EVALUATION AND DEMONSTRATION OF BIORATIONAL-BASED INTEGRATED PEST MANAGEMENT PACKAGE AGAINST POD BORER, *HELICOVERPA ARMIGERA* HUBNER INFESTING CHICKPEA

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ABSTRACT

Chickpea, (Cicer arietinum L.) is an important pulse crop world-wide. There are many constraints in the production of the crop, of which pod borer, Helicoverpa armigera Hubner is the notorious one which causes both quantitative and qualitative loss. Therefore, an on farm trial was conducted during rabi 2011-12 to 2013-14 to evaluate different biorational based IPM packages viz., IPM package 1 (P_1) = Installation of pheromone traps with Helicoverpa armigera lures @ 40 traps/ ha. ; IPM package 2 (P_2) =P_1+ spray neem oil @ 0.5 % on the appearance of first instar larvae. Results indicated that the IPM package (P_2) revealed the best performance reducing 76.18% pod damage over control and provided significantly the highest yield (1,933 kg/ha). Consequently, the highest benefit cost ratio (BCR) (1.97) was also recorded from this package. Hence, installation of pheromone traps and spraying of neem oil may be recommended for effective management of pod borer attacking chickpea.

***Keywords**: chickpea pod borer, pheromone traps, neem oil, IPM*

INTRODUCTION

Chickpea is of the important and premier pulse crop cultivated and widely consumed in India. It is occupying 8.56 million hectares area and contributing 39 per cent (7.35 million tonnes) to the total production of pulse in the country (Meena *et al*., 2012 and Singh *et al*., 2013). The major chickpea producing states are Madhya Pradesh, Uttar Pradesh, Haryana, Gujarat, Rajasthan, Maharastra, Andhra Pradesh, Kamataka, Bihar, Chattishgarh, and West Bangal. In Gujarat, chickpea occupies an area of *2.15* lakh hectares with a production of 2.10 lakh tones with an average productivity of 977 kg/ha, accounts for 2.46% and 2.80% area and production of country, respectively (Singh, 2010). Chickpea is cultivated in the entire Panchmahal district and the area comes under semi arid condition. The low productivity can be attributed to several factors i.e. quality seed, growing methods and adaption of appropriate plant protection measures. By conducting survey, farmer's interaction and field diagnostics, it was observed that one of the important factors for low productivity of chickpea was attributed to infestation by pod borer, *Helicoverpa armiger* Hubner which causes both quantitative and qualitative loss. The yield loss in chickpea due to pod borer was 10-60 per cent in normal weather conditions (Bhatt and Patel, 2001). On an average, 30-40 per cent pods were found to be damaged by this pest and an average of 400 kg/ha grain was lost by the borer. In favourable condition, pod damage goes up to 90-95 per cent (Shengal and Ujagir, 1990). So far, use of chemical pesticides has been the major approach for controlling this pest in different crops in lndia and in most of the developing countries. Chemical control is one of the effective and quicker methods in reducing pest population, where farmer obtains spectacular results within a short period. However, over reliance and indiscriminate use of pesticides for longer periods resulted in a series of problems, mainly risk of environmental contamination, loss of biodiversity which contributed to the development of insecticide resistant *H. armigera* population, resurgence, out breaks of the secondary pests into primary pest status, destruction of natural enemies, increase in inputs on chemicals and toxicological hazards due to pesticide residue etc., The use of excessive and un-recommended pesticides to manage the menace is in vogue with the farmers. In IPM practices, Installation of pheromone traps with *Helicoverpa armigera* lures @ 40 traps/ ha and spray of neem oil @ 0.5% have been recommended for management of chickpea pod borer. In view of the above factors, on farm trials were undertaken in a systematic manner on farmers' field to evaluate and demonstrate performance of integrated pest management (IPM) packages against chickpea pod borer for enhancing

production and productivity of chickpea.

METHODOLOGY

The present study was carried out by Krishi Vigyan Kendra-Panchmahal (Gujarat) during rabi season from 2011-2014 (3 years) under on farm testing activity in farmers field of six villages of three talukas of Panchmahal district. In total 36 OFTs in 6 ha area in different locations were conducted. Following IPM packages were compared:

IPM package 1 (P_1): Installation of pheromone traps with *Helicoverpa armigera* lures @ 40 traps/ ha. The traps were installed one month after sowing and at one feet height above the crop canopy covering the whole field uniformly. The lures were changed after every 3 weeks.

IPM package 2 (P_2): P_1+ spray neem oil @ 0.5 % on the appearance of first instar larvae. Conventional farmers' practices (P_3): No recommended pod borer management practices and untreated control.

