Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

Journal of Entomology and Zoology Studies

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2018; 6(5): 947-951

Received: 26-07-2018
Accepted: 27-08-2018

DN Kambrekar
Department of Agricultural Entomology, University of Agricultural Sciences, Dharwad, Karnataka, India

Correspondence
DN Kambrekar
Department of Agricultural Entomology, University of Agricultural Sciences, Dharwad, Karnataka, India

Pyrrole (Chlorfenapyr) insecticide potential to manage *Spodoptera litura* (Fabricius) and *Helicoverpa armigera* (Hubner) in soybean

DN Kambrekar

Abstract
The experiment on the bio-efficacy of Pyrrole (Chlorfenapyr) insecticide against *Spodoptera litura* and *Helicoverpa armigera* in soybean was conducted at Main Agricultural Research Station (MARS), University of Agricultural Sciences, and Dharwad during 2016-17 and 2017-18. The results revealed that, among the treatments evaluated against *S. litura* and *H. armigera* during 2016-17, chlorfenapyr 240 SC @ 1200 ml/ha was effective in reducing the larval population by recording the lowest population of 0.33 larvae /mrl and 0.50 larvae /mrl @ 10 DAS which is on par with the standard check, chlorantraniliprole 18.5 % SC @ 150 ml/ha (0.17 larvae /mrl each). Whereas, the highest larval population was recorded in the untreated control (5.67 and 5.57 larvae /mrl). Similar trend was observed during 2017-18 also in which least population was observed in chlorfenapyr 240 SC @ 1200 ml/ha (1.00 and 1.80 larvae/mrl) @ 10 DAS which is on par with the standard check, chlorantraniliprole 18.5 % SC @ 150 ml/ha (0.83 and 0.67 larvae /mrl) whereas, the highest larval population was recorded in the untreated control (6.83 larvae /mrl). Further, chlorfenapyr 240 SC @ 1200 ml/ha has also recorded the highest seed yield of 1898 q/ha in 2016-17 and 1880 q/ha during 2017-18.

Keywords: Chlorfenapyr 240 SC, *Spodoptera litura*, *Helicoverpa armigera* and soybean

1. Introduction
Soybean [*Glycine max* (L.) Merril], a grain legume is one of the important oilseed crops of Karnataka and is considered as a wonder crop due to its dual qualities *viz*., high protein content (40-43%) and oil content (20%), besides minerals and vitamins. Soybean meal is used as protein supplement in human diet, cattle and poultry feed [1]. Soybean is popularly known as golden bean or jewel bean in the world. Soybean is mainly grown in USA, Brazil, China, Argentina and India among them USA stands first in an area of about 76.53 million acres [2]. India contributes about 10.18 million ha with production of 12.28 million tones. Predominant soybean growing states in India are Madhya Pradesh (5.67 million ha), Maharashtra (3.07 million ha), Rajasthan (0.9 million ha) and Karnataka (0.20 million ha) [3]. With 1.84 lakh MT of production and 1025 kg per ha productivity, it occupies 1.80 lakh ha of area in Karnataka. The productivity of this crop is at a low level in India due to biotic and abiotic factors. Among the biotic factors, the ravages caused by insect pests are of paramount importance in reducing the yield. The luxuriant crop growth, soft and succulent foliage attracts many insects and provides unlimited source of food, space and shelter. About 380 species of insects have been reported on soybean crop from many parts of the world. In India, soybean is reported to be attacked by 273 species of insects, 1 mite, 2 millipedes, 10 vertebrates and one snail [4]. It is further reported that in India, 20 insect species have been recorded as major pests of soybean crop [5].

Among the different defoliators of soybean *viz*., *Spodoptera litura* (Fab.), *Thysanoplusia orichalcea* (Fab.) and *Spilarctia oblique* (Walk.) which feeds on foliage, flower and pods causing significant yield loss [5] are gaining importance. *S. litura* is widely distributed and extremely polyphagous and cause considerable damage to more than 112 host plants causing 26-100 per cent yield loss under field conditions. Considering the damaging level and yield loss, there is a need of an hour to take up control measures against this pest. Hence, the present investigation was therefore planned to evaluate the bioefficacy of chlorfenapyr against *S. litura* and and *H. armigera* in soybean under field conditions.

