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Evaluation of Novel Insecticides against *Spodoptera litura* in Soybean (*Glycine max* L. Merill) Crop

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ABSTRACT

A field experiment was carried out in the experimental research farm, NU: SASRD, Medziphema, Nagaland, during the time period July to October 2016, to assess the efficacy of some novel insecticides against Spodoptera litura on soybean. Seven chemicals viz. Imidacloprid 40 FS @ 1.25ml/kg seed, Thiamethoxam 30 FS @ 10ml/kg seed, Chlorantraniliprol 18.5 SC @ 100ml/ha, Indoxcarb 15.8 EC @ 333ml/ha, Quinalphos 25EC @ 1500ml/ha, Thiacloprid 21.7 SC @ 650ml/ha and Triazophos 40EC @ 800ml/ha were used for the field experiment. The highest mean per cent reduction after first spray in the population of tobacco caterpillar, Spdoptera litura Fabricius of 84.89 per cent was observed in the plot treated with Chlorantraniliprole 18.5 SC followed by 81.28 per cent reduction in population in the plot treated with Quinalphos 25EC having no significant difference between them. The lowest per cent reduction of 23.59 per cent was recorded in Thiamethoxam 30 FS. After second spray, the highest mean per cent reduction in the population of tobacco caterpillar, Spdoptera litura Fabricius was observed in the plot treated with Quinalphos 25EC with a mean per cent population reduction of 98.87 per cent followed by 87.36 per cent reduction in population in the plot treated with Thiacloprid 21.7 SC. The lowest per cent reduction of 20.15 per cent was recorded in Thiamethoxam 30 FS.

Key words: *Soybeans, Spdoptera litura, Novel Insecticides, Efficacy.*

INTRODUCTION

Soybean (*Glycine max* L. Merril) is a leguminous and self-pollinated crop belonging to family Leguminoceae, sub-family Papilionoideae, native to Eastern Asia or China. It is the major oilseed crop in the world accounting for 50 percent of the total area as well as production and provides approximately 60 percent of vegetable protein and 30 percent of oil in the World[6]. Soybean protein is rich in the valuable amino acid lycine (5%) in which most of the cereals are deficient. It contains less starch, thus, it is good for diabetic patient. Its oil is used as cooking medium and also for making *vanaspathi ghee*. Being the richest, cheapest and easiest source of best quality proteins and fats and having a vast multiplicity of uses as food and industrial products is called a 'Wonder crop'. Soybean grows well in warm climate. A temperature of 26-30^{o}C appears to be optimum for most varieties.

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The minimum temperature for effective growth is about 10oC, lower than 10oC tends to delay flowering. Well drained and fertile loam soil with pH of 6.5 to 7.5 is most suitable for the cultivation[2]. Globally soybean is the leading oilseed crop cultivated over an area of 118.13 million hectares with a production of 319.55 million metric tons. The United State of America is the largest soybean producer in the world, followed by Brazil, Argentina, China and India. In India, the area and production of soybean is 10.91 million hectares and 8.70 million metric tons respectively[3]. North eastern region of India is one of the promising soybean growing belts, with productivity of 1000 kg/ha, which is much higher than the national productivity level (822 kg/ha). It grows well on slopes, lands, jhum terraces and plains as a pure crop as well as intercrop with maize, paddy, arhar etc[1]. In Nagaland, the total estimated area under soybean cultivation is 24,750 ha with a total production of 31,060 metric ton and productivity of 1,255 kg/ha. Zunheboto is one of the district in Nagaland where the area (7590 ha), production (9750 metric ton) and productivity (1285 kg/ha) is highest[2]. It is one of the most popular food items for majority of the people of Nagaland and is utilized as a fermented product locally known as „Axone" or „Akhuni". In India, soybean is reported to be attacked by 273 species of insects, 2 millipedes, 10 vertebrates and 1 snail, and in India, 20 insect species have been recorded major pest infesting soybean crop[9]. Soybean stem fly, *Melangromyza sojae* is one of the most important pests of soybean that causes tunneling in the main stem, branches and petioles. It generally infest soybeans throughout the season; infestation was initially low, reached its peak from the fifth till the eight week after planting and declined towards the end of the season[4]. Aphid, jassid and white fly are also important as vectors for transmission of viral (YMV) diseases[5]. Chemical control strategies remain the main tool in the suppression of soybean insect pests. It is known fact that some insect pests showed certain levels of behavioral resistance to different class of insecticides. However, it is impossible to fully avoid the use of synthetic insecticides, but its use should be judicious and need based. So keeping this in view, the above statements the present study entitled "Evaluation of Novel Insecticides against *Spodoptera litura* in Soybean (*Glycine max* L. Merill) crop." were taken under the following objective to test the effectiveness of some group of molecules against the major insect pests in soybean.

