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Estimation of avoidable losses in chickpea by pod borer, *Helicoverpa armigera* (Hubner) in Southern Rajasthan

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Abstract

An experiment was conducted during two *rabi* crop seasons from 2015-2016 to 2016-2017 at Agricultural Research Station, MPUAT, Banswara. The objective was to estimate avoidable losses in seed yield of chickpea on four chickpea varieties *viz.*, Pratap Channa-1, Dahod Yellow, GNG-1581 and JAKI-9218. Results showed that in both the seasons, significant difference was observed in the pod borer damage of *H. armigera* between unprotected and protected conditions. The maximum pod borer damage percentage was recorded in JAKI 9218 variety, while minimum damage was in Pratap channa-1 under unprotected conditions. In 2016-17, under protected condition all the chickpea varieties were free from pod damage due to *H. armigera*. The maximum yield loss (25.07%) in JAKI-9218 corresponded with the high pod borer damage percentage of 27.77 under unprotected conditions, in 2015-2016. Similarly, the low yield loss (5.37%) in chickpea variety, Dahod yellow corresponded with the low pod borer damage percentage (6.66).

Keywords: chickpea, *Helicoverpa armigera*, yield loss, dahod yellow

1. Introduction

Chickpea, (*Cicer arietinum* L.) is an important pulse crop of India and is also known as Bengal gram and Gram. Its seed contains about 17-20% of protein. In India, Madhya Pradesh, Maharashtra, Uttar Pradesh and Rajasthan are the major chickpea producing states contributing 87 percentage of the total production [1]. The area of about 8.35 million hectares with a production of 7.17 million tonnes and productivity of 859 kg per hectare during Rabi-2015-2016 under chickpea in the country [2]. In Rajasthan, this crop is cultivated in about 0.94 million hectares area with the production of 0.80 million tonnes and an average productivity of 852 kg per hectare [3].

About 60 insect species are known to feed on chickpea of which cutworm, *Agrotis ipsilon*, leaf caterpillar, *Spodoptera exigua* and pod borer, *Helicoverpa armigera* are the important and area specific pests in India. *Helicoverpa armigera* are the major pests in the zone and causing significant losses in chickpea. It begins their feeding at the seedling stage and feeds on the leaves by scrapping green tissue and pods and later infests on the buds, flowers and developing pods until the crop maturity. The typical symptom shows circular bore holes on gram pods plugged by the head of a larva. Biradar *et al.*, [4] estimated of about 55.70% avoidable losses in chickpea due to *H. armigera*. Due to its polyphagous, high fecundity and migratory nature and its resistance to the various group of insecticides led to the damage of 90-95% in chickpea and yield losses of 400 kg/ha with the damage to pods ranging from 30-40% to 90-95% [5, 6].

The pest infestation varies depends on the agro-climatic conditions prevailed in the zone and to need to generate location specific information on damage by *H. armigera*. Thus, there is a need to estimate crop damage due to *H. armigera* in different chickpea varieties. Keeping in view, the present work was formulated to study the infestation of *H. armigera* in different varieties of chickpea to generate location specify information on the damage and to identify the chickpea varieties that suffer the minimum damage due to *H. armigera*.

2. Materials and Methods

The study was conducted during two *rabi* crop seasons from 2015-16 to 2016-17 at Agricultural Research Station, Borwat Farm (MPUAT, Udaipur), Banswara, Rajasthan, India. The assessment of avoidable losses in seed yield of chickpea were done on four major

chickpea varieties viz., Pratap Channa-1, Dahod Yellow, GNG-1581 and JAKI-9218. The experiment was laid out in randomized block design, with two different treatments viz., protected and unprotected. The crop was sown in the last week of November/first week of December. Plot size was kept at 3x3 m and there were three replications for each chickpea varieties with 3 each for protected and unprotected conditions. Under protected conditions, kept free from the attack of insect pests by spraying it two times with chlorantraniliprole 18.5 SC (125 ml/ha) at 15 days interval. Whereas, only water spray was given in the unprotected conditions. The unprotected plots were allowed for a natural infestation of pests. About 5-10 randomly selected plants from each variety were taken for the pod damage per replication and pod damage percentage for each variety was calculated from protected and unprotected plots. Data of yield per plot were recorded and converted into yield per hectare basis from protected and unprotected plots and the avoidable losses was calculated.

The avoidable yield loss due to pest was worked out by using following formula of Pradhan [7].

$$\text{Per cent avoidable loss in yield} = \frac{(T-UT)}{T} \times 100$$

Where, T= seed yield in treated plots, UT= seed yield in untreated plots.

3. Results and Discussion

3.1 Percentage Pod borer damage

In 2015–2016, the pod borer damage of *H. armigera* in

chickpea varied from 4.44 to 27.77 percentage in the unprotected condition while the protected condition was significantly different and recorded pod borer damage percentage from 1.11 to 11.11. The maximum pod borer damage percentage of 27.77 was recorded in JAKI 9218 variety, while minimum damage was in Pratap channa-1 under unprotected conditions (Table 1).

Similarly, in 2016-17, chickpea varieties, Dahod yellow, Pratap channa-1, GNG-1581 and JAKI 9218 recorded pod damage of 3.43, 4.45, 5.83 and 7.65%, respectively, under unprotected condition while the protected condition all the chickpea varieties were free from pod damage due to *H. armigera* (Table 2). During 2016-17, overall pod damage percentage was lower in all the chickpea varieties tested when compared to previous year.

