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BIO-EFFICACY AND ECONOMICS OF INSECTICIDES FOR MANAGEMENT OF *HELIOTHIS ARMIGERA* IN GRAM POD OF DISTRICT GONDA, UTTAR PRADESH

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ABSTRACT

The minimum larval incidence of *H. armigera* of 0.95 and 0.36 larva/m row length was recorded in rynaxypyr 20 SC at 3 and 7 days after spraying, respectively followed by flubendiamide 48 SC (1.47 & 0.78 larvae/m row length) and emamectin benzoate 5 SG (1.55 & 1.49 larvae/m row length) as against conventional insecticide profenophos 50 EC which recorded 2.09 and 1.49 larva/m row length. The treatment with rynaxypyr 20 SC was found significantly effective in reducing the pod damage (3.5%) followed by flubendiamic 48 SC (4.8%) and emamectin benzoate 5 SG (6.05%) as compared to profenophos (13.9%). The highest (2590 kg/ha) grain yeild was recorded in rynaxypyr 20 SC followed by flubendiamide 48 SC (2354 kg/ha) and emamectin benzoate 5 SG (2292 kg/ha). However, the highest (1:19.22) ICBR (Incremental cost benefit ratio) was recorded in flubendiamide 48 SC followed by rynaxypyr 20 SC (1:11.1), profenphos 50 EC (1:7.8), emamectin benzoate 5 SG (1:4.2) and lufenuron 5.4 EC (1:3.5).

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KEY WORDS : *Cicer arietinum, Heliothis armigera,* Management.

Introduction

Gram pod borer *(Heliothis armigera)* is a major pest of chick pea crop and very common throughout India. During the years of outbreak, it may severely damage almost all major rabi crops *i.e.* gram, lentil, pea, lathyrus, linseed and even wheat. In such situation chemical control is the only way to combat the pest damage. However, in the year of epidemic use of conventional insecticides fails to control the pest damage. The probable reasons for this may be the development of resistance to conventional insecticides, possible immigration of *H. armigera* biotype resistant to these insecticides from coastal area, commencing the control operation only at grown-up larval stage, injudicious use of insecticides by the farmers *etc*.

Considering the seriousness of the pest problem and need of newer insecticides for the management of gram pod borer some of the newly introduced insecticides viz., juvenile hormone analogue, avermectins, neonicotinoids, pyrole derivative, *etc* were chosen for present investigation.

Materials and Methods

The field trials were conducted at AICRP on Pulses, M.P.K.V., Rahuri (M.S.) during the year 2010-2011, 2011-2012 and 2012-2013 in R.B.D. with three replications. Chick pea *cv.* Digvijay was used with the spacing at 30 x 10 cm in a plot size of 4.0 x 3.0 m. Three sprays of insecticide treatments were given at the time of occurrence of larval incidence of *H. armigera* and 15 days interval thereafter with high volume knapsack sprayer @ 500 litre spray fluid/ha (Table-1). Observations on survival of larval population were recorded from middle at three places in one m row length (MRL) of plants before spray and 3 and 7 days after each spray and total population was transformed to square root of n+1 value for statistical analysis. While the observations on pod damage were recorded on five randomly sampled plants at the time of harvest by counting the total number of healthy and damaged pods from which % pod damage was calculated.

Results and Discussion

The result of larval incidence of *H. armigera* before spraying was non-significant. The data on surviving larval population of pod borer indicated that the differences in larval population at 3 and 7 days after spraying (DAS) were significant. All the insecticide treatments recorded significantly lower larval population than untreated control. At 3 DAS, the minimum (0.95 larva/MRL) mean survival larval population was noticed in the treatment with rynaxypyr 20 SC @ 18 g a.i./ha and it was at par with flubendiamide 48 SC @ 60 g a.i./ha (1.47 larvae/ MRL) and emamectin benzoate @ 11 g a.i./ha (1.55 larvae/MRL) (Table-1). Similar results were also noticed at 7 DAS, rynaxypyr 20 SC @ 18 g a.i./ha recorded least larval

Population of *H. armigera* (0.36 larvae/MRL) was significantly at par with rest of the insecticidal treatments *viz.,* flubendiamide 48 SC @ 60 g a.i./ ha (0.87 larvae/MRL), emamectin benzoate @ 11 g a.i./ha (0.89 larvae/MRL), lurenuron 5.4 EC @ 60 g a.i./ha (1.33 larvae/MRL) and profenophos 50 EC @ 500 g a.i./ha (1.49 larvae/MRL). Maximum (3.68 and 3.24 larvae/MRL) population was recorded in untreated control at 4 and 8 DAS, respectively.

All the insecticides were at par with each other and found to be significantly superior in reducing the pod damage over untreated control during the three years study (Table-1). The treatment of rynaxypyr 20 SC @ 18 g a.i./ha recorded significantly lower pod damage (3.5%) . However, it was at par with flubendiamide 48 SC @ 60 g a.i./ha and emamectin benzoate @ 11 g a.i./ha and lufenuron 5.4 EC @ 60 g a.i./ha was also significantly effective as they recorded 8.2 and 8.9% pod damage over untreated control (13.9%), respectively.

The efficacy of newer insecticides was in decreasing order in term of pod damage caused by *H. armigera* was rynaxypyr 20 SC @ 18 g a.i./ ha.> flubendiamide 48 SC @ 60 g a.i./ ha>emamectin benzoate @ 11 g a.i./ha > profenophos 50 EC @ 500 g a.i./ha > lufenuron 5.4 EC @ 60 g a.i./ha. All the insecticidal treatments recorded significantly higher grain yield than untreated control (Table-1). The mean maximum grain yield of 2590 kg/ha was obtained from the treatment, rynaxypyr 20 SC @ 18 g a.i./ha and it was at par with flubendiamide 48 SC @ 60 g a.i./ha (2365 kg/ha) and emamectin benzoate @

TABLE-1: Effect of new molecules on larval population of *Heliothis armigera* in Gram pod.