MATERIAL AND METHODS

The present investigation entitled "Evaluation of Novel Insecticides in Soybean (*Glycine max* L. Merill) crop against *Spodoptera litura*." was carried out in the Entomology Research Farm, School of Agricultural sciences and Rural Development, Nagaland University, Medziphema, Nagaland during kharif season 2016. The experimental site is located at Medziphema, Nagaland having an elevation of 310m above mean sea level (MSL) with a geographical location of 23045"43" N latitude and 93053"04" E longitudes. The experimental site lies in humid and sub-tropical region with an average rainfall from 2000-2500 mm annually. The mean temperature ranges from 21^{O} C to 32^{O} C during summer and rarely goes below 8^{O} C. The soil is sandy loam, acidic in nature with it ranging from 4.5- 6.5. Two treatments *i.e.* imidacloproid 48 FS and thiamethoxam 30 FS were used as seed treatments before sowing and the remaining five treatments as foliar spray. The cultivar used was JS-335. The field experiment was laid out in Randomized Block Design (RBD) with 8 treatments (7 insecticides and 1 untreated control) each replicated thrice. The experimental plot was divided into 3 equal blocks. Again each block was divided into 8 equal blocks measuring 5 m X 2.7 m with interspacing of 1 m in between plots. The treatments were randomly distributed within the plots. The total number of plots was 24

plots. The observation of defoliators was recorded as number of larvae recorded at three places and mean was recorded in numbers per meter at weekly interval. To calculate the efficacy of each treatment, the per cent reduction of insect pest's population was calculated using the formula:

$$\text{Per cent reduction} = \frac{\text{Pretreatment count - Post treatment count}}{\text{Pretreatment count}} \times 100$$

RESULTS AND DISCUSION

Percent population reduction of *Spodoptera litura* after first spray:

The initial mean population of tobacco caterpillar, *Spodoptera litura* Fabricius one day before spraying ranged from 1.57 to 2.29 larvae per meter. After three days of spraying, the highest per cent reduction in population of tobacco caterpillar, *Spdoptera litura* Fabricius was observed in the plot treated with Chlorantraniliprole 18.5 SC (87.30%) followed by Thiacloprid 21.7 SC (85.45%) having no significant difference between them, followed by Quinalphos 25 EC (75.22%), Indoxacarb 15.8 EC (64.43%), Triazophos 40 EC (46.74%) and Imidacloprid 48 FS (32.46%). The lowest per cent reduction was recorded in Thiamethoxam 30 FS giving 25.35%. After seven days of spraying, the highest per cent reduction in tobacco caterpillar, *Spodoptera litura* was observed in the plots treated with Quinalphos 25 EC (87.34%) followed by Chlorantraniliprole 18.5 SC (82.48%), Thiacloprid 21.7 SC (72.56%), Indoxacarb 15.8 EC (70.32%), Triazophos 40 EC (50.22%) and Imidacloprid 48 FS (28.36%). The lowest per cent reduction was recorded in Thiamethoxam 30 FS (21.82%).

