*Research Paper :*

# Effect of date of sowing and irrigation level on the incidence of *Helicoverpa armigera* (Hubner) on chickpea crop

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SUMMARY

**A field experiment was conducted during *Rabi* 2002-2003 at the Agricultural Engineering Farm, College of Agriculture, JNKVV., Jabalpur (M.P.) To study the effect of date of sowing (October 28, November 20 and December 11) and irrigation levels ($I_0$-No irrigation, $I_1$ – one irrigation at branching, $I_2$-one irrigation at flowering, $I_3$-one irrigation at podding and $I_4$-One irrigation at branching + one at irrigation at podding) on the incidence of *Helicoverpa armigera* (Hubner) on chickpea crop. In the October 28 and November 20 sown crop harbored least larval population (3.79 and 6.83 larvae/0.25 sqm), least pod damage (7.17% and 7.58%) and gave highest grain yield (25.13 and 26.098 q/ha, respectively) whereas December 11 sown crop showed highest larval population (14.96 larvae/0.25sqm) and pod damage (13.36%), and yielded lowest (16.53 q/ha). Crop treated with different levels of irrigation showed no significant difference and highest number of larvae (8.33 to 8.93 larvae/0.25 sqm) and statistically lowest yield (19.94 to 24.78 q/ha).**

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Chickpea is generally known as Bengal gram or Gram and botanically called *Cicer arietinum* Linn. It is the oldest and most important pulse crop, mostly grown under dry land condition with heavy cloddy soil. It has an important place in the diet of Indian people because it gives comparatively more protein than any other food grains. Other than dry grains, its green pods are also consumed as such, after rosting, while the green grain and its green twigs are used as vegetable by many of the people in their daily meals. Gram contains 21.5% protein, 61.5% carbohydrates and 4.5% fat (Ahlawat and Omprakash 1996). In Indian agriculture, gram crop ranks fifth in area and fourth in production among the food grain crop. It is cultivated in about 6.68 million ha. with a production of 5.07 million tonnes in India with a productivity of 759 kg/ha. (Anonymous, 2002a). The largest acreage falls in credit of Madhya Pradesh, Rajasthan, Haryana, Maharashtra and the Punjab. In Madhya Pradesh gram occupies the largest area among the pulses covering about 2222 thousands ha. with production of 2197 thousand tonnes with a productivity of 989 kg/ha (Anonymous, 2002b). In India, the yield potential of gram is quite low. The poor crop management, low doses of fertilizers, disease and the serious damage by insect pests are the main constrains for successful cultivation of the crop. The gram pod borer (*Helicoverpa armigera* Hubn., Lepidoptera: Noctuidae) is the most destructive, polyphagous and serious pest causing heavy economic losses to the crop every year In Madhya Pradesh it is also a key pest of gram and causes more than 10.17% yield loss regularly (Thakur *et al*., 1980), Choudhary and Sharma (1982) observed that during larval development each larva damages 7 to 16 pods. Continuous presence of single larva per meter row during pod formation stage of the crop resulted in 6.9% pod damage, 6.2% grain damage and 5.4% yield loss.

## MATERIALS AND METHODS

### Plot size:

A field of 1376 $m^2$ was divided into 45 plots the size of each sub plot being 18.2 $m^2$. The experiment was conducted in a split plot design. The details are given below:

The experiment was conducted in split plot

design, with15 treatments and three replications. The treatments included three date of sowing *i.e.* 28 October, 20 November and 11 December and five irrigation levels including control. The irrigation levels were $I_0$-no irrigation, $I_1$-one irrigation at branching, $I_2$-one irrigation at flowering, $I_3$-one irrigation at podding and $I_4$-one irrigation at branching + one irrigation at podding.

Larval population of *H. armigera* and cocoon population were recorded on chickpea crop by random sample. The sample size was ½ m x ½ m crop area. Observations were taken on five sample per treatment. Pod damage and grain yield was recorded at harvest. The data on larval population, cocoon population, pod damage and grain yield were subjected to the analysis of variance at 5 per cent level of significance. The correlation between different abiotic factors and larval population, were worked out.

## RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been presented under following heads:

### On the basis of overall larval population:

Overall mean larval population of *H. armigera* recorded during the crop season in all the treatments which are shown in the Table 1.

