

Original Research Article

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Effectiveness of some Insecticides against Larval Population of Two Major Defoliators of Soybean

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ABSTRACT

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The present investigation was carried out during kharif season 2010 and 2012 at farmers' field near College of Agriculture, Kundeshwar Road, Tikamgarh (M.P.). Nine insecticides were evaluated against semilooper and tobacco caterpillar on JS 93-05 variety of soybean in randomized complete block design with three replications. The result revealed that all the insecticides, under investigation, were found effective in reducing the population of semilooper and tobacco caterpillar over the unsprayed control. However, among the insecticides, indoxacarb (14.5 SC) was superior followed by lambda cyhalothrin (5 EC) in reducing the larval population of semilooper and tobacco caterpillar.

Introduction

Soybean is a unique crop with high nutritional value, providing 40 per cent protein and 20 per cent edible oil besides minerals and vitamins. It is playing an important role in augmenting both, the production of edible oil and protein simultaneously under the circumstances in which the shortage of these commodities being experienced by India.

Various names have been given to this important crop as Miracle bean, Golden bean, Cow of the field, Meat of the field, Gold from the soil, Pearl of the orient, Cinderella crop etc.

It is a major oil seed crop of world grown in an area of 113.01 million ha with production of 283.79 million tons and productivity of 2.51 t/ha, India ranks fourth in world in respect of area and production (Anon., 2014). Major soybean growing states in India are Madhya Pradesh, Maharashtra, Rajasthan, Karnataka, Uttar Pradesh, Andhra Pradesh and Gujarat. In Madhya Pradesh, soybean occupies an area of 5.12 million ha with production of 5.85 mt and productivity of 1142 kg per ha. In Indian scenario, Madhya Pradesh contributes about 53.88% and 59.06% in total area and production of soybean, respectively in the country and is known as "soya state" (Anon., 2010).

The luxuriant crop growth, soft and succulent foliage attracts many insects and provides unlimited source of food, space and shelter. Soybean crop is reported to be attacked by about 350 species of insects in many parts of the world (Luckmann, 1971). Now a day infestation of defoliators is becoming the most important production constraint, posing threat to soybean cultivation in Madhya Pradesh. To minimize such serious damage on soybean, screening of effective insecticides for management of semilooper and tobacco caterpillar is needed. Hence, this study was conducted for evaluating the effectiveness of nine insecticides for the management of semilooper and tobacco caterpillar.

Materials and Methods

Experimental site

The experiment was carried out during Kharif season of 2010 and 2012 at farmers' field situated on Kundeshwar road, Tikamgarh (M.P.). The Tikamgarh District encompassing an area of 5048 Km Co-ordinates of 24°26' ; 25°40' North latitudes and 78°26' to 79°26'; East longitudes. It is nearly 1400 ft. from the sea level. It is situated in the northern part of M.P. The soil is heavy black clay and light in texture.

Field preparation and Fertilizer application

The field was ploughed and cross bakhared before sowing. Drainage channels were prepared at the time of sowing for drainage of excess rain water from the field. Fertilizer was applied at the time of sowing @ 20kg N: 60kg P₂O₅: 20kg K₂O/ha as basal dose.

Seed rate and method of sowing

The popular variety of soybean JS 93-05 was sown @ 80kg/ha in row by putting the seeds in furrows with row to row distance of 40cm

and 10cm between plants. A randomized block design experiment with ten treatments was laid out to compare the efficacy of insecticides molecules against the incidence of semilooper, tobacco caterpillar in soybean. Plot size was kept 5x2.80m spacing between plot to plot was 70cm and from one replication to other was kept 1m.

Nine insecticides were tested in the field against the semilooper and tobacco caterpillar. The treatments were Indoxacarb (14.5 SC) 500 ml, Rynaxypyr (20 SC) 100ml, Diafenthiuron (50 WP) 500g, Profenophos (50 EC) 1250 ml, Lambda cyhalothrin (5EC) 300ml, Endosulfan (35 EC) 1000ml, Triazophos (40 EC) 800ml, Cypermethrin (25 EC) 600 ml, Chlorpyrifos (20 EC) 1500ml and Untreated control (Water spray).

The observation on larval population of defoliators was recorded per meter row length (mrl) leaving border rows.

Larval count was made by shaking the plants gently over a white cloth placed between the rows. Observations were recorded 1 day before treatment and 2 and 7 days after treatment (DAT).

