Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(2): 1528-1531
Received: 07-01-2019
Accepted: 10-02-2019

Shobharani M
Agricultural Research Station, Bidar University of Agricultural Sciences, Raichur, Karnataka, India

Sidramappa
Agricultural Research Station, Bidar University of Agricultural Sciences, Raichur, Karnataka, India

Sunilkumar NM
Agricultural Research Station, Bidar University of Agricultural Sciences, Raichur, Karnataka, India

Correspondence
Shobharani M
Agricultural Research Station, Bidar University of Agricultural Sciences, Raichur, Karnataka, India

Evaluation of different doses of Novaluron 5.25% + Indoxacarb 4.5% SC for the management of lepidopteron pests on soybean

Shobharani M, Sidramappa and Sunilkumar NM

Abstract
The present study was conducted during kharif, 2012-13 and 2013-14 at Agricultural Research Station, Bidar to assess the efficacy of ready mix insecticide, Novaluron 5.25% + Indoxacarb 4.5% SC at different doses along with other insecticides for the management of *Spodoptera litura*, *Helicoverpa armigera* and other lepidopteron pests infesting soybean. Among the different insecticides evaluated, Novaluron 5.25% + Indoxacarb 4.5% SC @ 875 ml/ha and 825 ml/ha were proved superior by recording lowest larval population of lepidopteron pests and recorded highest grain yield.

Keywords: Novaluron 5.25% + indoxacarb 4.5% SC, *Spodoptera litura*, *Helicoverpa armigera*, soybean

Introduction
Soybean (*Glycine max* (L.) Merrill) is the number one oilseed crop in India. It provides the cheapest as well as the highest source of edible vegetable protein than any other pulse crop. The protein and edible oil content in soybean accounts to 40-43 and 20 per cent, respectively. Soybean protein is rich in amino acids like lysine, methionine and cystine. Soybean cake and meal are used as protein supplement for human food products and animal feeds. In addition, it contains good amount of minerals, salts and vitamins (Thiamine and Riboflavin). Soybean is reported to be attacked by 273 species of insects (Rawat and Kapoor, 1968) [8] and in India 20 insect pest species have been recorded infesting soybean crop (Singh and Singh, 1990) [9, 10]. Some common insect pest complex infecting soybean crops are green semilooper, tobacco leaf eating caterpillar, white fly, girdle beetle etc. (Uttam *et. al.*, 2012). The defoliators [*Spodoptera litura* (Fab.), *Thysanoplusia orichalcea* (Fab.), *Spilarctia obliqua* (Walk.)] and *Helicoverpa armigera* (Hubner) are feeding on foliage, flower and pods causing significant yield loss (Singh and Singh, 1990) [9, 10]. Taking in to consideration the seriousness of the pest infestation and damage to soybean crop, the present study was undertaken to manage the pest with the help of chemical insecticides and to know the suitable control measure for the management of the pest.

Materials and Methods
The field experiments were conducted for two consecutive years during kharif 2012-13 and 2013-14 at Agricultural Research Station Bidar. The experiment was laid out in Randomized block design with seven treatments replicated thrice [as detailed in Table.1]. Soybean var. JS-335 was sown at 30cm ×10cm spacing and all the recommended package of practices was followed to raise the crop, except plants protection measures. First spray was done at initiation of pest infestation in all the experimental plots and subsequent two more sprays were given at ten days intervals. Observations on incidence of *Helicoverpa armigera*, *Spodoptera litura and* Semiloopers were recorded at one day before spray and 5 and 10 days after each spray on randomly selected 10 plants/plot. The data was subjected for square root transformation and statistical analysis. The seed yield was recorded plot wise at the time of harvest and converted to hectare basis and subjected for statistical analysis.

Results and Discussion
The pooled data on efficacy of different treatment schedules of novaluron 5.25%+ indoxacarb 4.5% SC against lepidopteron pests infesting soybean has been presented in table 1, 2, 3 and 4. There was no significant difference in larval population between treatments as well as control during Kharif 2012 and 2013 (Table 1). All the treated plots with chemicals were significantly superior in their performance over that of control plots after application of insecticides.

