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EFFICACY OF INSECTICIDES IN CONTROLLING POD BORER (*HELICOVERPA ARMIGERA* HUBNER) INFESTING CHICKPEA

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Abstract

A field experiment was carried out at the Regional Pulses Research Station of Bangladesh Agricultural Research Institute, Madaripur, Bangladesh during *rabi* season of 2013-14 and 2014-15 to select effective insecticides to control pod borer (*Helicoverpa armigera* Hubner) of chickpea (*Cicer arietinum*). Signinificantly the highest insect infestation and yield loss were recorded from untreated control. Spray with every insecticide for 3 times at 7 days interval reduced insect infestation and yield loss significantly over control in both years. Reduction in insect infestation was 11.77-18.77% and 6.34-13.34% and yield loss was 280-393-168-281 kgha^{-1} in 2013-14 and 2014-15, respectively. The highest grain yield was obtained with Tracer 45 SC (Spinosad) (1177 kgha^{-1}) followed by Volium Flexi 300 SC (Thiamethaxam) (1045 kgha^{-1}) and Belt 24 WG (Flubendiamide) (1020 kgha^{-1}) in first year. In second year, Tracer 45 SC produced maximum yield (1396 kgha^{-1}) followed by Volium Flexi 300 SC (1315 kgha^{-1}) and Admire 200 SL (Imidacloprid) (1300 kgha^{-1}). In 2013-14, the highest benefit cost ratio (3.39) was obtained with Volium Flexi 300 SC followed by Belt 24 WG (2.65) and Admire 200 SL (1.67). In 2014-15, the highest benefit cost ratio was also obtained with Voilum Flexi 300 SC (2.38) followed by Admire 200 SL (1.79) and Belt 24 WG (1.63). Comparing two years data considering highest profit, Volium Flexi 300 SC might be applied @ 0.05% at an interval of 7 days to the crop for three times.

Introduction

Chickpea (*Cicer arietinum* L.), commonly known as gram is one of the important major pulse crops in Bangladesh. It is generally grown under rainfed condition in *rabi* season. Among the major pulses grown in Bangladesh, chickpea ranked 7th in terms of area and 6th in terms of production but second in terms of consumption. The national average yield of chickpea is only 1.09 tha^{-1} (Anon., 2015). Among the factors responsible for low yield of the crop, insect pests appeared to be most important. The crop is attacked by eleven species of insect pests (Rahman *et al.,* 1982). Among them pod borer, *Helicoverpa armigera* (Hubner) is major one of chickpea growing areas of the Bangladesh (Begum *et al.,* 1992). Findings of a country wide survey indicate that 30 to 40% pods are damaged by pod borer causing 400 kg grain loss per hectare (Rahman, 1990). Under favourable conditions, pod borer may cause 90-95% pod damage (Shengal and Ujagir, 1990; Sachan and Katti, 1994). The young caterpillar feeds on

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leaves, while grown up caterpillar bores into the pods and feeds on the seeds. Pod borer damages flower, flower bud and developing pods (Hossain, 2012). The management of this noxious pest is primarily based on insecticides (Rahman, 1991). Under the above circumstances, the present piece of research was conducted to find out effective and suitable insecticides against pod borer infesting chickpea and to ensure economic production.

Materials and Method

Five insecticides, namely Admire 200 SL (Imidacloprid) (0.05%), Belt 24 WG (Flubendiamide) (0.04%), Tracer 45 SC (Spinosad) (0.04%), Volium Flexi 300 SC (Thiamethaxam) (0.05%) and Proclaim 5 SG (Emamectin Benzoate) (0.1%) were tested against pod borer infesting chickpea under field conditions. Each of the insecticides represented a treatment. Plots received no spray with any insecticide represented untreated control. The experiment was conducted in the experimental farm of the Regional Pulses Research Station (RPRS) of Bangladesh Agricultural Research Institute, Madaripur, Bangladesh during the *rabi* season of 2013-14 and 2014-15. The land was prepared for good tilth using tractor driven cultivator and harrow. After ploughing, debris was removed from the field. NPK fertilizers were applied at final land preparation @ 20-40-20, respectively in the form of urea, triple super phosphate and muriate of potash, respectively. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. The unit plot size was 3m × 4m. Seeds of a recommended variety BARI Chola-5 were sown in continuous rows maintaining 40 cm row to row spacing. The seedlings were thinned to have plant to plant distance of 10 cm. Insecticidal suspensions were prepared in tap water and sprayed three times at 7 days interval starting from first appearance of the insects at flowering stage. Intercultural operations were done as and when necessary. Control plots were sprayed with tap water.

