Estimation of yield losses caused by insect pests on pigeon pea (*Cajanus cajan*(L.)Millsp.)

ABSTRACT

Field experiment was carried out to estimate the yield losses in pigeon pea crop due to insect pests during *kharif* 2018-19, 2019-20 and 2020-21 at College of Agriculture, Navsari Agricultural University, Bharuch (Gujarat). Results revealed that avoidable yield loss due to insect pests in pigeon pea was recorded up to 38.48% when no plant protection measures are taken. Amongst different insect pests, the maximum damage was recorded due to pod borer, *Helicoverpaarmigera* (34.90%) followed by pod sucking bugs, *Clavigrallagibbosa* (29.75%) and pod fly, *Melanogromyzaobtusa* (23.64%). Pod damage due to spotted pod borer, *Maruca vitrata* and tur plume moth, *Exelastisatomosa* was recorded up to 14.09% and 5.60%, respectively.

Keywords:*yield loss, Helicoverpaarmigera, Melanogromyzaobtusa, Clavigrallagibbosa, pigeon pea*

1. INTRODUCTION

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 of India, after chickpea. Pigeon pea is an important pulse crop of dry land agriculture because of its ability to produce economic yield under limited moisture condition. In India, the area grown under pigeon pea is 47.24 lakh ha with a production of 43.16 lakh tones and a productivity of 914 kg/ ha. In Gujarat, pigeon peais grown under 2.41 lakh ha with an annual production of 2.86 lakh tonnes leading to a productivity of 1186 kg/ha (Anon., 2021) [1].Pigeon pea is grown throughout the country except the hilly regions where winter temperature is very low. The major pigeon pea growing states are Maharashtra, Uttar Pradesh, Karnataka, Gujarat and Andhra Pradesh that altogether account for more than 87 per cent area and 83 per cent of the production (Anon., 2015) [2]. A large number of insect pests (more than 300 species) are noticed to attack pigeon pea (Prasad and Singh, 2004)[3]. Insects that attack the reproductive structures of plant cause the maximum yield losses (Rangaiah and Sehgal, 1984) [4]. The most economical pests those attack at flowering and podding stage are pod borer, *Helicoverpaarmigera*(Hubner) Hardwick; blue butterflies, *Lampidesboeticus*L. and *Catochrysopsstrabo*(Fabricius); plume moth, *Exelastisatomosa*(Walsingham) and pod fly, *Melanagromyza obtuse* Malloch (Reed *et al.,* 1989) [5]. Pod borers cause huge annual losses and damage to pods due to the borer complex was reported to be 20 to 72 per cent (Lateef and Reed, 1983) [6]. Hence, considering the economical importance of the crop, the present investigation was undertaken to know the impact of pests on yield loss in pigeon pea.

2. MATERIAL AND METHODS

Field experiment was carried out during *kharif* 2018-19, 2019-20 and 2020-21 at College farm, College of Agriculture, Navsari Agricultural University, Bharuch (Gujarat) to know the yield loss caused by insect pests of pigeon pea crop. Experimental area was divided in to

two plots *i.e.* protected and unprotected plot by following two sample 't' test method with a plot size of 20 m x 20 m and plant spacing of 90 cm x 20 cm. Variety "*Vaishali*" of pigeon pea crop was selected for study. All the agronomic practices were followed as per recommendation with a fertilizer dose of 20-40-0 NPK kg/ha. One set of plots were kept as protected and provided complete protection by spraying imidacloprid 17.8 SL @ 0.005% at 30 days after sowing and chlorantraniliprole 18.5 SC @ 0.006 % at 50% flowering stage andflubendiamide 39.35 SC @ 0.0096% at 50% pod setting stage.Another set of plots termed unprotected were kept untreated and exposed to natural infestation by insect pests. For recording observations, 20 plants were selected randomly from both sets of plots and yield attributing characters such as plant height, number of pods/plant, numbers of seeds/pod and grain yield (kg/ha) were recorded. The observations on yield was recorded from 20 plots (size 1m x 1.8m) having 10 plants in each plot and were converted on hectare basis. The pod damage and grain damage due to insect pests were recorded by following below mentioned standard methodology.

1. Pod borer (*Helicoverpaarmigera*) :

Number of damaged and healthy pods were recorded and per cent pod borer infestation was worked out. Number of pods damaged due to *Helicoverpa* larva was ascertained by clean big hole on pod.