Percent population reduction of *Spodoptera litura* after Second spray:

The initial mean population of Tobacco caterpillar, *Spodoptera litura* Fabricius on day before spraying ranged from 0.73 to 2.00 larvae per meter. After three days of spraying the highest per cent reduction in tobacco caterpillar, Spodoptera litura Fabricius was observed in the plots treated with Quinalphos 25 EC (98.53%) showing the effectiveness of the treatment followed by Chlorantraniliprole 18.5 SC (87.67%), Thiacloprid 21.7 SC (82.30%), Indoxacarb 15.8 EC (77.30%), Triazophos 40 EC (69.45%) and Imidacloprid 48 FS (30.79 %). The lowest per cent reduction was recorded in Thiamathoxam 30 FS (17.84 %), which were at par with the untreated control (15.47%). After seven days of spraying, the highest per cent reduction in population of tobacco caterpillar, *Spodoptera litura* Fabricius was observed in the plots treated with Quinalphos 25 EC (99.20%) showing the efficacy of the treatment followed by Thiacloprid 21.7 SC (92.45%), Chlorantraniliprole 18.5 SC (84.74%), Triazophos 40 EC (74.62%), Indoxacarb 15.8 EC (72.45%) and Imidacloprid 48 FS, (45.32%). The lowest per cent reduction was recorded in Thiamethoxam 30 FS, (22.45%).

Results obtained from present investigation have shown that among the different treatments, the most effective against tobacco caterpillar, *Spodoptera litura* was recorded by Quinalphos 25 EC showing significantly superiority over the other treatments followed by Thiacloprid 21.7 SC and Chlorantraniliprole 18.5 SC. The results of the present investigation substantially supported by the findings of Yadav *et al.*[10] who also reported that Quinalphos was found to be effective in reducing the population of larvae of *Spodoptera litura*. Patil *et al.*[7] assessed the management of tobacco caterpillar infesting soybean was effective with Chlorantraniliprole which in close conformity with the findings. In similar findings, Shabana[8] also reported that the most effective against tobacco caterpillar, *Spodopter litura* was recorded by Quinalphos 25 EC.

Table 1: Efficacy of different insecticidal treatments against Tobacco caterpillar, *Spodoptera litura* Fabricius after first spray

Treatments	***First spray***			
	Pre-treatment count	***Percent (%) reduction***		
		3 DAS	***7 DAS***	***Mean***
Imidacloprid 48 FS @ 1.25ml/kg seed	2.00 (1.58)	32.46 (34.51)	28.36 (32.04)	30.41
Thiamethoxam 30 FS @ 10ml/kg seed	1.57 (1.43)	25.35 (30.11)	21.82 (27.77)	23.59
Chlorantraniliprole 18.5 SC @ 100ml/ha	2.29 (1.67)	87.30 (69.72)	82.48 (65.59)	84.89
Indoxacarb 15.8 EC @ 333ml/ha	1.76 (1.50)	64.43 (53.49)	70.32 (57.04)	67.38
Quinalphos 25 EC @ 1500ml/ha	2.00 (1.58)	75.22 (60.52)	87.34 (69.76)	81.28
Thiacloprid 21.7 SC @ 650ml/ha	2.11 (1.61)	85.45 (67.83)	72.56 (58.58)	79.01
Triazophos 40 EC @ 800ml/ha	1.82 (1.52)	46.74 (43.12)	50.22 (45.16)	48.48
Untreated control	3.70 (2.05)	21.40 (27.45)	21.36 (27.42)	21.38
SEm±	NS	2.12	2.14	-
CD (p=0.05)	NS	6.43	6.49	-

Note: Figures in the parenthesis: no of insect/leaf are square root transformed values and % reduction are angular transformed values DAS=Days After Spraying

Table 2: Efficacy of different insecticidal treatments against Tobacco caterpillar, *Spodoptera litura* Fabricius after second spray