Results and Discussion

It was observed that the soybean crop was attacked by semiloopers and tobacco caterpillar during crop growing period. The pest population in different treatments was averaged for both the years under study and computed for description.

Comparative efficacy of insecticides against the incidence of defoliators of soybean

Four commonly used insecticides and five new molecules were screened against major insects of soybean under field condition during 2010 and 2012. The larval population

in different observations was averaged for both the years under study and data were used for description.

Observations on the larval population of semilooper and tobacco caterpillar were recorded 1 day before and 2 and 7 days after treatment in per meter row length (mrl).

One day before the application of insecticides

The data presented in Table 1 indicated that during 2010 larval population of semilooper ranged from 2.84 to 3.26 larvae/mrl, whereas it ranged from 5.25 to 6.59 larvae/mrl during 2012.

Observations were recorded 1 day before the application of insecticides revealed that all the treatments had more or less similar number of semiloopers and ranged from 4.12 to 4.86 larvae/ mrl which were uniformly distributed in all the plots. Statistically a non-significant variation was recorded in the semiloopers population at this stage.

Two days after the application of insecticides

The data presented in Table 2 indicated that during 2010 larval population of semilooper ranged from 0.67 to 1.56 larvae/mrl as compared to 3.90 larvae/mrl in control whereas it ranged from 3.06 to 4.69 larvae/mrl during 2012.

After 2 days of insecticidal application, all the treatments were significantly superior over the control. Indoxacarb, lambda cyhalothrin, triazophos, profenophos, cypermethrin, were *at par* with each other and were more effective than rynaxypyr, endosulfan, diafenthiuron and chlorpyrifos (Table 2) in reducing the larval population during both the years and also in pooled mean larval population.

Seven days after the application of insecticides

The data presented in Table 2 indicated that during 2010 larval population of semilooper ranged from 0.97 to 1.67 larvae/mrl as compared to 3.60 larvae/mrl in control whereas it ranged from 3.53 to 4.86 larvae/mrl during 2012. After 7 days of insecticidal spray, all insecticidal treatments were found effective and significantly superior over untreated control in reducing larval population. The population of semiloopers is presented in the Table 2. All the treatments recorded significantly less larval population (2.25 to 3.20 larvae/mrl) as compared to untreated control. Among the insecticides, indoxacarb was superior followed by lambda cyhalothrin, triazophos, profenophos, cypermethrin, rynaxypyr, endosulfan, diafenthiuron and Chlorpyrifos. Significantly lowest larval population was recorded in indoxacarb (2.25 larvae/mrl) and it was *at par* with all the treatments except endosulfan, diafenthiuron, chlorpyrifos. However, all the insecticidal treatments were significantly superior over control (6.20 larvae/mrl).

Rajput *et al.*, (1996) reported quinalphos (0.05%) and cypermethrin (0.01%) as highly effective against the green semilooper. Singh (1995) reported triazophos (0.04%), acephate (0.07%), Chlorpyrifos (0.05%), methomyl (0.04%), ethion (0.1%), endosulfan (0.07%) and quinalphos (0.05%) were highly toxic against the grey semilooper on soybean up to 15 days after treatment. Singh and Singh (1988), found that monocrotophos (0.036%), triazophos (0.04%) and fenvalerate (0.01 %) to be highly effective against the grey semilooper. Singh and Singh (1990) reported quinalphos (1.5% dust) against *Diacrisia orichalcea* and cypermethrin (0.01%), deltamethrin (0.01%) and quinalphos (0.05%) against *Chrysodeixis acuta* respectively to be the most effective.

Table.1 Population of semiloopers before insecticidal application

Treatments	Dose/ha	1 day before treatment Mean larval population (larvae/ml)		
		2010	2012	Pooled
Indoxacarb (14.5 SC)	500 ml	3.13	6.59	4.86
Rynaxypyr (20 SC)	100 ml	3.25	5.39	4.32
Diafenthiuron (50 WP)	500g	3.11	5.58	4.35
Profenophos (50 EC)	1250 ml	2.85	5.93	4.39
Lambda cyhalothrin (5 EC)	300 ml	3.26	5.25	4.26
Endosulfan (35 EC)	1000 ml	2.87	5.37	4.12
Triazophos (40 EC)	800 ml	2.84	6.48	4.66
Cypermethrin (25 EC)	600 ml	3.04	6.42	4.73
Chlorpyriphos (20 EC)	1500 ml	3.21	5.56	4.39
Untreated control		3.13	6.04	4.58
SEm _±		0.38	0.45	0.31
CD at 5%		NS	NS	NS