During 2012-13, at 5 days after spraying, lowest *H. armigera* population was recorded in novaluron 5.25%+ indoxacarb 4.5% SC sprayed @ 875 ml/ha followed by the same chemical sprayed @ 825 ml/ha with 1.30 and 1.36 larvae per ten plants respectively. These two treatments were followed by novaluron 10% EC @1000ml/ha (1.87 larvae/ ten plants) and novaluron 5.25%+ indoxacarb 4.5% SC @ 750 ml/ha (2.02 larvae/ ten plants). At 10 days after spraying, novaluron 5.25%+ indoxacarb 4.5% SC sprayed @ 875 and 825 ml/ha showed lowest larval population of *H. armigera* with 0.89 and 0.95 larvae/ ten plants respectively. These two treatments were followed by indoxacarb 14.5% SC @ 333 ml/ha (1.36 larvae/ten plants) and novaluron 10% EC @ 1000ml/ha (1.53 larvae/ ten plants). A steady increase in the *H. armigera* population was observed in untreated control plot throughout the experimental period.

During Kharif 2013, one day before imposition of treatment, larval population of *H. armigera* ranged from 3.15 to 3.50 per ten plants in various treatments and there was no significant difference among the treatments. At 5 days after imposing the treatment, lowest *H. armigera* population was recorded in the treatments where, novaluron 5.25%+ indoxacarb 4.5% SC sprayed @ 875 ml/ha and 825 ml/ha with 1.45 and 1.56 larvae/ ten plants respectively. These two treatments were followed by indoxacarb 14.5% SC @ 333ml/ha (2.04 larvae/ten plants) and novaluron 5.25%+ indoxacarb 4.5% SC @ 750 ml/ha (2.19 larvae/ ten plants). Ten days after treatment same trend was followed with respect to the larval population. However, untreated control plot recorded highest larval population.

As revealed in Table 2, day before spraying there was no significant difference in *Spodoptera litura* larval population among the different treatment during 2012 kharif. After 5 days of spraying, lowest Spodoptera larval population was recorded in novaluron 5.25%+ indoxacarb 4.5% SC treatments sprayed @ 875 and 825 ml/ha with 1.01 and 1.04 larvae/ten plants respectively.These two treatments were followed by Indoxacarb 14.5% SC@ 333ml/ha (1.52 larvae/ ten plants) and Novaluron 10% EC @1000ml/ha (1.61 larvae/ ten plants). However untreated control plot recorded highest larval population. Ten days after spraying same trend was followed with respect to the spodoptera larval population.

During Kharif 2013, larval population of *Spodoptera litura* ranged from 3.78 to4.50 per ten plants in various treatments and there was no significant difference among the treatments. Five days days after imposing the treatment, lowest Spodoptera larval population was recorded in the treatments where, novaluron 5.25%+ indoxacarb 4.5% SC sprayed @ 875 and 825 ml/ha with 1.85 and 2.00 larvae per ten plants respectively. These two treatments were followed by indoxacarb 14.5% SC @ 333ml/ha (2.78 larvae/ten plants) and novaluron 5.25%+ indoxacarb 4.5% SC @ 750 ml/ha (2.99 larvae/ ten plants). Ten days after treatment same trend was followed. However, untreated control plot recorded highest larval population.

The results in the Table 3, reveals that there was no significant difference in semilooper larval population among the treatments during 2012 kharif. Five days of spraying, lowest semilooper larval population was recorded in novaluron 5.25%+ indoxacarb 4.5% SC treatments at 875 and 825 ml/ha with 1.24 and 1.30 larvae/ten plants respectively. These two treatments were followed by Novaluron 10% EC @1000ml/ha (1.55 larvae/ ten plants) and Indoxacarb 14.5% SC@ 333ml/ha (1.68 larvae/ ten plants). However untreated control plot recorded highest larval population. Ten days after spraying same trend was followed with respect to the semilooper larval population.

During Kharif 2013, same trend was followed with respect to the semilooper larval population. There was a steady increase in the semilooper larval population was observed in untreated control plot throughout the experimental period.

