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Impact of Intercrop Combinations in the Management of Gram Pod Borer, *Helicoverpa armigera* (Hubner) in Chickpea

Keshav Mehra, Veer Singh

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ABSTRACT

Background: Bengal gram or chickpea (*Cicer arietinum* L.) is an important pulse crop grown in North India. The gram pod borer, *Helicovera armigera* (Hubner) is the major biotic constraint in the production of gram and causes heavy crop losses (20-60%) throughout the India. The damage caused by pod borer starts from early stages and continues up to the vegetative growth, flowering, poding and till maturity of the crop. The larvae of pod borer feeds on the leaves, stem, pods and the seeds of gram, yield losses mainly occurred due to the pod damage. A single larva can destroy 30-40 pods before attaining the maturity. Cultural practices like use of different intercrop combinations might be successful in avoiding or reducing the pod borer infestation. The current study was aimed to find out the best possible intercrop combination for the management of pod borer in chickpea.

Methods: A field experiment was conducted at research farm, College of Agriculture, SKRAU, Bikaner during *Rabi*, 2014-15 and 2015-16 to study the impact of different intercrop combinations in the management of gram pod borer, in chickpea.

Result: The intercrops, *viz*., wheat, barley, mustard, linseed and safflower with chickpea significantly reduced the population of *H. armigera* over the sole crop of chickpea. The minimum larval population and pod damage was observed in chickpea+safflower intercrop combination, whereas, the maximum was observed in chickpea+linseed. The highest equivalent yield (11.93 q ha^{-1}) was computed in chickpea+barley, whereas, minimum (10.17 q ha^{-1}) being in chickpea+linseed intercrop combination.

Key words: Chickpea, Equivalent yield, Gram pod borer, Intercrop, Larval population.

INTRODUCTION

Pulses are the major source of protein for the vegetarians in India. Bengal gram or chickpea (*Cicer arietinum* L.) is an important pulse crop grown in North India. It contains 22-24 per cent protein, which is almost twice found in wheat. Productivity of gram is influenced by the several biotic and abiotic stresses at various stages of the crop. The gram pod borer, *Helicovera armigera* (Hubner) is the major biotic constraint in the production of gram and causes heavy crop losses (20-60%) throughout the India (Anonymous, 2013). The damage caused by pod borer starts from early stages and continues up to the vegetative growth, flowering, poding and till maturity of the crop (Dhingra *et al.,* 2003). The larvae of pod borer feeds on the leaves, stem, pods and the seeds of gram, yield losses mainly occurred due to the pod damage. A single larva can destroy 30-40 pods before attaining the maturity (Tripathi and Sharma, 1985). Pod borer alone can cause around 150-200 million rupees losses annually (Chndrashekar *et al.,* 2014). Cultural practices like use of different intercrop combinations might be successful in avoiding or reducing the pod borer infestation. Yadava (1987) observed reduce incidence of pod borer in chickpea when wheat barley, linseed or mustard were intercropped. Pandey and Ujagir (2008) observed maximum pod borer damage (90.6%) in sole chickpea crop which is significantly suppressed by the introduction of inter crops. Keeping this points in view present research was undertaken to find out the impact of different intercrops on the incidence of H. *armigera* on chickpea.

Department of Entomology, College of Agriculture, Swami Keshwanand Rajasthan Agriculture University, Bikaner-334 006, Rajasthan, India.

Corresponding Author: Keshav Mehra, Krishi Vigyan Kendra, Beechwal, Bikaner-334 006, Rajasthan, India.
Email: keshav.mehra35@gmail.com

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MATERIALS AND METHODS

The experiment was laid out in a randomized block design (RBD) with five treatments of intercrops and one sole crop of chickpea, each replicated four times for two consecutive years, *Rabi,* 2014-15 and 2015-16. The plot size was kept 2.7 × 3 m^2 with row to row and plant to plant distance of 30 cm and 10 cm, respectively. The intercrop combinations included; chickpea+wheat (one row of intercrop after three row of chickpea), chickpea+barley, chickpea+mustard, chickpea+linseed, chickpea+safflower, sole crop of chickpea.