**Table 1 : Overall larval population in different dates of sowing and irrigation levels**

| Treatments | No. of larvae | | | |
|---|---|---|---|---|
| | $D_1$ | $D_2$ | $D_3$ | Mean |
| $I_0$ | 4.14 | 5.77 | 15.10 | 8.33 |
| | (2.25) | (2.59) | (3.98) | (2.94) |
| $I_1$ | 3.10 | 8.99 | 14.69 | 8.93 |
| | (2.01) | (3.15) | (3.94) | (3.03) |
| $I_2$ | 3.52 | 7.28 | 14.29 | 8.36 |
| | (2.12) | (2.87) | (3.85) | (2.94) |
| $I_3$ | 3.98 | 5.14 | 16.40 | 8.50 |
| | (2.21) | (2.45) | (4.15) | (3.00) |
| $I_4$ | 4.22 | 6.97 | 14.33 | 8.50 |
| | (2.27) | (2.81) | (3.90) | (3.00) |
| Mean | 3.79 | 6.83 | 14.96 | |
| | (2.17) | (2.77) | (3.96) | |
| | I | D | I x D | |
| S.E.± | 0.13 | 0.30 | 0.27 | |
| C.D. (P=0.05) | NS | 0.63 | NS | |

Mean of five samples and three replications
Figures in parenthesis are the transformed data $\sqrt{x+1}$
NS= Non-significant

The data presented in the Table 1 showed that there was no significant difference on the larval population due to different levels of irrigation. However the mean maximum population (8.93 larvae/sample) of larvae were recorded under the treatment when one irrigation was applied at the branching stage ($I_1$) and minimum (8.33 larvae/sample) being when irrigation was not applied ($I_0$). The data on larval population differed significantly due to different dates of sowing. The lowest larval population (3.79 larvae/sample) had been recorded to be in 28 October sown crop ($D_1$) which was significantly superior to other dates of sowing. The maximum larval population (14.96 larvae/sample) recorded on the crop sown on 11 December ($D_3$) which was significantly inferior (6.83 larvae/sample) to 20 November sown crop ($D_1$ and $D_2$). The different interactions between irrigation levels and dates of sowing were found non-significant.

### On the basis of pod damage:

The data analyzed on the basis of pod damage in different dates of sowing and irrigation levels are presented in Table 2.

**Table 2 : Pod damage by *H. armigera* in different dates of sowing and irrigation levels**

| Treatments | Percentage of pod damage | | | |
|---|---|---|---|---|
| | $D_1$ | $D_2$ | $D_3$ | Mean |
| $I_0$ | 7.27 | 7.63 | 18.76 | 11.22 |
| | (15.49) | (16.01) | (25.30) | (18.93) |
| $I_1$ | 7.44 | 7.52 | 11.31 | 8.75 |
| | (15.66) | (15.88) | (19.63) | (17.06) |
| $I_2$ | 6.82 | 8.53 | 11.12 | 8.82 |
| | (15.08) | (16.85) | (19.45) | (17.12) |
| $I_3$ | 7.67 | 6.77 | 12.39 | 8.94 |
| | (15.96) | (15.01) | (20.61) | (17.19) |
| $I_4$ | 6.64 | 7.46 | 13.21 | 9.10 |
| | (14.89) | (15.78) | (21.28) | (17.31) |
| Mean | 7.17 | 7.58 | 13.36 | |
| | (15.41) | (15.91) | (21.25) | |
| | I | D | I x D | |
| S.E.± | 0.94 | 2.10 | 1.92 | |
| C.D. (P=0.05) | NS | 4.39 | NS | |

Figures in parenthesis are the angular transformed values
Mean of five samples and three replications
NS=Non-significant

The data presented in the Table 2 show that there was no significant effect of different irrigation levels on pod damage. The per cent pod damage ranged from 8.75% under the treatment when one irrigation was

applied at the branching ($I_1$) to when irrigation was not applied 11.22% ($I_0$). The significant difference was observed in per cent pod damage due to different dates of sowing. The minimum pod damage (7.17 per cent) was observed to be in 28 October sown crop ($D_1$) which was at par (7.58 per cent) with 20 November sown crop ($D_2$) but significantly superior (13.36 per cent) to 11 December sown crop ($D_3$). The highest per cent pod damage was observed to be in 11 December sown crop ($D_3$). Different interactions between irrigation levels and dates of sowing were found non-significant.