Yield

Table 4, shows the pooled yield data of 2012 and 2013 reveals that, Novaluron 5.25% + Indoxacarb 4.5% SC @ 875 ml /ha and 825 g /ha recorded highest grain yield of 14.58 q/ha and 14.28 q/ha and cost benefit ratio of 1:2.87 and 1: 2.88 respectively. These two treatments were followed by and Indoxacarb 14.5% SC@ 333ml/ha (11.78 q/ha), Novaluron 5.25% + Indoxacarb 4.5% SC @ 750ml /ha (11.74 q/ha) and Novaluron 10% EC @1000ml/ha (11.55 q/ha) with cost: benefit ratio of 1:2.63, 1:1.85, 1:2.40 respectively. Untreated control recorded lowest grain yield of 8.10 q /ha.

From the present study, the result revealed that, Novaluron 5.25% + Indoxacarb 4.5% SC @ 825 ml/ha and 875 ml/ha can be used on Soybean crop for the management of the *Spodoptera litura***,** *Helicoverpa armigera* and semiloopers, as these two treatments recorded lowest pest population and highest yield of soybean. The present results are in accordance with the results of Ghosal *et. al*., (2016) [1, 2] who reported that, technical formulation of novaluron 5.25%+ indoxacarb 4.5% SC (Plethora) @ 825 ml/ha and 875 ml/ha were excellently effective against *Helicoverpa armigera* of pigeon pea and were safe to the three important predator (*Menochilus* sp., *Syrphus* sp. and *Chrysoperla* sp. recorded in the pigeon pea field and he also reported that technical formulation of novaluron 5.25%+ indoxacarb 4.5% SC (Plethora) @ 875 ml/ha and 825 ml/ha can protect the tomato crop infesting with fruit borer complex (*Helicoverpa* and *Spodoptera*) more efficiently than that of their sole use by recording highest fruit yield and cost benefit ratio. Further, these results were almost similar to the findings of Das *et al.* (2015) [4], who reported that mixed formulation of novaluron 5.25+indoxacarb 4.5 SC proved to be the most effective insecticides than that of their sole formulation against *Helicoverpa armigera*.

The Novaluron 5.25% + Indoxacarb 4.5% SC is highly vulnerable to lepidopteran insect pest with two novel modes of action *viz.* chitin biosynthesis inhibition creates abortive moulting by novaluron and blockage of axonal sodium channel causing rapid cessation of feeding and paralysis by indoxacarb. Yogeeswarudu and Venkata Krishna (2014) in their findings concluded that novel insecticides indoxacarb and novaluron can manage Helicoverpa up to 95.83 per cent and 87.12 per cent respectively. Gamil et al. (2011) [5] concluded that 2nd instar larvae of *Spodoptera littoralis* are more susceptible to indoxacarb than 4th instar. Moadeli et al. (2014) [7] evaluated the LC50 and LC90 values of indoxacarb againt Spodoptera exigua which were 2.510 and 38.828 mg a.i. /l respectively. Mishra (1986) [6]; Singh and Singh (1990) [9, 10]; Bhatt and Patel (2002) [3] also reported similar result about the effect of these novel insecticides on *H. armigera* and *S. litura*.

Looking into the literature and results of the present study, we can conclude that the technical formulation of novaluron 5.25%+ indoxacarb 4.5% SC @ 875 ml/ha and 825 ml/ha can protect the soybean crop more efficiently than that of their sole use.

Table 1: Bio-efficacy of Novaluron 5.25% + Indoxacarb 4.5% SC against *Helicoverpa armigera* on soybean

Sl. No.	Treatments	Dose (g or ml/ha)	Average population of *Helicoverpa* larvae/ ten plants					
			2012-13			2013-14		
			1DBS	5DAS	10DAS	1DBS	5DAS	10DAS
1	Novaluron 5.25% + Indoxacarb 4.5% SC	750	2.89 (1.97)	2.02 (1.73)	1.56 (1.59)	3.18 (2.04)	2.19 (1.76)	1.63 (1.60)
2	Novaluron 5.25% + Indoxacarb 4.5% SC	825	2.75 (1.94)	1.36 (1.52)	0.95 (1.38)	3.36 (2.09)	1.56 (1.57)	0.92 (1.37)
3	Novaluron 5.25% + Indoxacarb 4.5% SC	875	2.53 (1.88)	1.30 (1.50)	0.89 (1.36)	3.50 (2.12)	1.45 (1.54)	0.84 (1.34)
4	Novaluron 10% EC	1000	2.68 (1.91)	1.87 (1.68)	1.53 (1.58)	3.33 (2.08)	2.17 (1.76)	1.56 (1.58)
5	Indoxacarb 14.5% SC	333	2.66 (1.91)	2.05 (1.74)	1.36 (1.52)	3.15 (2.04)	2.04 (1.72)	1.42 (1.54)
6	Dichlorovos 76% EC	376	2.82 (1.95)	2.18 (1.78)	1.76 (1.65)	3.27 (2.07)	2.33 (1.81)	1.79 (1.65)
7	Untreated control	-	2.72 (1.93)	3.70 (2.16)	3.97 (2.23)	3.15 (2.04)	4.47 (2.34)	4.94 (2.43)
	CD (0.05)		NS	0.25	0.20	NS	0.21	0.26

