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Influence of dates of sowing on population dynamics of *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae) in chickpea ecosystem

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Abstract
To know the effect of planting dates of chickpea (JG 11 variety) on *H. armigera* occurrence, three different dates were taken *viz.*, early sowing (15th September), normal sowing (15th October) and late sowing (15th November) at ZARS, Kalaburagi, UAS, Raichur, during 2018-19. The results revealed that lowest average larval activity was recorded in normal sown chickpea with 3.15 larvae per 10 plants, followed by late sown crop with average larval density of 3.95 larvae per 10 plants, where as highest mean larval activity was observed in early sown chickpea with 4.32 larvae per 10 plants. Significantly lower total pod damage was recorded in 15th October sown crop with 32.19 per cent pod damage followed by late sown chickpea with 33.56 per cent pod damage which were on par with each other. Significantly greater total pod damage was recorded in early sown chickpea (45.19%).

Keywords: sowing, population, chickpea ecosystem, *Helicoverpa armigera*

Introduction
Chickpea plant is susceptible to a number of insect pests in which gram pod borer (*Helicoverpa armigera* Hubner) is a major worldwide pest of great economic importance on this crop. This pest is the major constraint in chickpea production causing severe losses, in spite of several rounds of insecticidal applications. Sometimes in serious cases, there may be a complete crop failure. It is a highly polyphagous pest, feeding on a wide range of food, oil seed and fibre crops. Due to its wider host range, multiple generations, migratory behaviour, high fecundity and developing insecticidal resistance, it has become a difficult pest to tackle.
Pest appearance, population fluctuation, infestation rate and crop yield are very much dependent on sowing time. Although, *H. armigera* attack chickpea throughout the cropping growth, but damage caused during flowering and pod formation stage that results in substantial yield loss (Ahmad *et al.*, 2016) [1]. Larvae of *H. armigera* start feeding up on the leave and pods whatever available soon after hatching. Generally, population peaks correspond to full bloom and pod formation stage of chickpea (Shah and Shahzad, 2005) [7]. The extent of damage inflicted by *H. armigera* to chickpea depends not only on number of larvae but also on the developmental stages of crop (Tripathi and Sharma, 1985; Shah and Shahzad, 2005) [8, 7]. In view of its seriousness, effect of time of sowing was studied on the infestation of *H. armigera* on chickpea.

Materials and Methods
In order to know the effect of planting dates of chickpea on *H. armigera* occurrence, three dates of sowing of chickpea *viz.*, early sowing (15th September), normal sowing (15th October) and late sowing (15th November) were taken in a plot size of 100 sq m each at Zonal Agricultural Research Station, Kalaburagi, University of Agricultural Sciences, Raichur (Plate 1). The crop was raised following standard package of practice (Anon., 2017) [3] except the pod borer management. Observations on pod borer were made in 10 spots of 1 m row length each or 10 plants.
Observations on incidence of *H. armigera* (number of larvae/10 plants) was recorded at 60, 70, 80 and 90 days after sowing and damaged pods per 10 plants was recorded at observations mentioned above and also at harvest.

Percent pod damage was calculated using the below mentioned formula:

$$\text{Percent pod damage} = \frac{\text{Number of damaged pod}}{\text{Total number of pods}} \text{ X } 100$$

Results and Discussion

In order to know the effect of planting dates of chickpea (JG 11 variety) on *H. armigera* incidence, different dates of sowing *viz.,* early sowing (15th September), normal sowing (15th October) and late sowing (15th November) was taken in a plot size of 100 sq. m area and the observation on pod borer was taken in 10 spots of 1 sq m on 10 plants each at ZARS, Kalaburagi in cropping season of 2018-19. Results revealed that sowing dates significantly influenced the incidence of *H. armigera* across the dates of sowing. On 15th October sown chickpea was recorded less larval density (1.50 larvae/10 plants) and pod damage (2.96%) at 60 days after sowing (DAS) over early sown and late sown crop (Table 1). Larval density and per cent pod damage was increased at 70 and 80 DAS in all three dates sown crop. However comparatively less larval population was noticed in 15th September sown crop at 70 DAS (4.9 larvae /10 plants) which was on par with other two sowing dates. At 80 DAS significantly lowest larval activity was seen in 15th October sown chickpea with 3 larvae per 10 plants and significantly higher number of larvae was noticed in 15th September sown crop with 6.25 larva per 10 plant (Table 1). The similar trend was observed on 90 DAS but incidence was at lower side in all the dates of sowing.