The experimental field was visited regularly to record infestation of the insect in treated and untreated control plots. For data collection, 10 plants were selected from middle rows of each unit plot at mature stage. The bored (damaged) and total number of pods found on selected plants was counted and percent pod infestation was computed based on total number of pods. After harvest and sunning, grain weight of each plot was recorded and expressed in yield per hectare. The grain yield loss per hectare due to pod borer infestation of each treatment was calculated using a standard formula based on percent pod infestation of actual yield obtained and expected yield in absence of any pod borer infestation for the respective treatment (Hossain *et al*., 1999). Yield loss of chickpea due to pod borer = Ye-Ya, where Ya= Actual yield ($kgha^{-1}$) and Ye= Expected yield in absence of any infestation.

$$Ye = \frac{YaX100}{100 - P}$$, where P= Percent pod infestation.

Net return and benefit cost ratio were calculated by prevailing market price of the commodity. The experimental data were analyzed after arcsine and square root transformation in 2013-14 and 2014-15, respectively. The means were compared using DMRT.

Results and Discussion

Pod borer infestation and yield loss

Effectiveness of different insecticides tested in the present study to suppress pod borer infestation and yield loss of chickpea are presented in Table 1. All the insecticides significantly reduced insect infestation and yield loss compared to untreated control in both crop seasons.

In 2013-14, significantly the highest pod borer infestation of 39.89% and yield loss of 428 $kgha^{-1}$ were recorded from untreated control. The infestation was reduced to 25.12-28.12% and yield loss to 280-393 $kgha^{-1}$ due to spray with the insecticides. The highest reduction was achieved with Volium Flexi 300 SC and the lowest with Admire 200 SL.

In 2014-15, insect infestation was 24.67% and yield loss of 330 $kgha^{-1}$ recorded in untreated control plot. The two parameters were reduced to 11.33-18.33% and 168-282 $kgha^{-1}$, respectively. The reduction was significant compared to untreated control. The lowest insect infestation and yield loss were recorded from plots sprayed with Volium Flexi 300 SC (Thiamethaxam) followed by Tracer 45 SC (Spinosad). The effectiveness of Volium Flexi 300 SC and Tracer 45 SC to reduce infestation was not significantly different. The highest insect infestation and yield loss were recorded in Proclaim 5SG treated plots.

Comparatively higher insect infestation was observed in 2013-14 compared to 2014-15. Such variation was due to higher rainfall recorded in 2013-14 which increased bushiness of chickpea plants and insect infestation. The rain fed cropping season of 2014-15 favored optimum growth of chickpea with higher pod setting and disfavor pod borer population increase. This was supported by (Hossain, 2003).

Yield, net return and benefit cost ratio

The Yield, net return and benefit cost ratio are presented in Table 2. The yield of chickpea varied significantly with crop growth, pod setting and pod borer infestation depending on climatic variation of the cropping seasons under study. As indicated earlier, the higher rainfall in 2013-14 cropping season resulted in the vigorous and bushy growth with less pod setting and also higher pod borer infestation in chickpea. In this season, the lowest yield (645 $kgha^{-1}$) was recorded from untreated control. The highest yield (1177 $kgha^{-1}$) was obtained from Tracer 45 SC treated plot followed by Volium Flexi 300 SC (Thiamethaxam) treated plot (1045 $kgha^{-1}$). Volium Flexi 300 SC (Thiamethaxam) treated plot gave the

Table 1. Effect of insecticides application on reduction of pod borer infestation (%) and yield loss of chickpea during the rabi season of 2013-14

Treatments	Pod infestation (%)		Infestation reduction over control (%)		Yield loss (kgha^{-1})	
	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15
Admire 200 SL (Imidacloprid)	28.12b (31.06)*	15.00 c (3.87)**	11.77	9.67	362d	229d
Belt 24 WG (Flubendiamide)	27.00 bc (30.36)	15.33 c (3.92)	12.89	9.34	377c	231c
Tracer45 SC (Spinosad)	25.05c (29.13)	12.00 d (3.46)	14.84	12.67	393b	190e
Volium Flexi 300 SC (Thiamethaxam)	21.12 d (26.53)	11.33d (3.37)	18.77	13.34	280e	168f
Proclaim 5 SG (Emamectin Benzoate)	25.01c (29.10)	18.33 b (4.28)	14.88	6.34	315e	281b
Control	39.89a (37.99)	24.67 a (4.97)	-	-	428a	330a

In a column, treatment means having the same letter(s) didn't differ significantly at 5% level, *Figures in the parentheses are the arcsine transformed mean values, **Figures in the parentheses are the square root transformed mean values.

