoeing and weeding results in checking the multiplication of *Helicoverpa armigera* in initial stages of crop growth. Such practices will ultimately decrease the number of sprays.

Gupta *et al.* (1991), Khan *et al.* (1993), Giraddi *et al.* (1994), Noorani *et al.* (1994), Choudhary and Sachan (1995), Lal (1996) and Rakesh and Nath (1996) tested various insecticides against gram pod borer on chickpea at various stages of growth like 50% flowering, pod formation and dough stages. They reported that the application of insecticides at proper stages resulted in less pod borer population, less pod damage and increased yield as compared to the check.

Keeping in view the severity of this pest, an experiment was conducted at Regional Agricultural Research Institute, Bahawalpur during Rabi season, 2001-2002 with

the sole aim to find out the most effective insecticide for the control of *Helicoverpa armigera* (Hubner).

Materials and Methods

An experiment was conducted involving five insecticides (Table 1) to investigate their effects on gram pod borer (*Helicoverpa armigera* Hubner) during Rabi season, 2001-2002 at Regional Agricultural Research Institute, Bahawalpur. The experiment was laid out according to randomized complete block design with 3 replications and plot size of 5.4 m². Chickpea variety Bittle-98 was used as a test genotype. Similar agronomic practices were applied to all treatments from sowing to harvesting. First spray was applied at pod formation stage on 28th Feb., 2000 and second spray after 15 days of the first spray on 15th March, 2002 (Khan *et al.*, 1993; Noorani *et al.*, 1994). Observations regarding the pest population were recorded from 5 randomly selected plants from each plot 24 h before spray and after 3, 7 and 14 days of first and second sprays. The pod damage was recorded by counting the total number of pods and the number of pods damaged by the pest. All the insecticides were sprayed 24 h after recording the observation followed by second application after 15 days of the first spray.

Table 1: Insecticides and their doses used in the experiment

Insecticides Used	Formulation	Dose ha ⁻¹ (ml)	Group
Chlorpyrifos	40 EC	2500	Organo-Phosphate
Endosulfan	35 EC	2500	Chlorinated
Indoxycarb (Steward)	150SC	425	Oxadiazine Class
Profenophos	40 EC	2500	Organo-Phosphate
Spinosad (Tracer)	240 EC	200	Naturalyte
Check (no spray)	-	-	-

Table 2: Average larval population of *Helicoverpa armigera* on chickpea after first spray of various insecticides

Larval population plant ⁻¹						
Insecticides used	24h before sprary	After spray (days)			Mean	% decrease over check
		3	7	14		
Chlorpyrifos	1.66	1.08	0.53	1.50	1.04	-37.3
Endosulfan	2.00	1.25	0.85	2.25	1.45	-27.5
Indoxicarb (Steward)	2.16	1.08	0.30	0.75	0.71	-66.1
Profenophos	1.80	1.05	0.50	1.75	1.10	-38.9
Spinosad (Tracer)	1.93	0.97	0.20	0.50	0.56	-71.0
Check (no spray)	1.93	1.75	3.00	3.58	2.78	
P value	0.060	0.003	0.000	0.000	0.004	
CV (%)	17.05	20.48	15.42	17.39	39.81	
Cd1	NS	0.467	0.251	0.546	0.921	
Cd2	NS	0.665	0.357	0.776	1.309	
SE	0.198	0.148	0.080	0.173	0.292	

Table 3: Average larval population of *Helicoverpa armigera* on chickpea after second spray of various insecticides

Larval population plant ⁻¹						
Insecticides used	24h before sprary	After spray (days)			Mean	% decrease over check
		3	7	14		
Chlorpyrifos	1.50	0.88	0.35	1.25	0.83	-44.7
Endosulfan	2.25	1.50	1.00	2.00	1.50	-33.3
Indoxicarb (Steward)	0.75	0.26	0.10	0.75	0.37	-50.7
Profenophos	1.75	1.18	0.62	0.13	0.64	-63.4
Spinosad (Tracer)	0.50	0.23	0.18	0.10	0.17	-66.0
Check (no spray)	3.58	4.25	5.08	6.83	5.39	
P value	0.000	0.000	0.000	0.000	0.000	
CV (%)	17.39	12.88	14.27	13.39	42.23	
Cd1	0.546	1.024	0.315	0.511	1.139	
Cd2	0.776	1.457	0.448	0.727	1.620	
SE	0.173	0.325	0.100	0.162	0.362	