These treatments were imposed in farmers' fields. All recommended agronomical practices were followed to raise healthy crop. Pheromone traps with lures of *H. armigera* were installed in the field at 30 days after sowing (DAS) @ 40 traps/ ha maintaining equal distance among the traps. The pheromone traps were placed just above the crop canopy by means of bamboo support. The traps were kept in the chickpea field throughout the cropping season.

Spray neem oil @ ٠.5 % was done twice at an interval of ٧ days starting from pod formation stage. At maturity, all the pods were collected from ١٠ randomly selected plants from middle rows of each plot and examined. The damaged (bored) and total numbers of pods were counted and the per cent pod damage was determined using the following formula: % Pod damage = Number of damaged pods/ Total number of pods x 100. The grain yield obtained from each field was also recorded. Moreover, benefit cost ratios of different IPM packages were also calculated. Catch of adult *H. armigera* moths were also recorded fortnightly from each pheromone trap.

Statistical analysis

The data collected were transformed into angular values as per the standard requisites. The experiments were subjected to statistical scrutiny and the means were compared with Least Significant Difference (L.S.D.) (Gomez and Gomez,1984).

RESULTS AND DISCUSSION

The infested pods ranged from 8.24 to 34.60 ٪ and differed significantly among the treatments (Table ١). The lowest pod borer damage (8.24٪) was attained from IPM package 2 (P_2) (pheromone trapping + spray neem oil @ ٠,5 %) followed by IPM package 1 (P_1) (pheromone trapping). However, the highest pod borer damage was found in untreated control plots. Fortnightly catch of adult *Helicoverpa armigera* moths by pheromone trap was 3,6٨/trap, which contributed in bringing down pod infestation. The pod borer damage reduction over control by different IPM packages ranged from 18.50٪ to 76.18٪. The highest pod damage reduction over control was observed in $P_٢$ and the lowest in farmer's practiced field.

Table 1 : Effect of different management packages on pod borer damage in chickpea during Rabi 2011-12 to 2013-14 (Pooled data of three years)

Treatments	Pod damage (%)	Damage reduction over control (%)
$P_{1=}$ Pheromone traps	17.68 (24.79)	48.90
$P_{2=}$ Pheromone traps + neem oil spray	8.24 (16.65)	76.18
$P_{3=}$Farmers practice	28.20 (32.04)	18.50
Untreated control	34.60 (36.02)	0
S.E±	(0.62)	
CV	(3.94)	
LSD(5%)	(2.19) *	

Figures in parenthesis are transformed angular values;
* Significant at 5%

This result were in accordance with the findings of Mahmudunnabi *et al.,* (2013) who reported that the lowest pod damage was observed in pheromone traps + bio-pesticide sprayed plots. Pod damage reduction by pheromone traps and bio-pesticides over untreated control ranged from 32.12 to 68.20%. Prabu (2009) and Dong and Zhao (1996) noted that neem oil has repellent, antifeedent, stomach and contact poison properties as well as inhibits growth of many insects and effective against several insect pests which are partly in agreement with the present findings.

Table 2 : Benefit cost analysis after application of different management options for the control of chickpea pod borer (Pooled data of three years)

Treatments	Yield (Kg/ ha)	Input cost (Rs)	Gross Return (Rs)	Net Return (Rs)	BC ratio
$P_{1=}$ Pheromone traps	1,697	24,460	44,408	19,948	1.81
$P_{2=}$ Pheromone traps + neem oil spray	1,933	25,727	50,632	24,905	1.97
$P_{3=}$Farmers practice	1,390	22,750	36,425	13,675	1.60
Untreated control	1,115	21,000	24,530	3,530	1.17

The yield of chickpea in different treatments varied remarkably. The highest yield was 1,933 kg/ha obtained from P_2 comprising pheromone trapping + spraying of neem oil followed by P_1 comprising pheromone trapping (1,697 kg/ ha) and P_3 (Farmers practices). Similarly, the highest yield increase over control (73.36%) was obtained from P_2. However, the lowest yield (1,115 kg/ha) was obtained from untreated control. This result of the present study is more or less in conformity with Mahmudunnabi *et al.,* (2013) who obtained significantly the highest yield (1,832 kg/ha) from pheromone trapping + bio-pesticide sprayed fields.

CONCLUSION

Final recommendation for micro level situation in IPM package 2 i.e., installation of pheromone traps with *Helicoverpa armigera* lures @ 40 traps/ ha. + spray neem oil @ ٠,٥ % on the appearance of first instar larvae manage chickpea pod borer. Liking of farmers this IPM package is due to higher yield (1,933 kg/ha) and lower chickpea pod borer damage (8.24%).

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