The larval population of *H. armigera* was recorded on ten randomly selected tagged plants from each plot at weekly intervals from appearance to harvesting of the crop. At the harvesting time ten tagged plants were brought to laboratory for calculating the healthy and damaged pods, the yield of

chickpea and intercrops from each replicated plot were recorded separately at harvest.

The data obtained on gram pod borer population from experimental field were transformed into $\sqrt{x+1}$ values and were subjected to analysis of variance. The data on per cent pod damage were transformed into angular value and subjected to analysis of variance. The data on marketable yield of chickpea sole crop and intercrops were recorded and expressed in quintal per hectare. Finally equivalent yield was computed on the basis of formula described by Baldev (2002):

Equivalent yield (q ha^{-1}) =

$$\text{Seed yield of main crop (q ha}^{-1}\text{)} + \left\{ \text{Seed yield of Intercrop (q ha}^{-1}\text{)} \times \frac{\text{Price of Intercrop (q ha}^{-1}\text{)}}{\text{Price of main crop (q ha}^{-1}\text{)}} \right\}$$

RESULTS AND DISCUSSION

The pooled data presented in Table 1 revealed that all the inter crop combinations (wheat, barley, mustard, linseed and safflower) significantly reduced the larval population of the gram pod borer, *Helicoverpa armigera* over the sole crop of chickpea. The minimum larval population at peak (3.75 larvae/10 plants) was recorded on chickpea+safflower which was at par with chickpea+barley and chickpea+mustard recorded, 4.13 and 4.38 larvae per 10 plants, respectively. The maximum larval population at peak was recorded on chickpea+linseed (5.63 larvae/10 plants) which was at par with chickpea+wheat (5.25 larvae/10 plants) however, significantly differed with sole crop, the larval reduction was ranged from 20.76 (chickpea+linseed) to 52.63 per cent (chickpea+safflower).

The present results are in accordance with the findings of Das (1998), Meena *et al.* (2001), Prasad and Chand (1989) and Prasad and Kumar (2002) who reported lower incidence of *H. armigera* on chickpea intercropped with wheat, mustard, barley and safflower. Hossain (2003) and Shivaleela and Nandihalli (2010) also recorded lower incidence of pod borer in chickpea+safflower and chickpea +wheat combination. The present results are also in confirmation with the findings of Yadav *et al.* (2007) who recorded minimum larval population at peak on chickpea+ safflower intercrop combination Whereas, the maximum population being in chickpea+linseed and chickpea+wheat intercrop combination. Ahmad *et al.* (2016) also recorded lower larval population of *H. armigera* on chickpea+mustard and chickpea+barley intercrop combination which supports the present findings.

The pooled data (Table 2) of pod damage and seed yield revealed that the pod damage was significantly reduced in all the intercrop combinations over sole crop of chickpea (32.81%). The minimum pod damage (20.93%) was observed in chickpea+safflower combination which was also found at par with chickpea+barley (22.93%) and chickpea+ mustard (23.56%). The chickpea intercropped with wheat and linseed registered, 27.07 and 28.68 per cent pod

Table 1: Impact of intercrop combinations on the incidence of *H. armigera* on chickpea (pooled data *Rabi*, 2014-15 and 2015-16).