2. Tur plume moth (*Exelastisatomosa*):

Per cent tur plume moth larva infestation was calculated by counting healthy and damaged pods due to tur plume moth larva. Pods damaged due to tur plume moth larva were ascertained by presence of small dirty hole between two grain on pod.

3. Spotted pod borer (*Maruca vitrata*)

Per cent damage due to *Maruca* infestation was calculated by counting number of healthy and damaged pods.*Maruca* larva damage was ascertained by presence of webbed and frass materials on pods.

4. Pod Sucking Bug (*Clavigrallagibbosa*):

Per cent pod damage by pod sucking bug was calculated on the basis of counting healthy and damaged pods due to pod sucking bug.

5. Pod fly(*Melanogromyzaobtusa*):

Per cent pod fly infestation was worked out by counting numbers of healthy and damaged grain from 100 pods. Pod fly damage was detected by presence of maggot or pupa tunneled grain by splitting the pods.

Data were subjected to two sample 't' test and analysed by using ICAR, Web Agri Stat Package (WASP). The loss in yield due to insect pests in pigeon pea was worked out by using following equation given by Le Clerg (1971) [7].

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

Where, X_1 = Yield in treated (Protected) plot

X_2 = Yield in untreated (Unprotected) plot

3. RESULTS AND DISCUSSION

2018-19

During year 2018-19, mean plant height (cm) and mean no. of pods/plant were 1.04 times and 1.48 times higher in protected plot than unprotected plot (Table-1). However, no significant difference was observed in mean number of seeds/pod between protected and unprotected plot. The per cent pod damage due to pod borer, tur plume moth, pod sucking bug, spotted pod borer and per cent grain damage due to pod fly was 31.89%, 6.78%, 35.99%, 14.76% and 23.02%, respectively in unprotected plot which was 3.39, 4.74, 9.78, 4.12 and 3.71 times higher than protected plot, respectively.The mean grain yield (kg/ha) in protected plot was recorded 1058.32 which was 1.68 times greater than yield in unprotected plot (630.55). The avoidable yield loss due to insect pest in pigeon pea was recorded 40.41 per cent.

2019-20

Mean plant height (cm) and mean no. of pods/plant were 1.07 times and 1.36 times higher in protected plot than unprotected plot (Table-1). However, no significant difference was observed in mean number of seeds/pod between protected and unprotected plot. The per cent pod damage due to pod borer, tur plume moth, pod sucking bug, spotted pod borer and per cent grain damage due to pod fly was 36.06%, 5.25%, 27.80%, 15.07% and 22.60%, respectively in unprotected plot which was 3.15, 4.82, 6.03, 6.18 and 4.20 times higher than protected plot, respectively.The mean grain yield (kg/ha) in protected plot was recorded 1103.36 which was 1.57 times greater than yield in unprotected plot (703.27). The avoidable yield loss due to insect pest in pigeon pea was recorded 36.26 per cent during 2019-20.

2020-21

Mean plant height (cm) and mean no. of pods/plant were 1.06 times and 1.14 times higher in protected plot than unprotected plot (Table-1). However, no significant difference was observed in mean number of seeds/pod between protected and unprotected plot. The per cent pod damage due to pod borer, tur plume moth, pod sucking bug, spotted pod borer and per cent grain damage due to pod fly was 36.76%, 4.77%, 25.49%, 12.46% and 25.31%, respectively in unprotected plot which was 3.08, 2.66, 3.07, 3.65 and 4.86 times higher than protected plot, respectively. The mean grain yield (kg/ha) in protected plot was recorded 1114.80 which was 1.64 times greater than yield in unprotected plot (681.65). The avoidable yield loss due to insect pest in pigeon pea was recorded 38.85 per cent during 2020-21.

Pooled

The pooled results of three years (Table -1) showed that mean plant height (cm) and mean no. of pods/plant were 1.06 times and 1.30 times higher in protected plot than unprotected plot. However, no significant difference was observed in mean number of seeds/pod between protected and unprotected plot. The per cent pod damage due to pod borer, tur plume moth, pod sucking bug, spotted pod borer and per cent grain damage due to pod fly was 34.9%, 5.6%, 29.75%, 14.09% and 23.64%, respectively in unprotected plot which was 3.20, 3.92, 5.39, 4.49 and 4.22 times higher than protected plot, respectively. The mean grain yield (kg/ha) in protected plot was recorded 1092.20 which was 1.63 times higher than yield in unprotected plot (671.82). The avoidable yield loss due to insect pest in pigeon pea was recorded 38.48 per cent.