(Three Years-mean data)

Treatments (g a.i./ha)	Surviving larval population/MRL				
	0 DAS	4 DAS	8 DAS	Pod damage (%)	Grain yield (kg/ha)
Flubendiamide	2.76	1.47	0.87	4.87	2365
48 SC (60)	(1.93)	(1.57)	(1.36)	(12.26)	
Rynaxypyr	2.80	0.95	0.36	3.58	2590
20 SC (18)	(1.94)	(1.39)	(1.16)	(11.46)	
Emamectin	2.70	1.55	0.89	6.05	2292
benzoate	(1.91)	(1.59)	(1.37)	(13.53)	
5 SG (11)					
Lufenuron	2.86	1.89	1.33	8.94	1820
5.4 EC (60)	(1.96)	(1.69)	(1.52)	(16.51)	
Profenophos	2.83	2.09	1.49	8.23	1782
50 EC (500)	(1.95)	(1.75)	(1.57)	(16.31)	
Untreated	3.50	3.68	3.24	13.98	1213
Control	(2.11)	(2.15)	(2.05)	(21.64)	
SE ±	0.18	0.06	0.07	0.80	165.15
CD (P=0.05)	NS	0.18	0.20	2.14	444.34
CV %	15.37	10.27	11.26	11.89	14.27

DAS : Days after spraying; *Figures in the parenthesis are square root n+1 transformed values MRL - Meter Row Length.

11 g a.i./ha (2292 kg/ha).

The pooled data of three years (2012-13, 2013-14 and 2014-15) on economic of the treatments, revealed that all the insecticidal treatments had resulted in significantly increased yield and consequently greater monetary returns over untreated control (Table-2). Among the treatments, rynaxypyr 20 SC @ 18 g a.i./ha recorded maximum (Rs. 3,8076/ha) monetary returns followed by flubendiamide 48 SC @ 60 g a.i./ha (Rs. 38,076 ha), emamectin benzoate @ 11 g .a.i./ ha (Rs. 35,607/ha) lufenuron 5.4 EC @ g a.i./ha (Rs. 20,031/ha) and profenphos 50 EC @ 500 g a.i./ha (Rs. 18,777/ha). Irrespective of monetary returns, the maximum exetemental cost benefit ratio (ICBR) was in the flubendiamide 48 SC @ 60

TABLE-2: Economics of new molecules in gram pod (Three years pooled data 2012-13 to 2014-15).

Treatments	Dose (g a.i. /ha)	Pooled yield (kg/ha)	Increase in yield over control	Monetary returns (Rs/ha)	Cost of insecticide & spraying (Rs./ha)	Net Income (Rs. /ha)	ICBR
Flubendiamide 48 SC	60	2365	1152	38076	1880	36196	1:19.25
Rynaxypyr 20 SC	18	2590	1377	45441	3744	41697	1:11.14
Emamectin benzoate 5 SG	11	2292	1079	35607	6836	28771	1:4.21
Lufenuron 5.4 EC	60	1820	607	20031	4440	15591	1:3.51
Profenophos 50 EC	500	1782	569	18777	2124	16653	1:7.84
Untreated Control	--	1213	---	---	---	---	---

Rates :			
Flubendiamide	Rs. 13,600/- per L	Profenophos	Rs. 328/- per L
Rynaxypyr	Rs. 12,500/- per L	Cost of grains	Rs. 3,300/- per L
Emamectin benzoate	Rs. 8,500/- per kg	Spraying charges	Rs. 380/- per spray
Lufenuron	Rs. 2,500/- per L	Cost of cultivation	Rs. 30,000/- per ha

g a.i./ha (1:19.25) followed by rynaxypyr 20 SC @ 18 g a.i./ha (1:11.14). The findings of present investigations are in accordance with the earlier results[2] which revealed that application of rynaxypyr 20 SC @ 75 ml/ha was found to be the most effective in reducing the *H. armigera* larval population, pod damage and recorded highest grain yield in gram pod. It was also reported that rynaxypyr 20 SC @ 75 ml/ha gave the highest net returns but the ICBR of flubendiamide 48 SC @ 50 ml/ha was higher than rynaxypyr 20 SC @ 75 ml/ha and suggested that rynaxypyr 20 SC @ 75 ml/ha or flubendiamide 48 SC @ 50 ml/ha could be an effective and economical towards managements of *H. armigera* in gram pod. Similar findings[3] reported that flubendiamide 0.007%, rynaxypyr 0.009% and emamectin benzoate 0.0015% were most effective in reducing the *H. armigera* population and pod damage of chick pea. The highest yield was also recorded in the treatment of flubendiamide of 0.007% followed by indoxacarb 0.0075%, spinosad 0.009% and emamectin benzoate 0.0015%. The highest cost benefit ratio was obtained in the treatment of indoxacarb 0.0075% followed by flubendiamide 0.007% and spinosad 0.009%. There was close observation on economics of various treatments in *kharif* sorghum[1]. Similar results were on use of insecticides on chick pea[5]. Thus, considering the efficacy and economics of rynaxypyr 20 SC and flubendiamide 48 SC, any one of these insecticides spray at 50% flowering and second at 15 days after spray can be suggested for the effective control of *H. armigera* on gram pod.

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