Table.2 Efficacy of different insecticides on the larval population of semiloopers after 2 and 7 days of treatment

Treatments	Dose/ha	Two days after treatment Mean larval population (larvae/ml)			Seven days after treatment Mean larval population (larvae/ml)		
		2010	2012	Pooled	2010	2012	Pooled
Indoxacarb (14.5 SC)	500 ml	0.67	3.06	1.87	0.97	3.53	2.25
Rynaxypyr (20 SC)	100 ml	1.21	4.19	2.70	1.34	4.46	2.90
Diafenthiuron (50 WP)	500g	1.40	4.69	3.05	1.46	4.86	3.16
Profenophos (50 EC)	1250 ml	1.11	3.73	2.42	1.27	3.83	2.55
Lambda cyhalothrin (5 EC)	300 ml	0.96	3.49	2.22	1.14	3.57	2.36
Endosulfan (35 EC)	1000 ml	1.24	4.37	2.81	1.40	4.45	2.93
Triazophos (40 EC)	800 ml	1.11	3.57	2.34	1.22	3.67	2.45
Cypermethrin (25 EC)	600 ml	1.12	3.76	2.44	1.31	3.91	2.61
Chlorpyriphos (20 EC)	1500 ml	1.56	4.53	3.05	1.67	4.71	3.20
Untreated control		3.90	8.42	6.16	3.60	8.57	6.20
SEm _±		0.15	0.30	0.20	0.17	0.35	0.23
CD at 5%		0.45	0.89	0.59	0.49	1.03	0.67

Table.3 Population of tobacco caterpillar before insecticidal application

Treatments	Dose/ha	1 day before treatment Mean larval population (larvae/ml)		
		2010	2012	Pooled
Indoxacarb (14.5 SC)	500 ml	2.43	3.30	2.87
Rynaxypyr (20 SC)	100 ml	2.57	3.97	3.27
Diafenthiuron (50 WP)	500g	2.18	2.98	2.58
Profenophos (50 EC)	1250 ml	2.40	3.83	2.85
Lambda cyhalothrin (5 EC)	300 ml	2.94	3.76	3.07
Endosulfan (35 EC)	1000 ml	2.22	3.47	2.74
Triazophos (40 EC)	800 ml	2.03	3.63	2.63
Cypermethrin (25 EC)	600 ml	2.83	3.31	3.07
Chlorpyriphos (20 EC)	1500 ml	2.86	3.33	3.10
Untreated control		2.72	3.32	3.02
SEm±		0.44	0.78	0.52
CD at 5%		NS	NS	NS

Table.4 Efficacy of different insecticides on the larval population of tobacco caterpillar after 2 and 7 days of treatment

Treatments	Dose/ha	Two days after treatment Mean larval population (larvae/ml)			Seven days after treatment Mean larval population (larvae/ml)		
		2010	2012	Pooled	2010	2012	Pooled
Indoxacarb (14.5 SC)	500 ml	0.92	1.14	1.03	1.03	1.41	1.22
Rynaxypyr (20 SC)	100 ml	1.52	1.72	1.62	1.66	1.96	1.81
Diafenthiuron (50 WP)	500g	1.41	1.94	1.67	1.52	1.89	1.71
Profenophos (50 EC)	1250 ml	1.30	1.91	1.61	1.33	1.75	1.54
Lambda cyhalothrin (5 EC)	300 ml	1.14	1.90	1.52	1.26	1.74	1.50
Endosulfan (35 EC)	1000 ml	1.90	2.18	2.04	2.16	2.34	2.26
Triazophos (40 EC)	800 ml	1.22	2.09	1.66	1.44	1.91	1.67
Cypermethrin (25 EC)	600 ml	2.37	2.59	2.48	2.55	2.84	2.70
Chlorpyriphos (20 EC)	1500 ml	2.27	2.15	2.21	2.53	2.20	2.37
Untreated control		3.65	3.18	3.42	3.82	4.22	4.02
SEm±		0.15	0.29	0.17	0.19	0.21	0.12
CD at 5%		0.44	0.85	0.51	0.58	0.63	0.34

