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). Significantly 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 kg ha\(^{-1}\) in 2013-14 and 2014-15, respectively. The highest grain yield was obtained with Tracer 45 SC (Spinosad) (1177 kg ha\(^{-1}\)) followed by Volium Flexi 300 SC (Thiamethoxam) (1045 kg ha\(^{-1}\)) and Belt 24 WG (Flubendiamide) (1020 kg ha\(^{-1}\)) in first year. In second year, Tracer 45 SC produced maximum yield (1396 kg ha\(^{-1}\)) followed by Volium Flexi 300 SC (1315 kg ha\(^{-1}\)) and Admire 200 SL (Imidacloprid) (1300 kg ha\(^{-1}\)). 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 Volium 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
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 (kg ha⁻¹) and Ye= Expected yield in absence of any infestation.

\[ Ye = \frac{Ya \times 100}{100 - P}, \text{ where } P = \text{Percent pod infestation.} \]
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 kg ha\(^{-1}\) were recorded from untreated control. The infestation was reduced to 25.12-28.12% and yield loss to 280-393 kg ha\(^{-1}\) 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 kg ha\(^{-1}\) recorded in untreated control plot. The two parameters were reduced to 11.33-18.33% and 168-282 kg ha\(^{-1}\), 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 (Thiamethoxam) 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 kg ha\(^{-1}\)) was recorded from untreated control. The highest yield (1177 kg ha\(^{-1}\)) was obtained from Tracer 45 SC treated plot followed by Volium Flexi 300 SC (Thiamethoxam) treated plot (1045 kg ha\(^{-1}\)). Volium Flexi 300 SC (Thiamethoxam) 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

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<tbody>
<tr>
<td>Admire 200 SL (Imidacloprid)</td>
<td>28.12b (31.06)*</td>
<td>15.00 c (3.87)**</td>
<td>11.77</td>
<td>9.67</td>
<td>362d</td>
<td>229d</td>
<td></td>
<td></td>
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<tr>
<td>Belt 24 WG (Flubendiamide)</td>
<td>27.00 bc (30.36)</td>
<td>15.33 c (3.92)</td>
<td>12.89</td>
<td>9.34</td>
<td>377c</td>
<td>231c</td>
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</tr>
<tr>
<td>Tracer 45 SC (Spinosad)</td>
<td>25.05c (29.13)</td>
<td>12.00 d (3.46)</td>
<td>14.84</td>
<td>12.67</td>
<td>393b</td>
<td>190e</td>
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<tr>
<td>Volium Flexi 300 SC (Thiamethoxam)</td>
<td>21.12 d (26.53)</td>
<td>11.33d (3.37)</td>
<td>18.77</td>
<td>13.34</td>
<td>280e</td>
<td>168f</td>
<td></td>
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<tr>
<td>Proclaim 5 SG (Emamectin Benzoate)</td>
<td>25.01c (29.10)</td>
<td>18.33 b (4.28)</td>
<td>14.88</td>
<td>6.34</td>
<td>315e</td>
<td>281b</td>
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<tr>
<td>Control</td>
<td>39.89a (37.99)</td>
<td>24.67 a (4.97)</td>
<td>-</td>
<td>-</td>
<td>428a</td>
<td>330a</td>
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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

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Yield (kg/ha)</th>
<th>Additional yield over control (kg/ha)</th>
<th>Additional income over control (Tk/ha)</th>
<th>Cost of fungicides application (Tk/ha)</th>
<th>Net income (Tk/ha)</th>
<th>Benefit cost ratio (MBCR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admire 200 SL (Imidacloprid)</td>
<td>925</td>
<td>1300</td>
<td>280</td>
<td>293</td>
<td>19600</td>
<td>20510</td>
</tr>
<tr>
<td>Belt 24 WG (Flubendiamide)</td>
<td>1020</td>
<td>1277</td>
<td>375</td>
<td>270</td>
<td>26250</td>
<td>18900</td>
</tr>
<tr>
<td>Tracer 45 SC (Spinosad)</td>
<td>1177</td>
<td>1396</td>
<td>532</td>
<td>389</td>
<td>37240</td>
<td>27230</td>
</tr>
<tr>
<td>Volium Flexi 300 SC (Thiamethoxam)</td>
<td>1045</td>
<td>1315</td>
<td>400</td>
<td>308</td>
<td>28000</td>
<td>21560</td>
</tr>
<tr>
<td>Proclaim 5 SG (Emamectin Benzoate)</td>
<td>945</td>
<td>1253</td>
<td>300</td>
<td>246</td>
<td>21000</td>
<td>17220</td>
</tr>
<tr>
<td>Control</td>
<td>645</td>
<td>1007</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

In a column, treatment means having the same letter(s) didn’t differ significantly at 5% level. For calculating net return and benefit cost ratio 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 (Thiamethoxam) = 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 kg ha\(^{-1}\)) was recorded from untreated control plot. The highest yield (1396 kg ha\(^{-1}\)) was obtained in Tracer 45 SC treated plot followed by (1315 kg ha\(^{-1}\)) 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 (Imidacloroprid). 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 Endosulfan 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.

**References**