**On the basis of grain yield:**

The data analysed on the basis of grain yield in different dates of sowing and irrigation levels are presented in Table 3.

**Table 3 : Grain yield in different dates of sowing and irrigation levels**

| Treatments | Yield kg/plot | | | | |
|---|---|---|---|---|---|
| | $D_1$ | $D_2$ | $D_3$ | Mean | q/ha |
| $I_0$ | 3.83 | 4.35 | 2.70 | 3.63 | 19.94 |
| $I_1$ | 4.98 | 4.10 | 3.47 | 4.18 | 22.96 |
| $I_2$ | 5.14 | 5.13 | 2.81 | 4.36 | 23.95 |
| $I_3$ | 4.14 | 5.32 | 2.92 | 4.12 | 22.63 |
| $I_4$ | 5.52 | 4.86 | 3.17 | 4.51 | 24.78 |
| Mean | 4.72 | 4.75 | 3.01 | | |
| q/ha | 25.13 | 26.098 | 16.53 | | |
| | I | D | I x D | | |
| S.E.± | 0.35 | 0.78 | 0.71 | | |
| C.D. (P=0.05) | 0.73 | 1.64 | NS | | |

Mean of five samples and three replications
NS=Non-significant

The data on grain yield were found significant in different levels of irrigation. Average maximum yield (24.78 q/ha) was recorded under the treatment when one irrigation was applied at the branching + one irrigation was applied at the podding stage ($I_4$) which was significantly superior to all other levels of irrigation. The minimum yield (19.94 q/ha) was obtained in when irrigation was not applied ($I_0$) which was significantly at par (24.78 q/ha) with other levels of irrigation except under the treatment when one irrigation was applied at the branching + one irrigation was applied at the podding stage ($I_4$). Yield data on different dates of sowing showed the significant difference. The highest yield (26.098 q/ha) had been recorded to be in 20 November sown crop ($D_2$) which was at par (25.93 q/ha) with 28 October sown crop ($D_1$) and significantly superior (16.53 q/ha) to 11 December sown crop ($D_3$). The different interactions between irrigation levels and dates of sowing were found non-significant (Table 3).

**Conclusion:**

It was concluded that the *Helicoverpa armigera* (Hubner) commonly known as gram pod borer is the most destructive, polyphagous and serious pest causing heavy economic losses to the crop every year. The chickpea crop is principally attacked by this pest from its early growing stage till maturity of crop. Thus the present study has indicated that the lowest larval populations (3.79 larvae/sample) were recorded in 28 October sown crop ($D_1$) which was significantly superior to other dates of sowing. The maximum populations (14.96 larvae/sample) were recorded in 11 December sown crop ($D_3$). The percentage of pod damage was ranged from 8.75% to 11.22%. The minimum pod damage (7.17%) were observed in 28 October sown crop ($D_1$) which was significantly at par (7.58%) with 20 November sown crop ($D_2$) but superior (13.36%) to 11 December sown crop ($D_3$). The maximum yield (24.78 q/ha) was recorded under the treatment when one irrigation was applied at the branching + one irrigation was applied at the podding stage ($I_1$), which was significantly superior to all other levels of irrigation. Grain yield in different levels of irrigation ranged between 19.94 and 24.78 q/ha. The grain yield recorded in different dates of sowing differed significantly. The highest yield (26.098 q/ha) had been recorded in 20 November sown crop ($D_2$) which was significantly at par (25.93 q/ha) with 28 October sown crop ($D_1$). The minimum yield (16.53 q/ha) were recorded in 11 December sown crop ($D_3$). The cocoon population of the parasite ranged between 0.33 and 2.33 with non significant difference between the different levels of irrigation. The highest cocoon population (6.60 cocoon/ sample) were recorded in 28 October sown crop ($D_1$), which was significantly superior (1.06 and 1.13 cocoon) to 20 November and 11 December sown crop, respectively ($D_2$ and $D_3$). The different interactions between irrigation levels and dates of sowing were found non significant.

Thus, the present study has indicated that the late sown crop of chickpea suffered most by *H. armigera* and yielded less than the earlier sown crop.

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