Present findings regarding pod damage due to pod borer, *H. armigera* are in agreements with the findings of Patel and Patel (1990) [8] who reported that the pod damage due to *H. armigera*was up to 39.20% in BDN-2 variety of pigeon pea and Lateef and Reed (1983) [6] also reported pod damage due to the borer complex up to 20 to 72%. However, Sahoo and Senapati, 2000 [9] reported the yield loss up to 27.77% due to pod borer complex in pigeon pea. Present findings of damage due to pod fly and pod bug are more or less in agreement

with reports of Kumar *et al*. (2016) [10] who reported higher pod damage in pigeon pea due to pod fly, pod bug, and lepidopteron pod borer in the range of 26.66 to 43.0%, 16.0 to 19.0% and 4.0 to 7.66%, respectively. Pandey *et al*., 2011[11] reported the grain damage caused due to pod fly varied from 20 to 80% in Uttar Pradesh which was in complete agreement with present investigation. However, Adgokar*et al.* (1993) [12]reported 70-80% damage due to pod fly in pigeon pea whereas, Khan *et al*. (2014) [13] reported that 21.00 to 38.50% pod and 12.29 to 19.87% seed damaged by pod fly and 5.50 to 12.50 % pod damage by pod borers. Sandip Patra *et al*., 2016 [14] reported pod damage 8.75 and 6.25% by *Helicoverpaarmigera* and 44.94 and 17.75% by *Melanagromyza obtuse* during first and second seasons, respectively. Mean pod damage caused by *H. armigera*, and *M. obtuse* were found to be 7.50 and 31.35%, respectively. Results revealed that pod boring insects (*H. armigera*, *L. boeticus*, *A. clavipes*and *M. obtusa*) caused major crop losses to pigeon pea.

Table: 1 Comparative yield losses due to insect pests on pigeon pea (2018-19,2019-20,2020-21 & pooled)													
Sr no.	**Parameter**	**2018-19**			**2019-20**			**2020-21**			**Pooled (2018-2020)**		
		Protected (X_1)	**Unprotected (X_2)**	**T- Cal**	**Protected (X_1)**	**Unprotected (X_2)**	**T- Cal**	**Protected (X_1)**	**Unprotected (X_2)**	**T- Cal**	**Protected (X_1)**	**Unprotected (X_2)**	**T- Cal**
1	Mean plant height(cm)	169.55	163.55	2.67*	170.25	158.70	5.19*	171.50	161.20	4.45*	170.43	161.15	7.069*
2	Mean number of pods/plant	155.60	105.00	7.04*	164.25	120.65	6.07*	186.20	162.65	2.88*	168.68	129.43	7.042*
3	Mean number of seeds/pod	4.20	4.05	1.02	4.30	4.25	0.34	4.35	4.30	0.33	4.28	4.20	0.97
4	Mean per cent pod damage due to pod borer	9.40	31.89	8.38*	11.44	36.06	7.88*	11.95	36.76	9.64*	10.92	34.90	14.78*
5	Mean per cent pod damage due to tur plume moth	1.43	6.78	5.38*	1.09	5.25	5.92*	1.79	4.77	2.59*	1.43	5.60	7.42*
6	Mean per cent pod damage due to pod sucking bug	3.68	35.99	9.83*	4.61	27.80	7.95*	8.29	25.49	6.83*	5.52	29.75	13.61*
7	Mean per cent pod damage due to spotted pod borer	3.58	14.76	7.73*	2.44	15.07	9.56*	3.41	12.46	6.96*	3.14	14.09	13.91*
8	Mean per cent grain damage due to pod fly	6.20	23.02	10.43*	5.38	22.60	9.11*	5.21	25.31	10.28*	5.60	23.64	17.21*
9	Mean grain yield(kg/ha)	1058.32	630.55	14.61*	1103.36	703.27	13.24*	1114.80	681.65	10.38*	1092.2	671.82	20.95*
10	Mean Yield loss (%)	**40.41**			**36.26**			**38.85**			**38.48**		
***The t-value significant at P = 0.05 (2.024)													

4. CONCLUSION

The yield loss due to insect pests in pigeonpea was recorded up to 38.48 per cent when no plant protection measures are taken. Higher number of pod damage was recorded due to pod borer (34.90%) followed by pod sucking bugs (29.75%) among different insect pests. Grain damage due to pod fly was recorded up to 23.64%.

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