2. Materials and Methods

The experiment on the bio-efficacy of chlorfenapyr 240 SC against *S. litura* and *H. armigera* in soybean was conducted at Main Agricultural Research Station (MARS), University of Agricultural Sciences, Dharwad during 2016-17 and 2017-18. The soybean variety DSb-21 was sown with row spacing of 30 cm and plant to plant spacing of 10 cm. The treatments included four different doses of Chlorfenapyr 240 SC (600, 800, 1000 and 1200 ml/ha); Chlorantraniliprole 18.5 % SC @ 150 ml/ha and Profenophos 50 EC @ 1000 ml/ha as standard checks with one untreated check. Totally seven treatments were imposed with three replications. Two sprays were given first spray being at ETL and second spray at 15 days after the first spray using a hand operated knapsack sprayer fitted with the hallow cone nozzle. The recommended package of practices was followed to raise the crop except plant protection. Population of *S. litura* and *H. armigera* was recorded on the basis of number of larvae per meter row length at 3, 5 and 10 days after application of insecticides while pre-treatment count was done a day before spraying. Two rounds of spray were taken in both the years (2016-17 and 2017-18). The observations of two sprays of both the years were averaged to analyze the effective treatment. The data on number of insects was subjected to $\sqrt{(x+0.5)}$ transformation before analysis. The pest population was assessed with suitable statistical analysis.

3. Results and Discussion

3.1 Efficacy of Chlorfenapyr 240 SC on *Spodoptera litura* in 2016-17

During first spray, the day before application of the insecticides, the population of *S. litura* was uniform and there was no statistical difference among the treatments during the first spray. On the third day after first spray, Chlorfenapyr 240 SC @ 1200 ml/ha was effective in reducing the larval population by recording the lowest population of 3.90, 3.23 and 1.90 larvae per meter row length at 3, 5 and 10 days after the spray respectively followed by chlorantraniliprole 18.5 SC @ 150 ml/ha (2.55, 1.88 and 0.55 larvae per meter row length at 3, 5 and 10 days after the spray respectively), which are statistically on par with each other. Chlorfenapyr 240 SC @ 1000 and 800 ml/ha were the next best treatments. Among the different treatments, Profenophos 50 EC @ 1000 ml/ha has recorded a highest larval population of 6.93, 6.27 and 4.93 larvae per meter row length at 3, 5 and 10 days after spray and remain on par with the untreated check. During the second spray, similar trend in the efficacy of treatment was observed wherein, Chlorfenapyr 240 SC @ 1200 ml/ha has recorded a lowest larval population of 2.17, 0.83 and 0.33 larvae per meter row length at 3, 5 and 10 days after spraying and remained on par with the standard check (chlorantraniliprole 18.5 SC @ 150 ml/ha) (Table-1).

3.2 Efficacy of Chlorfenapyr 240 SC on *Helicoverpa armigera* in 2016-17

Before the spray, the larval population of *H. armigera* was uniform in all the treatments which ranged from 6.00 to 7.50 larvae per meter row length during the first spray. On third day after first spray, BAS 306 02 I 240 SC @ 1200 ml/ha was effective in reducing the larval population by recording the lowest population of 3.90, 2.67and 0.5 larvae per meter row length at 3, 5 and 10 days after the spray respectively followed by chlorantraniliprole 18.5 SC @ 150 ml/ha (2.88, 1.63 and 0.17 larvae per meter row length at 3, 5 and 10 days after the spray respectively), which are statistically on par with each other. BAS 306 02 I 240 SC @ 1000 and 800 ml/ha were the next best treatments. Among the different treatments, Profenophos 50 EC @ 1000 ml/ha has recorded a highest larval population of 7.27, 6.50 and 5.33 larvae per meter row length at 3, 5 and 10 days after spray and remain on par with the untreated check. During the second spray also the same treatments excelled over others in reducing the population of *H. armigera* where BAS 306 02 I 240 SC @ 1200 ml/ha has recorded a lowest larval population of 3.67, 1.17 and 0.50 larvae per meter row length at 3, 5 and 10 days after spraying and remained on par with the standard check (chlorantraniliprole 18.5 SC @ 150 ml/ha) (Table 2).