3.2 Avoidable yield loss

During 2015–2016, the loss in the yield by *H. armigera* varied from 5.37 to 25.07 per cent on different varieties of chickpea (Table 1). The maximum yield loss (25.07%) was observed in chickpea variety, JAKI-9218. It was followed by Pratap Channa-1 (16.43%) and GNG-1581 (19.16%). The remaining variety, Dahod yellow recorded much less yield loss. It is evident that the maximum yield loss in JAKI-9218 corresponded with the high pod borer damage percentage of 27.77 under unprotected conditions, in 2015-2016. Similarly, the low yield loss (5.37%) in chickpea variety, Dahod yellow corresponded with the low pod borer damage percentage (6.66). In chickpea variety, Pratap channa-1 had pod damage percentage of 4.44 with the yield losses of 16.43%.

Table 1: Mean incidence of pod borer damage (%) and seed yield of different chickpea varieties under protected and unprotected conditions (2015-16)

Varieties	Pod damage (%)			Seed yield (q/ha)			Avoidable losses (%)
	P	UP	Mean	P	UP	Mean	
Pratap Channa-1	3.33(10.51)	4.44(11.99)	3.88(11.25)	9.37	7.83	8.60	16.43
Dahod Yellow	1.11(3.50)	6.66(14.95)	3.88(11.25)	11.91	11.27	11.59	5.37
GNG-1581	1.11(3.50)	8.86(17.27)	4.99(10.39)	14.61	11.81	13.22	19.16
JAKI-9218	11.11(19.42)	27.77(31.79)	19.44(25.61)	13.12	8.40	10.76	25.07
Mean	4.16(9.23)	11.94(19.00)	8.05	12.25	9.83	11.04	
For comparing			CD at 5%			CD at 5%	
Varieties			4.32			3.09	
Protection			3.05			2.18	
Interaction			6.11			4.37	

P=protected UP=unprotected *Figures in parentheses are angular transformed values

Table 2: Mean incidence of pod borer damage (%) and seed yield of different chickpea varieties under protected and unprotected conditions (2016-17)

Varieties	Pod damage (%)			Seed yield (q/ha)			Avoidable losses (%)
	P	UP	Mean	P	UP	Mean	
Pratap Channa-1	0.00(0.57)	4.45(12.08)	2.22(6.04)	21.14	16.88	19.01	25.24
Dahod Yellow	0.00(0.57)	3.43(10.61)	1.71(5.31)	21.72	20.14	20.93	7.85
GNG-1581	0.00(0.57)	5.83(16.02)	2.91(8.01)	24.36	18.16	21.26	34.14
JAKI-9218	0.00(0.57)	7.65(13.93)	3.82(6.96)	27.97	20.52	23.98	39.85
Mean	0.00(0.57)	5.34(13.16)	2.66	23.40	16.82	21.29	
For comparing	SEm		CD at 5%	SEm		CD at 5%	
Varieties			1.32			3.31	
Protection			0.93			2.34	
Interaction			1.86			4.68	

P=protected P=unprotected *Figures in parentheses are angular transformed values

In 2016-2017, the yield loss in different chickpea varieties varied from 7.85 to 39.85 per cent and data are presented in

table 2. The results are similar to the previous year, the maximum yield losses (39.85%) in seed yield of chickpea

variety, JAKI 9218 corresponded with the maximum pod damage percentage of 7.65. It was followed by GNG-1581, Pratap channa-1 and Dahod yellow with the respective seed yield loss of 34.14, 25.24 and 7.85%. The seed yield loss percentage in these chickpea varieties corresponded with percentage pod damage of 3.43, 5.83 and 4.45 in Dahod yellow, Pratap channa-1 and GNG-1581, respectively under unprotected conditions.

The yield loss varies from 36.88 to 50% in chickpea due to pod borer infestation as reported by Singh *et al.*,^[8] in different localities of Uttar Pradesh. In the present study, the avoidable losses vary from 5.37 to 39.85 % in different chickpea varieties. Similarly, Deshmuch *et al.*,^[1] reported 41.17% loss in seed yield of chickpea by *H. armigera*. Dinesh *et al.*,^[9] estimated the yield losses caused by *H. armigera* infesting chickpea. Avoidable losses of 29.93% and 31.28% recorded due to *H. armigera* infestation in chickpea variety GNG 1581. In the present study also, the avoidable losses of 19.16 and 34.14% in GNG-1581 was reported. Mahawar^[10] also worked the mean yield loss of 26.57 per cent due to *H. armiger* whereas, Shinde *et al.*,^[11] recorded higher seed yield of chickpea in protected plots (30.55 q ha-1) when compared to untreated plots (11.11 q ha-1) with the estimated avoidable loss of 63.64 per cent. The mean seed yield in GNG-1581 was 15.00 q ha-1 in treated plots and 8.59 q ha-1 in untreated plots due to *H. armigera* and the avoidable loss of 42.74% was reported by Gowrishankar^[12].

4. Conclusion

It can be concluded from the present results that there was a significant reduction in the pod borer damage by *Helicoverpa* in the protected plots when compare to unprotected plots due to the spraying of effective insecticide. Ultimately, there is an increase in chickpea yield over unprotected plots and about 25-40% losses in seed yield can be avoided by taking proper control measures against *Helicoverpa amirgera*.

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