Treatments	***Second spray***			
	Pre-treatment count (no. of insect /leaf	***Percent (%) reduction***		
		3 DAS	***7 DAS***	***Mean***
Imidacloprid 48 FS @ 1.25ml/kg seed	2.00 (1.58)	30.79 (33.53)	45.32 (42.300	38.06
Thiamethoxam 30 FS @ 10ml/kg seed	1.82 (1.52)	17.84 (24.92)	22.45 (28.25)	20.15
Chlorantraniliprole 18.5 SC @ 100ml/ha	1.30 (1.34)	87.67 (70.02)	84.74 (67.310	86.21
Indoxacarb 15.8 EC @ 333ml/ha	1.00 (1.17)	77.30 (61.87)	72.45 (58.550	74.88
Quinalphos 25 EC @ 1500ml/ha	0.80 (1.14)	98.53 (83.42)	99.20 (84.980	98.87
Thiacloprid 21.7 SC @ 650ml/ha	0.73 (1.11)	82.30 (65.21)	92.45 (74.410	87.36
Triazophos 40 EC @ 800ml/ha	1.50 (1.41)	69.45 (56.59)	74.62 (59.99)	72.04
Untreated control	5.33 (2.14)	15.74 (23.27)	10.87 (19.24)	13.31
SEm±	0.47	2.46	2.19	-
CD (p=0.05)	1.42	7.45	6.64	-

Note: Figures in the parenthesis: no of insect/leaf are square root transformed values and % reduction are angular transformed values

DAS=Days After Spraying

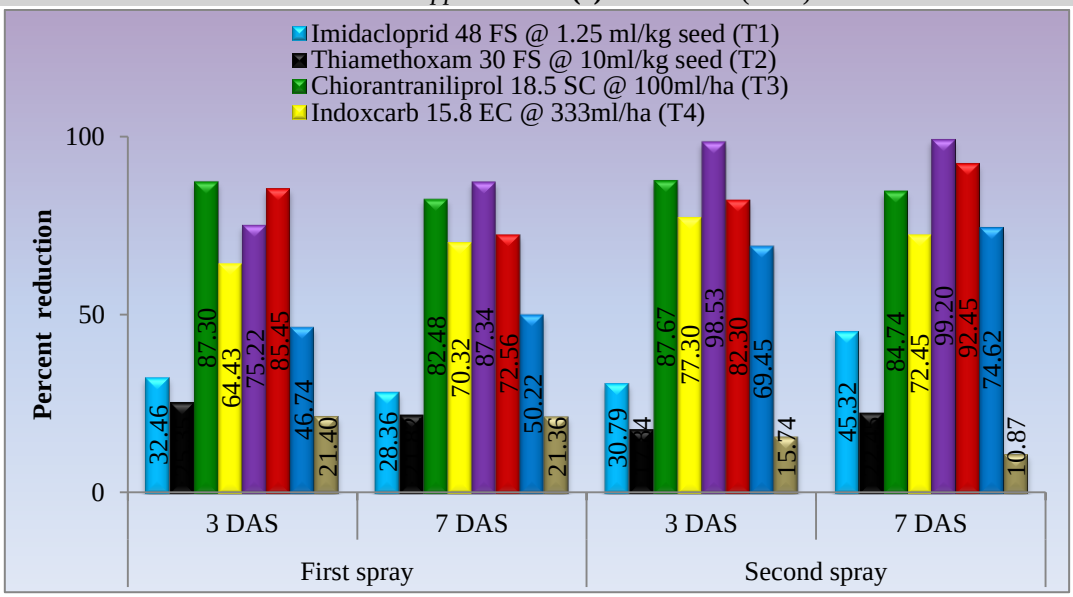

Fig: Effect of different insecticides against tobacco caterpillar, *Spodoptera litura* on soybean during July to October 2016

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