DAS: Days After Spray; Figures in the parentheses are square root transformed values √(x+1)

Table 2: Bio-efficacy of Novaluron 5.25% + Indoxacarb 4.5% SC against *Spodoptera litura* on soybean

Sl. No.	Treatments	Dose (g or ml/ha)	Average population of *Spodoptera litura* larvae/ ten plants					
			2012-13			2013-14		
			1DBS	5DAS	10DAS	1DBS	5DAS	10DAS
1	Novaluron 5.25% + Indoxacarb 4.5% SC	750	2.27 (1.81)	1.65 (1.62)	1.39 1.54	3.95 (2.22)	2.99 (1.99)	2.41 (1.83)
2	Novaluron 5.25% + Indoxacarb 4.5% SC	825	2.30 (1.82)	1.04 (1.42)	0.73 1.31	4.36 (2.31)	2.00 (1.70)	1.15 (1.45)
3	Novaluron 5.25% + Indoxacarb 4.5% SC	875	2.15 (1.77)	1.01 (1.41)	0.59 1.25	4.50 (2.34)	1.85 (1.66)	0.99 (1.39)
4	Novaluron 10% EC	1000	2.22 (1.79)	1.61 (1.61)	1.32 1.52	4.33 (2.31)	3.04 (2.00)	2.31 (1.80)
5	Indoxacarb 14.5% SC	333	2.51 (1.87)	1.52 (1.58)	1.16 1.46	4.00 (2.24)	2.78 (1.93)	2.13 (1.75)
6	Dichlorovos 76% EC	376	2.25) (1.80)	1.75 (1.65)	1.50 1.57	3.78 (2.19)	3.05 (2.01)	2.63 (1.90)
7	Untreated control	-	2.23 (1.80)	3.93 (2.21)	4.25 2.29	3.86 (2.20)	4.95 (2.44)	5.30 (2.51)
	CD (0.05)		NS	0.26	0.12	NS	0.32	0.24

DAS: Days After Spray; Figures in the parentheses are square root transformed values √(x+1)

Table 3: Bio-efficacy of Novaluron 5.25% + Indoxacarb 4.5% SC against Semiloopers on soybean

Sl. No.	Treatments	Dose (g or ml/ha)	Average population of semiloopers larvae/ ten plants					
			2012-13			2013-14		
			1DBS	5DAS	10DAS	1DBS	5DAS	10DAS
1	Novaluron 5.25% + Indoxacarb 4.5% SC	750	2.39 (1.84)	1.80 (1.67)	1.51 (1.57)	2.69 (1.91)	1.76 (1.66)	1.76 (1.66)
2	Novaluron 5.25% + Indoxacarb 4.5% SC	825	2.24 (1.80)	1.30 (1.51)	0.96 (1.38)	2.71 (1.93)	1.46 (1.56)	1.46 (1.56)
3	Novaluron 5.25% + Indoxacarb 4.5% SC	875	2.53 (1.88)	1.24 (1.49)	0.89 (1.36)	2.92 (1.98)	1.29 (1.50)	1.29 (1.50)
4	Novaluron 10% EC	1000	2.41 (1.85)	1.55 (1.59)	1.25 (1.48)	2.69 (1.92)	1.60 (1.60)	1.60 (1.60)
5	Indoxacarb 14.5% SC	333	2.7 (1.92)	1.68 (1.63)	1.29 (1.49)	2.66 (1.91)	1.56 (1.59)	1.56 (1.59)
6	Dichlorovos 76% EC	376	2.52 (1.88)	1.77 (1.66)	1.52 (1.58)	2.88 (1.97)	1.93 (1.70)	1.93 (1.70)
7	Untreated control	-	2.36 (1.83)	3.47 (2.11)	3.59 (2.14)	2.71 (1.93)	3.99 (2.23)	3.99 (2.23)
	CD (0.05)		NS	0.24	0.20	NS	0.29	0.29