Table 4: Mean pod damage and seed yield of chickpea sprayed with various insecticides

Insecticides Used	Pod damage (%)		Seed yield (kg plot ⁻¹)	
	Mean	% decrease over check	Mean	% increase over check
Chlorpyrifos	02.77	-74.8	0.48	+107.3
Endosulfan	04.06	-63.1	0.33	+40.3
Indoxcarb (Steward)	01.82	-83.5	0.55	+136.1
Profenophos	02.93	-73.3	0.44	+90.1
Spinosad (Tracer)	01.75	-84.1	0.58	+150.2
Check (no spray)	11.00		0.23	
P value	0.000		0.000	
CV (%)	28.18		7.100	
Cd1	2.078		0.058	
Cd2	2.956		0.082	
SE	0.660		0.018	

Table 5: Correlations among various parameters recorded

Larval population plant ⁻¹	Pod damage (%)	Seed yield (kg plot ⁻¹)
Before spray	+0.032NS	-0.165NS
After 1st spray	+0.821**	-0.732**
After 2nd spray	+0.907**	-0.785**
Pod damage (%)	-	-0.844**

Percentage of damaged pods was calculated as under:

$$\text{Pod damage (\%)} = \frac{\text{No. of damaged pods}}{\text{No. of total pods}} \times 100$$

Seed yield data were recorded at the time of harvest and were subjected to statistical analysis using a computer package 'MSTATC'. Correlations were computed by using the "Correlation" sub-programme of the same package. Means were compared by Duncan's new multiple range test (Steel and Torrie, 1980).

Results and Discussions

Larval population

Before spray: The results presented in Table 2 revealed that the larval population in all the plots recorded 24 h prior to the insecticidal application was similar ($P>0.05$).

First spray: The results revealed that Spinosad (Tracer) was the most effective insecticide in controlling the gram pod borer among all the insecticides tested at 3, 7 and 14 days after applications followed by Indoxcarb (Steward) and Chlorpyrifos. Endosulfan was found to be the least effective insecticide (Table 2). Mean values for larval population were significantly different from one another ($P<0.01$).

Second spray: Data presented in Table 3 showed that the effects of all the insecticides were similar to the effects found in the first spray. Maximum control was observed

when Spinosad (Tracer) was sprayed while minimum control was achieved by spraying Endosulfan. Highly significant differences were found among the mean values for larval population in various treatments ($P < 0.01$).

Pod damage and seed yield: Statistical analysis of the data revealed highly significant differences ($P < 0.01$) among mean values for pod damage and seed yield in all the treatments. The application of Spinosad (Tracer) resulted in the least damage by pod borer (1.75 %) followed by Indoxcarb (Steward) (1.82 %) compared to check (11.0 %) with corresponding seed yields of 0.58 and 0.55 kg plot⁻¹, respectively, as against 0.23 kg plot⁻¹ of the check (Table 4). Endosulfan was the least effective insecticide. These results are not in agreement with those of Choudhary and Sachan (1995), Khan *et al.* (1993) and Noorani *et al.* (1994) who found Endosulfan to be the most effective insecticide. Seed yield had highly significant negative correlation with larval population [$(r^2 = -0.732$ after first spray) ($r^2 = -0.785$ after second spray)] and pod damage ($r^2 = -0.844$) (Table 5). Pod borer population and pod damage were positively correlated [$(r^2 = +0.821$ after first spray) ($r^2 = +0.907$ after second spray)] (Table 5). The present results support the findings of Gupta *et al.* (1991), Khan *et al.* (1993), Giraddi *et al.* (1994), Lal (1996) and Rakesh and Nath (1996) who tested various insecticides against *Helicoverpa armigera* on chickpea at various stages of growth. They reported varying degrees of effects of various insecticides on chickpea in terms of pod borer population, pod damage and seed yield. The differences in present and the earlier worker's findings may be due to different experimental material (Bittle-98), insecticides tested (especially Indoxcarb and Spinosad) and different climatic conditions.

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