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## Estimation of yield losses due to infestation of pod borer *Helicoverpa armigera* (Hubner) in pigeon pea

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### Abstract

A field experiment was conducted to estimate the avoidable yield losses in pigeon pea due to infestation of the pigeon pea pod borer, *Helicoverpa armigera* (Hubner) for two consecutive seasons i.e. during *kharif* 2021-22 and 2022-23. The experiment was laid out in large plot techniques with two treatments and 15 repetitions. The pooled data over two years revealed that the seed yield was recorded 2226.50 and 953.90 kg/ha from protected and unprotected plot, respectively with 133.41% increased in yield from protected plots over the unprotected plots. The avoidable yield loss due to pod borer infestation was 57.16% by alternate application of pesticides *viz*, indoxacarb 0.008% and profenophos 40% + cypermethrin 4% @ 440 g a.i./ha at ten day intervals starting from the appearance of the pest.

**Keywords:** Pigeon pea, pod borer (*Helicoverpa armigera*), seed yield, yield loss

### Introduction

Pulse crops play an important role in maintaining soil health and supplying protein to large masses of people in the country. India grows a variety of pulse crops under a wide range of agro-climatic conditions and has the pride of being the world's largest producer of pulses. The most commonly grown pulses in India include chickpea, pigeon pea, black gram, green gram, field peas, horse gram *etc.* These form an important component of Indian agriculture, in view of their unique capacity to fill the dietary requirements of protein thirsty population of rural India, besides replenishing soil fertility through their sustainable characters. India is recognized as a major producer of pulses contributing 25 percent to global production.

The pigeon pea (*Cajanas cajan* (L.) Millsp.) belongs to the family *Fabaceae* and is well-known to found its origin in India. Pigeon pea (*Cajanus cajan* (L.) Millspaugh) is one of the major pulse crops of the tropics and subtropics. It is the second most important pulse crop in India, after chickpea (Nene *et al.*, 1990) [5]. Pigeon pea crop is cultivated in more than 25 countries of the world on 5.61 million hectares' areas with production of 4.42 million tons annually. Leading producers of this crop are found in Indian subcontinent, Africa and Central America. The average area, production and productivity of pigeon pea in India is 98.62 million ha, 266.89 million tons and 2706 kg per hectare, respectively during 2016-17 to 2020-21. Whereas, leading pigeon pea-growing states are Maharashtra, Uttar Pradesh, Madhya Pradesh, Bihar, West Bengal, Karnataka, Andhra Pradesh, Gujarat and Tamil Nadu. The average area, production and productivity of pigeon pea in Gujarat is 2.65 lakh ha, 3.08 lakh tons and 1163 kg per hectare, respectively during 2016-17 to 2020-21. (Anon., 2023) [2]. The estimated area, production and productivity of pigeon pea in Gujarat is 2.42 lakh ha, 2.87 lakh tons and 1185 kg per hectare during the *Kharif* season for the year 2022 (Anon., 2022) [1]. The pigeon pea crop is attacked by several insect pests from seedling to pod maturation and subsequently till harvesting especially pod borers there by which accounts for yield loss of more than 1000 dollars every year (Sharma *et al.*, 2001) [13]. About 250 species of insect pests belonging to 8 orders and 61 families have been reported by several researchers (Sekhar *et al.*, 1991) [12]. *Helicoverpa armigera* (Hubner) has attained the key pest prominence due to its direct attack on fruiting bodies, voracious feeding habits, high mobility and fecundity also multi-voltine and overlapping generations with facultative diapauses, nocturnal behavior, migration, host selection and propensity for acquiring

resistance against insecticides (Satpute and Sarode, 1995; Sarode, 1999) [11, 10]. The activity of natural enemies on *H. armigera* in pigeon pea is quite low as compared to that on other crops like sorghum (Bhatnagar, 1980) [4] as a result there is greater survival of this pest on pigeon pea and causes heavy loss in grain yield.

Looking to the importance of pigeon pea crop in agricultural economy of Gujarat state and seriousness of this pests in pigeon pea crop, it becomes absolutely necessary to have comprehensive information about yield losses caused by pigeon pea pod borer.

### Materials and Methods

An experiment was conducted to estimate yield losses due to *H. armigera* in pigeon pea, GJP-1 at Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh during the *Kharif* season of the year 2021-22 and 2022-23 with large plot techniques with two treatments and 15 repetitions. The crop was raised successfully by adopting recommended agronomical practices. Two strips of each 12.0 m x 10.0 m were prepared and were divided into 15 quadrates of size 3.3 m x 2.4 m as under:

- (a) **Protected (plot):** The crop was protected against *H. armigera* with alternate application of pesticides viz, indoxacarb 0.008% and Profenophos 40% + Cypermethrin 4% @ 440 g a.i./ha at ten day intervals starting from the appearance of the pest.
- (b) **Unprotected (plot):** The crop was kept free from insecticides and subjected to the natural infestation of castor capsule borer.