3.3 Efficacy of Chlorfenapyr 240 SC on *Spodoptera litura* in 2017 -18

During first spray, the day before application of the insecticides, the population of *S. litura* was uniform and there was no statistical difference among the treatments during the first spray. On the third day after first spray, Chlorfenapyr 240 SC @ 1200 ml/ha was effective in reducing the larval population by recording the lowest population of 4.57, 4.00 and 2.17 larvae per meter row length at 3, 5 and 10 days after the spray respectively followed by chlorantraniliprole 18.5 SC @ 150 ml/ha (3.55, 2.94 and 1.83 larvae per meter row length at 3, 5 and 10 days after the spray respectively), which are statistically on par with each other. Chlorfenapyr 240 SC @ 1000 and 800 ml/ha were the next best treatments. Among the different treatments, Profenophos 50 EC @ 1000 ml/ha has recorded a highest larval population of 6.00, 5.50 and 5.33 larvae per meter row length at 3, 5 and 10 days after spray. During the second season, a similar trend in the efficacy of treatment was observed wherein, Chlorfenapyr 240 SC @ 1200 ml/ha has recorded a lowest larval population of 2.50, 1.83 and 1.00 larvae per meter row length at 3, 5 and 10 days after spraying and remained on par with the standard check (Table-3).

3.4 Efficacy of Chlorfenapyr 240 SC on *Helicoverpa armigera* in 2017 -18

Before the spray the larval population of *H. armigera* was uniform in all the treatments which ranged from 6.27 to 6.67 larvae per meter row length during the first spray. On third day after first spray, BAS 306 02 I 240 SC @ 1200 ml/ha was effective in reducing the larval population by recording the lowest population of 4.23, 3.67 and 1.83 larvae per meter row length at 3, 5 and 10 days after the spray respectively followed by chlorantraniliprole 18.5 SC @ 150 ml/ha (3.22, 2.63 and 1.50 larvae per meter row length at 3, 5 and 10 days after the spray respectively), which are statistically on par with each other. BAS 306 02 I 240 SC @ 1000 and 800 ml/ha were the next best treatments. Among the different treatments, profenophos 50 EC @ 1000 ml/ha has recorded a highest larval population of 6.00, 5.73 and 5.00 larvae per meter row length at 3, 5 and 10 days after spray. During the second spray also the same treatments excelled over others in reducing the population of *H. armigera* where BAS 306 02 I 240 SC @ 1200 ml/ha has recorded lowest larval population of 3.00, 2.50 and 1.80 larvae per meter row length at 3, 5 and 10 days after spraying and remained on par with the standard check (Table 4).

Various workers reported the effectiveness of chlorfenapyr

against different insect pests. It is reported that chlorfenapyr 12.0 g a.i. was effective against serpentine leaf miner *Liriomyza* spp on tomato [6]. Chlorfenapyr 36% SC provided excellent control against *T. absoluta* T (Tomato leaf miner) on tomato crop [7]. Further, chlorfenapyr has been used as a broad spectrum insecticide cum acaricide for the control of whiteflies, thrips, caterpillars, mites, leaf miners, aphids, etc. in chilli [8]. During 2015, chlorfenapyr successfully reduced the infestation of *T. absoluta* in tomato field [9].

3.5 Soybean yield (kg/ha)

The data on the yield revealed that, chlorfenapyr 240 SC @ 1200 ml/ha recorded the highest seed yield of 1880 kg/ha and statistically on par with the standard check (1910 kg/ha). Among the treatments, lower yield was realized in the treatment with profenophos 50 EC @ 1000 ml/ha (1565 kg/ha), which is statistically inferior to other treatments but superior to the untreated check (1310 kg/ha) during 2016-17. In 2017-18, Chlorfenapyr 240 SC @ 1200 ml/ha recorded the highest seed yield of 1898 kg/ha and statistically on par with the standard check (1923 kg/ha). Among the treatments, lower yield was realized in the treatment with profenophos 50 EC @ 1000 ml/ha (1605 kg/ha), which is statistically inferior to other treatments but superior to the untreated check (1398 kg/ha) (Table 5).

