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Estimation of avoidable losses due to gram pod borer, (*Helicoverpa armigera* Hubner) in chickpea

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Abstract

A field experiment was conducted during *Rabi* season of 2017-18 and 2018-19 at Chaudhary Charan Singh Haryana Agricultural University, Hisar with an objective to assess the avoidable losses in chickpea variety HC-1 caused due to *Helicoverpa armigera*. The results showed that the mean number of larvae per meter row length were significantly less at $p < 0.05$ being 6.50 times lower under protected conditions (0.54) as compared to that of unprotected conditions (3.51). The mean number of damaged pods per plant were 2.34 times less under protected conditions (6.59) compared to 15.45 damaged pods under unprotected conditions. The mean per cent pod damage was 2.84 times higher under unprotected conditions (27.88) to that of 9.79 percent pod damage under protected conditions. Mean yield (kg) per hectare was 2.0 times higher in protected conditions (2013.66) as compared to that under unprotected conditions (1005.78). An avoidable yield loss of 49.61 per cent was recorded in grain yield (pooled).

Keywords: Chickpea, *Helicoverpa armigera*, avoidable yield losses, per cent pod damage

1. Introduction

Chickpea (*Cicer arietinum* L.) is an important pulse crop with 21 per cent of protein and stands third among the food-grains after wheat and rice. It is considered as rich and inexpensive source of proteins and vitamins which contains 20.8% protein, 4.0% fat, 8.5% fiber, 2.9% mineral matter, 8.49% lysine, 0.04% tryptophan and 0.11% methionine [8]. Its straw has also good forage value [19]. It occupies around two-fifth of the total area under the pulses in India. Total area under gram cultivation in India is 10.56 million ha, and total production is 11.23 million tonnes with average productivity of 1063 kg/ha [22]. In Haryana, total area under chickpea cultivation was recorded as 42 thousand ha with total production of 26 thousand tonnes and productivity 619 kg /ha [11].

Among biotic factors, insect pests are one of the major limiting factors affecting the production of chickpea. About 60 species of insect pests attack the chickpea crop out of which half a dozen are considered to be of economic importance. The major insect pests attacking chickpea include gram pod borer, *Helicoverpa armigera* (Hubner); leaf eating caterpillar, *Spodoptera exigua* (Hubner); Semilooper, *Autographa nigrisigna* (Walker); aphid (*Aphis craccivora* Koch); and the bruchids (*Callosobruchus* spp.). Out of these major pests, *H. armigera* is considered to be the more devastating pest responsible for the decrease in the productivity [3]. It feeds voraciously from seedling stage to maturity stage. Pest status of *H. armigera* has increased steadily over the past fifty years due to the diversification of agricultural ecosystems [2, 9].

H. armigera is a notorious, multigenerational and widely distributed pest and is reported to habituate 181 species of host plants belonging to 47 families in India [14, 21]. High reproductive rate, polyphagous behaviour, migratory nature and diapause are the major factors responsible for its serious pest status [6, 17]. It is voracious feeder on chickpea plant. Its infestation on the crop starts during the seedling stage and continues till crop maturity targeting flowers, pods and developing seeds [15]. Due to the attack of pod borer, the yield loss in chickpea has been estimated to be 10 to 60 per cent under normal weather conditions and can accelerate to 50 to 100 per cent in favorable climatic conditions [23]. In chickpea and pigeonpea *Helicoverpa* spp. caused an estimated loss of \$ 927 million in worldwide apart from \$ 5.0 billion in different crops [16]. The pest population increases tremendously during the pod formation stage [13] and thereby causes substantial damage to the developing grains inside the pods. Therefore, the present studies were conducted to assess the avoidable losses caused by *H. armigera* in chickpea.

2. Material and Methods

An experiment was conducted in plot size of 3*3m with 30*10cm spacing. The two treatments i.e. protected and unprotected plots were replicated fourteen times randomly as per ^[10] at the Pulses Research Farm, Chaudhary Charan Singh Haryana Agricultural University, Hisar during 2017-18 and 2018-19. One set of plots referred as protected was provided complete protection by spraying Novaluron 10 EC at weekly intervals while another set of plots termed as unprotected was kept untreated and exposed to natural infestation by *H. armigera*.

2.1 Observations

Observations for larval population of *H. armigera* were taken per meter row length at five different spots selected randomly

from each replication in both set of plots. Observations pertaining to various attributes related to the yield i.e. number of damaged pods per plant, percent pod damage per plant, and mean yield/ha (kg) were taken and subjected to 't' test. The loss in yield due to *H. armigera* was calculated by using the equation:

$$\text{Loss in yield (\%)} = \frac{X_1 - X_2}{X_1} \times 100$$

Where, X_1 = Yield in treated plot and X_2 = Yield in untreated plot

3. Results and Discussion

Table 1: Avoidable losses due to *Helicoverpa armigera* infestation in chickpea during 2017-18

Sr No	Parameters	Protected	Unprotected	t-calculated value	Mean Loss (%)
1	Mean no. of larva/mrl	0.43	3.32	27.12*	-
2	Mean number of damaged pods/plant	5.61	13.44	12.95*	-
3	Mean (%) pod damage/plant	8.38	23.89	48.31*	-
4	Mean yield/ha (kg)	2103.03	1033.47	31.96*	50.93