Table 1: Effects of different dates of sowing on the incidence of *H. armigera* on chickpea

Dates of sowing	60 DAS		70 DAS		80 DAS		90 DAS		At harvest	Yield/ha (kg)
	No. of larva/ 10 plants	Pod damage (%)	No. of larva/ 10 plants	Pod damage (%)	No. of larva/10 plants	Pod damage (%)	No. of larva/ 10 plants	Pod damage (%)	Pod damage (%)	
D1: (15-09-2018)	2.25 (1.79)^{b}*	10.19 (18.53)^{c}**	4.9 (2.41)^{a}	20.32 (26.72)^{c}	6.25 (2.69)^{c}	25.43 (30.27)^{c}	3.90 (2.21)^{b}	31.51 (34.12)^{b}	45.19 (42.24)^{b}	773.8^{b}
D2: (15-10-2018)	1.50 (1.58)^{a}	2.96 (9.72)^{a}	5.50 (2.53)^{a}	13.76 (21.64)^{b}	3.00 (1.99)^{a}	19.27 (25.87)^{a}	2.60 (1.85)^{a}	21.39 (27.37)^{a}	32.19 (34.57)^{a}	1007.1^{a}
D3: (15-11-2018)	2.25 (1.80)^{b}	6.78 (14.20)^{b}	5.20 (2.48)^{a}	10.05 (17.99)^{a}	5.35 (2.52)^{b}	22.94 (28.14)^{b}	3.00 (1.95)^{a}	23.04 (28.57)^{a}	33.56 (35.40)^{a}	1077.5^{a}
S.Em (±)	0.05	0.59	0.09	0.71	0.04	0.61	0.08	0.85	0.93	38.90
CD @ 5%	0.14	1.70	0.25	2.06	0.13	1.78	0.25	2.47	2.81	115.62
CV (%)	8.82	12.86	11.22	10.09	5.77	6.85	13.38	8.96	5.98	10.15

*Figures in parentheses are square root transformed values: √(X+1)

** Figures in parentheses are arc sin transformed values

Values within a column followed by the same letter are not significantly different at the 5% probability level

Lowest average larval activity was recorded in normal sown chickpea with 3.15 larvae per 10 plants, followed by late sown crop with average larval density of 3.95 larvae per 10 plants, where as highest mean larval activity was observed in early sown chickpea with 4.32 larvae per 10 plants (Fig. 1). Significantly lower total pod damage was recorded in 15th October sown crop with 32.19 per cent pod damage followed by late sown chickpea with 33.56 per cent pod damage which were on par with each other. Significantly greater total pod damage was recorded in early sown chickpea (45.19%) which led to significantly lowest yield with 773.8 kg per ha over normal sown (1007.1 kg/ha) and late sown (1077.5 kg/ha) crop which were at par with each other (Table 1). Similar studies were reported by Salman *et al.* (2018) [6] who concluded that the average yield loss due to *H. armigera* in chickpea was lowest in the early sown crop than late sown crop and hence, who recommended sowing in October 15th was the best. Harpal Singh *et al*. (2002) [4] studied the effect of different dates of sowing of two cultivars of chickpea on 10th, 20th, 30th October and 10th and 20th November on the incidence of *H. armigera* at P.A.U., Regional Research Station, Gurdaspur and found that both the cultivars of chickpea showed similar pattern of infestation under all the dates of sowing. The November sown crop of chickpea suffered more from the *H. armigera* damage and yielded less than earlier (October) sown crop. In the present findings the October 15th sown crop was better in reducing the larval incidence and recording yield. The suitable date of sowing may be varies from locality to locality as there may be seasonal variations from one locality to other. found that early sown (30th October) chickpea resulted in low gram pod borer larval population and pod damage per cent at Faisalabad (UP) when compared to 09th and 19th November sown crop. Similarly, Altaf *et al.* (2008) [2] also found that incidence and damage severity of pod borer in chickpea at Ishurdi, Pabna, Bangladesh was low in early sown crop (15-30th October) but late sown (December) crop received higher pod borer damage and produced lower yield. This variation in incidence of pest was due to the prevailing climatic condition of that particular agro climatic region.