Chlorfenapyr is a pro-insecticide and oxidative removal of the N-ethoxymethyl group of chlorfenapyr by mixed function oxidases leads to a toxic form identified as CL 303268 which functions to uncouple oxidative phosphorylation in the mitochondria, resulting in disruption of ATP production and loss of energy leading to cell dysfunction and subsequent death of the organism. This molecule has low mammalian toxicity and is classified as slightly hazardous insecticide as per WHO criterion.

Table 1: Efficacy of Chlorfenapyr 240 SC against *Spodoptera litura* in soybean during 2016-17

Sl. No.	Treatments	Dosage (ml/ha)	Larval population per meter row length						
			During First spray				During Second spray		
			1 DBS	3 DAS	5 DAS	10 DAS	3 DAS	5 DAS	10 DAS
1	Chlorfenapyr 240 SC	600	5.60	5.00 (2.33)	4.33 (2.19)	3.00 (1.87)	5.33 (2.41)	3.83 (2.08)	2.83 (1.82)
2	Chlorfenapyr 240 SC	800	6.00	4.67 (2.27)	4.00 (2.09)	2.67 (1.74)	4.50 (2.23)	3.17 (1.91)	2.00 (1.58)
3	Chlorfenapyr 240 SC	1000	5.83	4.07 (2.12)	4.60 (2.26)	3.27 (1.94)	3.67 (2.02)	2.33 (1.68)	1.33 (1.35)
4	Chlorfenapyr 240 SC	1200	5.67	3.90 (2.10)	3.23 (1.92)	1.90 (1.53)	2.17 (1.63)	0.83 (1.15)	0.33 (0.90)
5	Chlorantraniliprole 18.5 SC	150	5.67	2.55 (1.72)	1.88 (1.54)	0.55 (1.02)	1.83 (1.51)	0.50 (1.00)	0.17 (0.80)
6	Profenofos 50 EC	1000	7.17	6.93 (2.72)	6.27 (2.60)	4.93 (2.30)	7.33 (2.80)	6.00 (2.55)	5.33 (2.41)
7	Untreated Control	-	6.50	6.00 (2.55)	6.50 (2.64)	5.17 (2.38)	7.83 (2.89)	6.50 (2.64)	5.67 (2.48)
	CV %	-	-	11.68	10.35	13.25	7.26	6.88	6.32
	CD @ 5 %	-	NS	0.47	0.40	0.43	0.28	0.22	0.18
	S.Em +	-	-	0.15	0.13	0.14	0.09	0.07	0.05

DBS: Day before spray, DAS: Days after spray Figures in parentheses are $\sqrt{x+0.5}$ transformed values

Table 2: Efficacy of Chlorfenapyr 240 SC against *Helicoverpa armigera* in soybean during 2016-17

Sl. No.	Treatments	Dosage (ml/ha)	Larval population per meter row length						
			During First spray				During Second spray		
			1 DBS	3 DAFS	5 DAS	10 DAS	3 DAS	5 DAS	10 DAS
1	Chlorfenapyr 240 SC	600	6.60	5.33 (2.41)	4.33 (2.19)	3.00 (1.87)	5.33 (2.41)	3.67 (2.03)	3.17 (1.91)
2	Chlorfenapyr 240 SC	800	6.33	5.00 (2.34)	4.00 (2.10)	2.67 (1.73)	5.00 (2.34)	3.33 (1.90)	2.83 (1.82)
3	Chlorfenapyr 240 SC	1000	6.17	4.40 (2.21)	3.33 (1.95)	1.00 (1.19)	4.33 (2.18)	1.67 (1.44)	1.50 (1.41)
4	Chlorfenapyr 240 SC	1200	6.00	3.90 (2.10)	2.67 (1.78)	0.50 (0.98)	3.67 (2.02)	1.17 (1.27)	0.50 (1.00)
5	Chlorantraniliprole 18.5 SC	150	6.00	2.88 (1.84)	1.63 (1.45)	0.17 (0.80)	2.63 (1.76)	0.83 (1.15)	0.17 (0.80)
6	Profenofos 50 EC	1000	7.50	7.27 (2.79)	6.50 (2.48)	5.33 (2.41)	6.83 (2.71)	6.00 (2.55)	5.33 (2.41)
7	Untreated Control	-	6.00	7.50 (2.82)	6.40 (2.62)	5.50 (2.45)	7.40 (2.81)	6.17 (2.58)	5.57 (2.46)
	CV %	-	-	5.30	9.49	17.12	10.21	17.01	6.7
	CD @ 5 %	-	NS	0.22	0.35	0.49	0.42	0.55	0.2
	S.Em +	-	-	0.07	0.11	0.16	0.13	0.18	0.06