Table 2. Effect of insecticides application on yield, net return and benefit cost ratio in chickpea production during rabi season of 2013-14 and 2014-15

Treatments	Yield (kg/ha)		Additional yield over control (kg/ha)		Additional income over control (Tk/ha)		Cost of fungicides application (Tk/ha)		Net income (Tk/ha)		Benefit cost ratio (MBCR)	
	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
Admire 200 SL (Imidacloprid)	925c	1300c	280	293	19600	20510	7350	7350	12250	13160	1.67	1.79
Belt 24 WG (Flubendiamide)	1020b	1277d	375	270	26250	18900	7200	7200	19050	11700	2.65	1.63
Tracer 45 SC (Spinosad)	1177a	1396a	532	389	37240	27230	17640	17640	19600	9590	1.11	0.54
Volium Flexi 300 SC (Thiamethaxam)	1045b	1315b	400	308	28000	21560	6375	6375	21625	15185	3.39	2.38
Proclaim 5 SG (Emamectin Benzoate)	945c	1253e	300	246	21000	17220	10050	10050	10950	7170	1.09	0.71
Control	645e	1007f	-	-	-	-	-	-	-	-	-	-

In a column, treatment means having the same letter(s) didn't differ significantly at 5% level. For calculating net return and benefit the following market prices were used: Admire 200 SL (Imidacloprid) = Tk.1850/250 ml, Belt 24 WG (Flubendiamide) = Tk.1800/200 gm, Tracer 45 SC (Spinosad) = Tk.5280/200 ml, Volium Flexi 300 SC (Thiamethaxam) = Tk.1525/250 ml, Proclaim 5 SG (Emamectin Benzoate) = Tk.2750/500 g, Chickpea=Tk. 70/kg and Labour wage= Tk. 300/day/labourer (8 hours day).

highest benefit cost ratio (3.39) followed by (2.65) Belt 24 WG (Flubendiamide) treated plots. The plots sprayed with Proclaim 5SG (Emamectin Benzoate) provided lowest benefit cost ratio (1.09).

In 2014-15, the yield performance of chickpea in the experimental plots was better than in 2013-14 crop seasons due to prevailing favorable climatic condition which favored higher pod setting but disfavored the pod borer infestation and population increase. The lowest yield (1007 $kgha^{-1}$) was recorded from untreated control plot. The highest yield (1396 $kgha^{-1}$) was obtained in Tracer 45 SC treated plot followed by (1315 $kgha^{-1}$) Volium Flexi 300 SC (Thiamethaxam). Volium Flexi 300 SC (Thiamethaxam) treated plots gave the highest benefit cost ratio (2.38) followed by (1.79) Admire 200 SL (Imidacloprid). The plot sprayed with Proclaim 5 SG (Emamectin Benzoate) gave benefit cost ratio less than one (0.71). The rest of the treatments had the same effects as in the previous year except Belt 24 WG (Flubendiamide). Chaudhary and Sachan (1995), on the other hand Hossain (2012) showed the significant effect of Cypermethrin application on pod borer population reduction compared to untreated control. Giraddi *et al.* (1994) reported effective control by Endosulfun when 2 sprays were applied at 50% flowering followed by 2 sprays at the green pod stage (Hossain, 2012).

Conclusion

From the above discussion, it was found that, spraying of insecticides significantly reduced pod borer infestation in chickpea. Volium Flexi 300 SC (Thiamethaxam) treated plot resulted the lowest grain yield loss but highest yield obtained from Tracer 45 SC (Spinosad) treated plot in both the years. Due to higher price of this insecticide (Tracer 45 SC), BCR reduced than all other insecticides without Proclaim 5 SG. But Volium Flexi 300 SC (Thiamethaxam) offered the highest BCR in both the years. For getting highest profit, Volium Flexi 300 SC (Thiamethaxam) may be applied @ 0.05% at an interval of 7 days for three times.

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