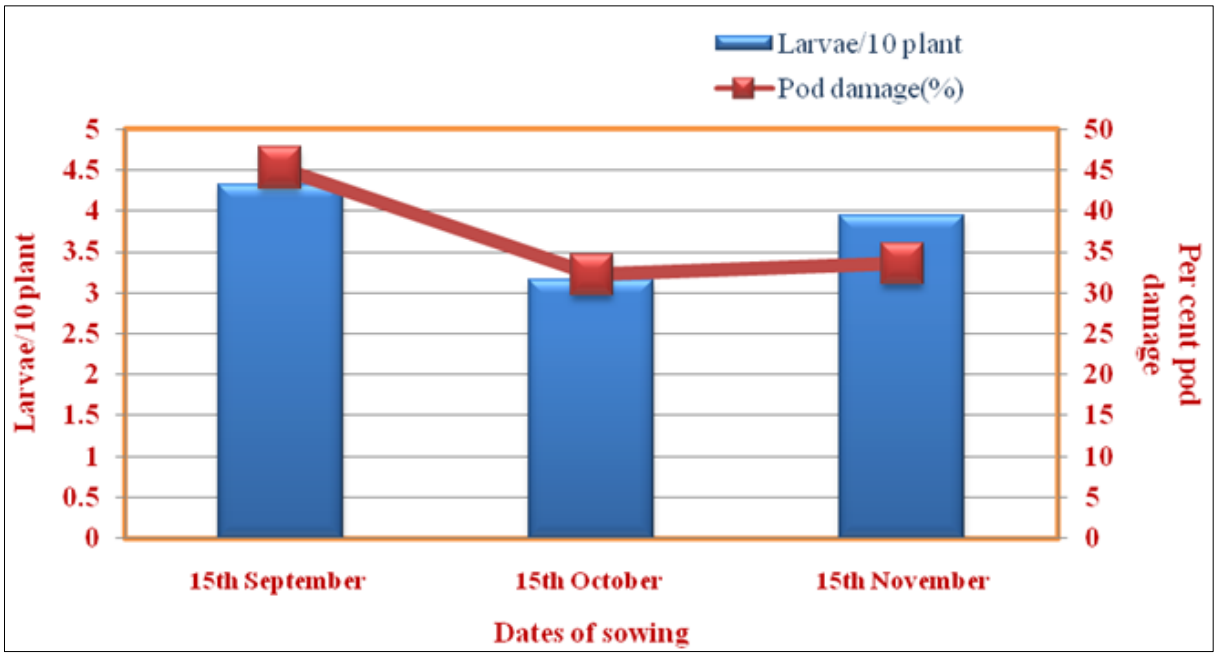

Fig 1: Effect of different dates of sowing on incidence of *H. armigera* and percent pod damage

Conclusion

Lowest average larval activity was recorded in normal sown chickpea, followed by late sown crop, where as highest mean larval activity is observed in early sown chickpea. Similar trend is followed in case of per cent pod damage as that of larval activity. Significantly lower total pod damage was recorded in 15th October sown crop, followed by late sown chickpea. Greater total pod damage has been recorded in early sown chickpea.

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