The observation of seed yield was recorded from each quadrate and the data was subjected to statistical analysis as per method given by Panse and Sukhatme (1985) [6]. Seed yield from the protected and unprotected plots was recorded at harvest. The yield increased in protected plots over the unprotected (control) and avoidable losses were worked out from the final yield of pigeon pea using the formula mentioned below given by Pradhan (1969) [7].

$$\text{Yield increased (\%)} = 100 \times \left[ \frac{T-C}{C} \right]$$

$$\text{Avoidable yield loss (\%)} = 100 \times \left[ \frac{T-C}{T} \right]$$

Where,

T = Yield of protected treatment plot (kg/ha),

C = Yield of unprotected (control) plot (kg/ha)

### Results and Discussion

The data on yield losses in pigeon pea due to pod borer, *H. armigera* are presented in Table 1 and depicted in Fig. 1 revealing significant difference in seed yield of pigeon pea between protected and unprotected plots. The seed yield of 2285.87 and 2167.13 kg/ha were recorded from protected plots, while the seed yield of 1009.20 and 898.60 kg/ha were recorded from unprotected plots during 2021-22 and 2022-23, respectively. The yield increased in protected plots over unprotected plots was 1276.67 and 1268.53 kg/ha during 2021-22 and 2022-23, respectively. In the case of yield increased over unprotected /untreated, 126.50 and 141.17 percent yield was increased in protected /treated plots over unprotected /untreated plots. However, 55.85 and 58.54 percent avoidable loss was recorded in protected /treated plots over unprotected /untreated plots during 2021-22 and 2022-23, respectively.

The mean data of two years on yield losses in pigeon pea due to pod borer, *H. armigera* are presented in Table 1 and depicted in Fig. 1 and revealed that the protected /treated plots recorded higher pigeon pea seed yield (2226.50 kg/ha) when it was compared with unprotected /untreated (953.90 kg/ha). The yield increase in protected plots over unprotected plots was 1272.60 kg/ha with 133.41 percent yield increase over unprotected /untreated and so the avoidable loss was recorded at 57.16 percent in protected/treated plots.

**Table 1:** Yield losses due to Pod borer (*H. armigera*) in pigeon pea

Treatment	Seed yield (kg/ha)	Yield Loss (kg/ha)	Yield increased Over Control (%)	Avoidable yield loss (%)
2021-22				
Unprotected (Untreated)	1009.20	1276.67	126.50	55.85
Protected (Treated)	2285.87			
ANOVA				
S. Em. ±	31.12	-	-	-
C.D. @ 5%	90.14	-	-	-
C.V. %	7.32	-	-	-
2022-23				
Unprotected (Untreated)	898.60	1268.53	141.17	58.54
Protected (Treated)	2167.13			
ANOVA				
S. Em. ±	32.35	-	-	-
C.D. @ 5%	93.69	-	-	-
C.V. %	8.17	-	-	-
Overall Mean (Two years)				
Unprotected (Untreated)	953.90	1272.60	133.41	57.16
Protected (Treated)	2226.50			
ANOVA				
S. Em. ±	28.70	-	-	-
C.D. @ 5%	83.12	-	-	-
C.V. %	6.99	-	-	-

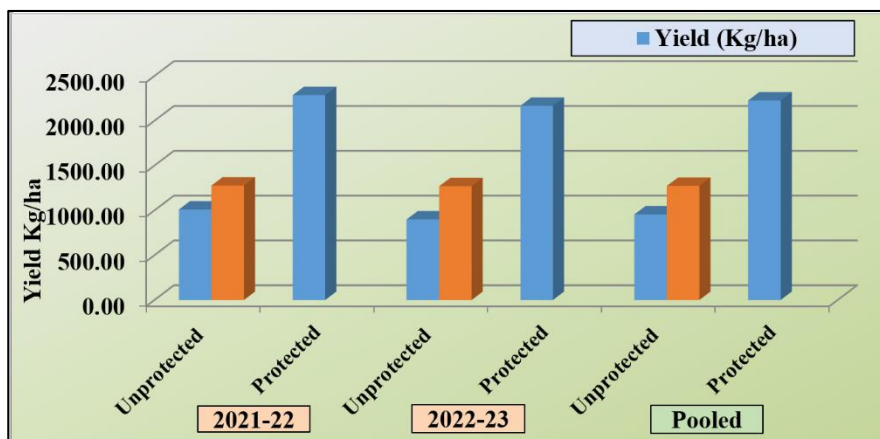


Fig 1: Yield losses caused by Pod borer (*H. armigera*) infesting pigeon pea

In all, the result clearly indicated that by providing protection with effective pesticides against pod borer, *H. armigera* 1272.60 kg/ha yield loss can be saved. Total avoidable yield loss could be worked out as 57.16 percent.

Losses in pigeon pea due to pod borer are estimated to be 11.1 to 36.4 percent in different parts of India (Ahmad and Rai, 2005) [3]. A yield loss due to pod borers in pigeon pea was estimated to a tune of 40.6 percent (Subharani and Singh, 2007) [15]. Sharma *et al.* (2010) [14] reported 25 to 70 percent losses whereas, Randhawa and Verma (2011) [9] reported 26-28 percent flower damage due to Pod borer, *H. armigera* infesting pigeon pea. Priyadarshini *et al.* (2013) [8] reported a 60 to 90 percent loss in the grain yield of pigeon pea against pod borer under favorable conditions. Hereafter, the present investigations are more or less in agreement with the results presented by the earlier researchers.

#### 4. Conclusion

From the above study, it was observed that by protecting with effective pesticides against pod borer, *H. armigera*, 1272.60 kg/ha and 57.16 percent yield loss in pigeon pea can be achieved and avoidable, respectively.

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