DBS: Day before spray, DAS: Days after spray Figures in parentheses are $\sqrt{x+0.5}$ transformed values

Table 3: Efficacy of Chlorfenapyr 240 SC against *Spodoptera litura* in soybean during 2017-18

Sl. No.	Treatments	Dosage (ml/ha)	Larval population per meter row length						
			During First spray				During Second spray		
			1 DBFS	3 DAFS	5 DAFS	10 DAFS	3 DASS	5 DASS	10 DASS
1	Chlorfenapyr 240 SC	600	6.60	6.00 (2.55)	5.67 (2.48)	5.33 (2.40)	5.67 (2.48)	5.00 (2.34)	4.17 (2.16)
2	Chlorfenapyr 240 SC	800	7.00	5.67 (2.48)	5.33 (2.41)	4.50 (2.20)	4.83 (2.3)	4.17 (2.15)	3.50 (1.99)
3	Chlorfenapyr 240 SC	1000	6.83	5.07 (2.36)	4.67 (2.27)	3.67 (2.04)	4.00 (2.11)	3.33 (1.96)	2.67 (1.77)
4	Chlorfenapyr 240 SC	1200	6.67	4.57 (2.24)	4.00 (2.12)	2.17 (1.61)	2.50 (1.73)	1.83 (1.50)	1.00 (1.21)
5	Chlorantraniliprole 18.5 SC	150	6.67	3.55 (2.00)	2.97 (1.84)	1.83 (1.53)	2.17 (1.63)	1.50 (1.41)	0.83 (1.15)
6	Profenofos 50 EC	1000	7.00	6.00 (2.55)	5.50 (2.45)	5.33 (2.40)	7.67 (2.86)	7.00 (2.74)	6.33 (2.61)
7	Untreated Control	-	7.50	8.17 (2.94)	8.07 (2.92)	7.83 (2.88)	8.17 (2.94)	7.50 (2.83)	6.83 (2.70)
	CV %	-	-	7.24	7.07	8.17	7.00	8.95	9.59
	CD @ 5 %	-	NS	0.32	0.305	0.32	0.28	0.34	0.33
	S.Em +	-	-	0.10	0.099	0.10	0.09	0.11	0.108

DBS: Day before spray, DAS: Days after spray Figures in parentheses are $\sqrt{x+0.5}$ transformed values

Table 4: Efficacy of Chlorfenapyr 240 SC against *Helicoverpa armigera* in soybean during 2017-18