Intercrop combination	Mean larval population of *H. armigera* per 10 plants											Mean incidence	Mean incidence sole crop as base	Mean per cent reduction over sole crop
	4 Δ	5	6	7	8	9*	10	11	12	13				
Chickpea+wheat	0.63	1.63	3.13	3.63	5.13	5.25	4.63	3.63	2.13	1.00	3.08	71.93	28.07
	(1.26)	(1.61)	(2.03)	(2.15)	(2.47)	(2.50)	(2.37)	(2.15)	(1.76)	(1.41)			
Chickpea+barley	0.38	1.13	2.13	2.75	3.88	4.13	3.63	2.75	1.75	0.63	2.31	54.09	45.91
	(1.16)	(1.46)	(1.77)	(1.94)	(2.21)	(2.26)	(2.15)	(1.94)	(1.66)	(1.26)			
Chickpea+mustard	0.38	1.38	2.38	3.00	4.25	4.38	3.75	3.00	1.88	0.88	2.53	59.06	40.94
	(1.16)	(1.54)	(1.84)	(1.99)	(2.29)	(2.31)	(2.18)	(2.00)	(1.69)	(1.37)			
Chickpea+linseed	0.88	1.75	3.38	4.13	5.63	5.63	4.88	4.00	2.38	1.25	3.39	79.24	20.76
	(1.37)	(1.66)	(2.08)	(2.26)	(2.56)	(2.57)	(2.42)	(2.23)	(1.84)	(1.50)			
Chickpea+safflower	0.13	0.88	1.75	2.50	3.63	3.75	3.38	2.50	1.38	0.38	2.03	47.37	52.63
	(1.06)	(1.37)	(1.66)	(1.87)	(2.15)	(2.18)	(2.09)	(1.87)	(1.54)	(1.16)			
Chickpea sole	1.25	2.63	4.25	5.13	7.00	7.50	5.88	4.75	2.75	1.63	4.28	100.00	-
	(1.50)	(1.90)	(2.29)	(2.47)	(2.82)	(2.91)	(2.62)	(2.39)	(1.93)	(1.61)			
SEm ±	0.05	0.05	0.06	0.05	0.05	0.06	0.04	0.05	0.05	0.05	-	-	-
CD at 5%	0.15	0.16	0.18	0.14	0.15	0.17	0.11	0.14	0.15	0.16	-	-	-

Figures in parentheses are $\sqrt{x+1}$ values, *Peak larval population, Δ Standard meteorological week.

Table 2: Impact of intercrop combinations on the pod damage and seed yield of chickpea against *H. armigera* (pooled data *Rabi,* 2014-15 and 2015-16).

Intercrop combination	Pooled				
	Peak larval population (per 10 plants)	Pod damage (%)	Yield of chickpea (q ha^{-1})	Yield of intercrop (q ha^{-1})	Equivalent yield (q ha^{-1})
Chickpea+wheat	5.13	27.07	6.74	9.83	10.66
	(2.47)	(31.30)			
Chickpea+barley	3.88	22.93	7.41	11.65	11.93
	(2.21)	(28.61)			
Chickpea+mustard	4.25	23.56	7.31	4.20	11.68
	(2.29)	(29.02)			
Chickpea+linseed	5.63	28.68	6.57	3.99	10.17
	(2.56)	(32.38)			
Chickpea+safflower	3.63	20.93	7.71	3.85	11.11
	(2.15)	(27.21)			
Chickpea sole	7.00	32.81	10.07	-	10.07
	(2.82)	(34.92)			
SEm ±	0.05	0.68	0.18	-	0.16
CD at 5%	0.15	2.02	0.52	-	0.47

Figures in parentheses are angular transformed values.

damage, respectively and both were statistically at par with each other. All the intercrop combinations gave significantly higher equivalent seed yield over the sole crop of chickpea. The highest equivalent seed yield (11.93 q ha^{-1}) was recorded in chickpea+barley followed by chickpea+mustard (11.68 q ha^{-1}) and both were found statistically at par with each other. The minimum equivalent seed yield (10.17 q ha^{-1}) was recorded in chickpea+linseed. The equivalent seed yield of 11.11 and 10.66 q ha^{-1} was recorded in chickpea+ safflower and chickpea+wheat combination respectively, however, both were found at par to each other.

These findings are in accordance with the findings of Siddegowda and Hallae (2003) and Pattar *et al.* (2012) also reported lowest pod damage in chickpea intercropped with safflower. Yadav *et al.* (2007) also recorded minimum pod damage and highest equivalent yield in chickpea+safflower intercrop combination followed by chickpea+barley and chickpea+mustard while, maximum pod damage was observed in linseed combination. Shivaleela and Nandihalli (2010) recorded highest pod damage in chickpea sole crop as compared to all the intercrops and obtained highest seed yield in chickpea+wheat (3:6) followed by chickpea+ safflower (4:2), which is partially supports the present findings. Ahmad *et al.* (2016) also recorded lowest pod damage in chickpea+mustard and highest in chickpea sole crop.

CONCLUSION

Based on the research findings, intercrop combinations evaluated against the *H. armigera* showed that chickpea+ safflower, chickpea+barley and chickpea+mustard intercrop combinations were significantly less conducive to *H. armigera* infestation as compared to other intercrop combinations (chickpea+wheat and chickpea+linseed).

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