DAS: Days After Spray; Figures in the parentheses are square root transformed values √(x+1)

Table 4: Effect of Novaluron 5.25% + Indoxacarb 4.5% SC on yield of Soybean 2012-13 and 2013-14 (Pooled)

Sl. No.	Treatments	Dose (g or ml/ha)	Average Yield (Q/ha)	Cost: Benefit ratio
1	Novaluron 5.25% + Indoxacarb 4.5% SC	750	11.74	1: 1.85
2	Novaluron 5.25% + Indoxacarb 4.5% SC	825	14.28	1: 2.88
3	Novaluron 5.25% + Indoxacarb 4.5% SC	875	14.58	1: 2.87
4	Novaluron 10% EC	1000	11.55	1: 2.40
5	Indoxacarb 14.5% SC	333	11.78	1: 2.63
6	Dichlorovos 76% EC	376	8.94	1: 1.63
7	Untreated control	-	8.10	-
	CD (0.05)		1.49	-

References

1. Ghosal A, Dolai AK and Chatterjee ML. Bioefficacy of new ready mixed insecticide (Novaluron 5.25% + Indoxacarb 4.5% SC) against pigeon pea pod borer (*Helicoverpa armigera* Hubner). Legume Research. 2016; 39(1):135-139.
2. Ghosal A, Dolai AK, Chatterjee ML. Plethora (novaluron + indoxacarb) insecticide for the management of tomato fruit borer complex. Journal of Applied and Natural Science. 2016; 8(2):919-922.
3. Bhatt NJ and Patel RK. Bioefficacy of various insecticides against *Helicoverpa armigera* on chickpea. Indian J Entomol. 2002; 64:27-34.
4. Das BC, Patra S, Dhote VW, Alam SKF, Chatterjee ML and Samanta A. Mix formulations: An alternative option for management of gram pod borer, *Helicoverpa armigera* and pod fly, *Melanagromyza obtusa* in pigeon pea. Legume Res. 2015; 38(3):396-401.
5. Gamil WE, Mariyb FM, Youssefb LA, Abdel Halima SM. Effect of Indoxacarb on some biological and biochemical aspects of *Spodoptera littoralis* (Boisd.) larvae. Ann. Agril. Sci. 2011*;* 56(2):121-126.
6. Mishra PN. Studies on the bio-efficacy of some insecticides against the pest complex of tomato, *Lycopersicon esculentus* Mill. var. Pusa Ruby. Madras Agric. J. 1986; 71:673-676.
7. Moadeli T, Hejazi MJ, Golmohammadi Gh. Lethal Effects of Pyriproxyfen, Spinosad, and Indoxacarb and Sublethal Effects of Pyriproxyfen on the 1st Instars Larvae of Beet Armyworm, *Spodoptera exigua* Hubner (Lepidoptera: Noctuidae) in the Laboratory. J Agr. Sci. Tech. 2014; 16:1217-1227.
8. Rawat RR, Kapoor RH. Arthropod pest of soybean in M. P. Conference on soybean production and marketing. September 20-23. Proceedings, NJKVV, Jabalpur, 1968, 62-65.
9. Singh D, Singh, DD. Control of tomato fruit borer, *Heliothis armigera* Hubner with Synthetic pyrethroids. Indian J Entomol, 1990; 52:534-540.
10. Singh OP, Singh KJ. Insect pest of soybean and their management. Indian Farming, 1990; 39(10): 9-14.
11. Uttam KP, Sharma, Shrivastva S. Spectrum of insect pest complex of soybean (*Glycine max* L. Merill) at Lambapeepal village in kota region. India. J Bio. Sci. 2012; 1(1):80-82.