Sl. No.	Treatments	Dosage (ml/ha)	Larval population per meter row length						
			During First spray				During Second spray		
			1 DBS	3 DAS	5 DAS	10 DAS	3 DAS	5 DAS	10 DAS
1	BAS 306 02 I 240 SC	600	6.27	5.67 (2.47)	5.33 (2.41)	5.00 (2.30)	4.67 (2.27)	4.00 (2.11)	3.33 (1.93)
2	BAS 306 02 I 240 SC	800	6.67	5.33 (2.41)	5.00 (2.34)	4.17 (2.20)	4.33 (2.19)	3.83 (2.08)	3.17 (1.91)
3	BAS 306 02 I 240 SC	1000	6.50	4.73 (2.29)	4.33 (2.20)	3.33 (1.96)	3.67 (2.04)	3.33 (1.94)	2.67 (1.78)
4	BAS 306 02 I 240 SC	1200	6.33	4.23 (2.17)	3.67 (2.04)	1.83 (1.53)	3.00 (1.86)	2.50 (1.73)	1.80 (1.50)
5	Chlorantraniliprole 18.5 SC	150	6.33	3.22 (1.92)	2.63 (1.74)	1.50 (1.41)	1.97 (1.54)	1.33 (1.35)	0.67 (1.07)
6	Profenofos 50 EC	1000	6.50	6.00 (2.55)	5.73 (2.49)	5.00 (2.30)	6.83 (2.71)	6.00 (2.55)	5.33 (2.41)
7	Untreated Control	-	6.40	7.83 (2.88)	7.73 (2.87)	7.50 (2.83)	7.07 (2.75)	6.40 (2.62)	5.73 (2.49)
	CV %	-	-	7.95	7.72	6.16	8.91	9.42	8.94
	CD @ 5 %	-	NS	0.34	0.32	0.23	0.34	0.34	0.29
	S.Em +	-	-	0.11	0.1	0.076	0.11	0.11	0.097

DBS: Day before spray, DAS: Days after spray Figures in parentheses are $\sqrt{x+0.5}$ transformed values

Table 5: Influence of different doses of Chlorfenapyr 240 SC on soybean yield

Sl. No	Treatments	Dosage (ml/ha)	Yield (kg/ha)	
			2016-17	2017-18
1	Chlorfenapyr 240 SC	600	1598	1546
2	Chlorfenapyr 240 SC	800	1650	1685
3	Chlorfenapyr 240 SC	1000	1721	1710
4	Chlorfenapyr 240 SC	1200	1898	1880
5	Chlorantraniliprole 18.5 SC	150	1923	1910
6	Profenofos 50 EC	1000	1605	1565
7	Untreated Control	-	1398	1310
	CD @ 5 %	-	72.30	40.25
	S.Em +	-	23.50	18.97

4. Conclusion

Among the different treatments in the present study, Chlorfenapyr 240 SC @ 1200 ml/ha was found to be effective in reducing the larval population of *S. litura* and *H. armigera* and has recorded higher yield which can be recommended for the management of defoliators in soybean.

5. References

1. Alexander MW. Soybean production in Virginia experimentstion division. Virginia Polytech. Inst. State Univ, 1974, 44.
2. Anonymous. Acreage National Agricultural Statistics Service (NASS), Agricultural Statitics Board, United

States Department of Agriculture, 2012a.
3. Anonymous. Agricultural Statistical at a glance. Directorate of economics and statistics, department of Agriculture and Cooperation, 2012b.
4. Singh OP. Perspective and prospects of insect pests control in India with references to sustainable environment in India. Proc. Of world soybean conference-VI Chicago, Hlionois U. S. A. 1999, 638-640.
5. Singh OP, Singh KS. Insect pests of soybean and their management. Indian Farming. 1990; 39:9-14.
6. Santos AC, Bueno RC, Vieira SS, Bueno AF. Efficacy of insecticides on *Tuta absoluta* (Meyrick) and other pests in pole tomato. Sociedade Entomology Brasil. 2011; 3:1-6.
7. Moussa S, Sharma A, Baiomy F, El-Adl FE. The Status of Tomato Leafminer; *Tuta absolut*a (Meyrick) (Lepidoptera: Gelechiidae) in Egypt and Potential Effective Pesticides Academy Journal of Entomology. 2013; 6(3):110-115.
8. Ditya P, Das SP, Sarkar PK, Bhattarchryya A. Degradation dynamics of chlorfenapyr residue in chilli, cabbage and soil. Bulletin of Environment Contamination and Toxicology. 2010; 84(5):602-605.
9. Sallam AA, Soliman MA, Khodary MA. Effectiveness of certain insecticides against the tomato leaf miner *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) Advances in Applied Agricultural Sciences. 2015; 3(2):54-64