*Significant at 5 per cent

Table 2: Avoidable losses due to *H. armigera* infestation in chickpea during 2018-19

Sr No	Parameters	Protected	Unprotected	t-calculated value	Mean Loss (%)
1	Mean no. of larva/mrl	0.66	3.70	5.31*	-
2	Mean number of damaged pods/plant	7.54	16.75	9.16*	-
3	Mean (%) pod damage/plant	11.24	30.74	11.01*	-
4	Mean yield/ha (kg)	1731.86	880.29	21.74*	48.93

*Significant at 5 per cent

Table 3: Avoidable losses due to *H. armigera* infestation in chickpea during 2017-18 and 2018-19 (pooled mean)

Sr No	Parameters	Protected	Unprotected	t-calculated value	Mean Loss (%)
1	Mean no. of larva/mrl	0.54	3.51	9.12*	-
2	Mean number of damaged pods/plant	6.59	15.45	8.13*	-
3	Mean (%) pod damage/plant	9.79	27.88	10.14*	-
4	Mean yield/ha (kg)	2013.66	1005.78	16.88*	49.61

*Significant at 5 per cent

3.1 Avoidable losses during year 2017-18

The loss estimation due to infestation of chickpea by considering different parameters of crop growth and the yield attributing traits (Table 1) indicated that the mean number of larvae per meter row length were significantly less at $p < 0.05$ being 7.72 times lower under protected conditions as compared to that of unprotected conditions in year 2017-18. The mean per cent pod damage was 2.85 times higher under unprotected conditions to that of 8.39 percent pod damage under protected conditions. Mean yield (kg) per hectare was 2.03 times higher in protected conditions as compared to that under unprotected conditions. An avoidable yield loss of 50.93 per cent was recorded in grain yield during the year 2017-18.

3.2 Avoidable losses during year 2018-19

Likewise, the results obtained in Table 2 indicated that the mean number of larvae per meter row length were significantly less at $p < 0.05$ i.e. 5.60 times lower under protected conditions as compared to that of unprotected conditions. The mean per cent pod damage was 2.73 times higher under unprotected conditions to that of 11.24 percent pod damage under protected. Mean yield (kg) per hectare was 1.96 times higher in protected conditions as compared to that

under unprotected conditions. An avoidable yield loss of 48.93 per cent was recorded in grain yield during the year 2018-19.

3.3 Avoidable losses (pooled mean) of 2017-18 and 2018-19

On analyzing the pooled data obtained for the two years in table 3, the results indicated that the mean number of larvae per meter row length were significantly less at $p < 0.05$ being 6.50 times lower under protected conditions as compared to that of unprotected conditions. The mean per cent pod damage was 2.84 times higher under unprotected conditions to that of 9.79 percent pod damage under protected. Mean yield (kg) per hectare was 2.0 times higher in protected conditions as compared to that under unprotected conditions. An avoidable yield loss of 49.61 per cent was recorded in grain yield according to the obtained pooled data. All the t-values calculated for all the parameters of crop growth and yield attributes were found significant when compared with t-value tabulated at significance of 0.05 percent (2.16) during years 2017-18, 2018-19 and pooled.

These results are in accordance with ^[5] who reported that the mean number of damaged pods was 5.44 and 5.12 times more and the mean percent pod damage was 6.76 and 6.86 times more under unprotected condition. Mean yield/ha (kg) were

1.43 and 1.46 times more when the crop was kept protected by spraying Flubendiamide 480SC at weekly intervals. They reported that on the basis of yield, an avoidable loss of 29.93 and 31.28 per cent was recorded due to *H. armigera* infestation in chickpea during 2013-14 and 2014-15. Similarly, the mean percent pod damage was 2.09 and 17.01 in protected and unprotected plots of chickpea as observed by [12]. They also reported mean losses in grain yield due to *H. armigera* across genotype was 24.84 per cent under protected and unprotected conditions.

Similar type of observations were made by [4] who reported that mean percent pod damage was 17.78 and 34.76 in protected and unprotected conditions in chickpea. They also reported avoidable grain yield loss of 41.17 per cent in chickpea when protected against pod borer, *H. armigera*. [18] recorded higher seed yield of chickpea in protected plots (30.55 q/ha) when compared to untreated plots (11.11 q/ha) with the estimated avoidable loss of 63.64 per cent. [7] also reported that the mean seed yield in GNG-1581 was 15.00 q per ha in treated plots and 8.59 q per ha in untreated plots due to *H. armigera* with the avoidable yield loss of 42.74 per cent. Likewise [11], recorded yield losses due to the pod borer in two cultivars of chickpea to be 23.35 per cent (CV. C-235) and 20.08 per cent (CV. HPG-17) during 1996-98. Similarly [20], reported yield loss to vary from 36.88 to 50 per cent in chickpea due to *H. armigera* in different localities of Uttar Pradesh.

4. Conclusion

In the current study, significant reduction in the damage caused by *H. armigera* was observed in the protected plots as compared to that of unprotected conditions in chickpea variety HC-1. The avoidable yield losses of 50.93, 48.93 and 49.61 per cent due to *H. armigera* infestation were observed during two year study (i.e. 2017-18 and 2018-19) and pooled, respectively. Therefore, it may be concluded that by adopting appropriate management practices during the cropping period of chickpea, considerable economic losses caused by *H. armigera* can be avoided and thus profit can be increased by the growers.

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