Table.5 Effect of insecticidal treatments on yield of soybean

Treatments	Dose/ha	Yield (Kg/ha)		
		2010	2012	Pooled
Indoxacarb (14.5 SC)	500 ml	1523.60	1434.13	1478.87
Rynaxypyr (20 SC)	100 ml	1229.67	1148.33	1189.00
Diafenthiuron (50 WP)	500g	1191.18	1141.67	1166.43
Profenophos (50 EC)	1250 ml	1234.667	1175.87	1205.27
Lambda cyhalothrin(5 EC)	300 ml	1290.74	1260.53	1275.64
Endosulfan (35 EC)	1000 ml	1119.45	1087.3	1103.38
Triazophos (40 EC)	800 ml	1257.85	1213.2	1235.53
Cypermethrin (25 EC)	600 ml	1127.41	1123.33	1125.38
Chlorpyriphos (20 EC)	1500 ml	1100.38	1090.98	1095.69
Untreated control		957.10	939.3	948.20
SEm±		115.63	74.17	84.14
CD at 5%		NS	218.80	248.23

The insecticides tested and found effective in reducing the insect population and increasing yield, some of these insecticides were also previously tested and found superior by these workers.

Hence the findings are in continuation and accordance with these workers.

Effect of insecticides on larval population of tobacco caterpillar

One day before the application of insecticides

The data presented in Table 3 indicated that during 2010 larval population of tobacco caterpillar ranged from 2.18 to 2.94 larvae/mrl, whereas, it ranged from 2.98 to 3.97 larvae/mrl during 2012.

The pre-treatment population of tobacco caterpillar was uniformly distributed in all the plots, and ranged between 2.58 to 3.27 larvae/meter row length (mrl), and difference was statistically non-significant (Table 3).

Two days after the application of insecticides

The data presented in Table 4 indicated that during 2010 larval population of tobacco caterpillar ranged from 0.92 to 2.37 larvae/mrl as compared to 3.65 larvae/mrl in control whereas it ranged from 1.14 to 2.59 larvae/mrl during 2012.

After 2 days of insecticidal treatment, all the treatments were significantly superior over the control. Indoxacarb and lambda cyhalothrin were the most effective treatments followed by profenophos, rynaxypyr, triazophos, diafenthuron, endosulfan, chlorpyrifos and cypermethrin during both years and in pooled mean population (Table 4).

Seven days after the application of insecticides

The data presented in Table 4 indicated that during 2010 larval population of tobacco caterpillar ranged from 1.03 to 2.55 larva/mrl as compared to 3.82 larva/mrl in control whereas it ranged from 1.41 to 2.84 larva/mrl during 2012.

A reduction in the pest population was observed after 7 days of the spray in the various treatments. The minimum number of tobacco caterpillar was recorded in indoxacarb (1.22 larvae/meter), which was effective and significantly superior over all the other treatments except lambda cyhalothrin and profenophos.

The least effective insecticide on the tobacco caterpillar was found to be cypermethrin with 2.70 larvae/meter. The maximum number of tobacco caterpillar was recorded under the untreated control (4.02 larvae/ meter). However, all insecticides were significantly superior over control (Table 4).

Effect of various treatments on yield of soybean

The data presented in Table 5 indicated that during 2010 soybean yield ranged from 1100.38 to 1523.60 kg/ha as compared to 957.10 kg/ha in control, whereas, it ranged 1087.3 to 1434.13 kg/ha during 2012. The effect of different treatments on yield is presented in Table 5. The maximum yield was recorded in indoxacarb (1478.87 kg/ha), which was found to be significantly superior over other treatments and control. Although it was found that most of the insecticidal treatments were superior over control but lambda cyhalothrin (1275.64 kg/ha) and triazophos (1235.53 kg/ha), were *at par* with the indoxacarb. The minimum yield of 948.20 kg/ha was recorded in control (948.2 kg/ha).

Yadav *et al.*, (2001) found chlorpyrifos 50 EC + cypermethrin 5 EC gave maximum yield followed by quinalphos 20 AF and lambda cyhalothrin 5 EC. Singh *et al.*, (1998) also found fanvalerate and quinalphos to be more effective for getting higher produce. Higher grain yield of soybean recorded as a result of effective chemical control of insect-pests with endosulfan (Venkateshan and Kundu, 1994). Increase in yield by the application of insecticides over control has also been reported by various workers. Therefore the results in present study are in support and confirmation with these workers.

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