

# FIELD EFFICACY OF NEWER INSECTICIDE MOLECULES AGAINST *SPODOPTERA LITURA* FABRICIUS ON CABBAGE

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## ABSTRACT

An experiment was conducted in *Rabi* season during 2013-14 to find out the efficacy of newer molecules against *Spodoptera litura* Fabricius on cabbage. Based on first and second spray the results clearly indicated that the spinosad 45 SC @ 0.025 % (0.19 larva/plant) proved as the most effective treatment in controlling this pest under field conditions followed by emamectin benzoate 5 SG @ 0.025 % (0.40 larva/plant) against *S. litura*. However, emamectin benzoate 5 SG was at par with indoxacarb 14.5 SC (0.60 larva/plant), profenophos 40% + cypermethrin 4% (0.71 larva/plant), rynaxypyr 20 SC (0.73 larva/plant) and thiodicarb 75 WP (0.80 larva/plant), which were registered as second effective group against *S. litura*. The highest yield of cabbage was recorded in the treatment of spinosad 45 SC (353.26 q/ha) and it was at par with emamectin benzoate 5 SG (334.58 q/ha) and indoxacarb 14.5 SC (327.30 q/ha).

## INTRODUCTION

The word "Cabbage" is derived from the French word "Coboche" meaning head and is supposed to be originated from Cyprus and around the Mediterranean coast. The larvae of *Spodoptera litura* (Fab.) (Lepidoptera: Noctuidae) has been reported to feed on 112 cultivated crops all over the world (Moussa *et al.*, 1960). *S. litura* is a serious polyphagous pest of several cultivated crops and has attained global importance. Widespread development of resistance to chemical insecticides including the widely used pyrethroids has been reported in *S. litura* (Ahmad *et al.*, 2007). In recent years the problem of resistance to chemical has worsened, resulting in 20-30% crop loss due to pests in India (Bhargava *et al.*, 2008) and causing widespread hardship especially amongst poor farmers. Thus, it has worldwide distribution and cosmopolitan in food habit, feeding on the plants of economic importance. Besides this, the excessive use of only chemical insecticides has also been criticized for their deleterious effects like development of insecticide resistance in insects and pest resurgence. *S. litura* has been reported to show higher level of resistance against many of the insecticides used in the country, Hence it was necessitate to use the newer chemical insecticides or biopesticides against *S. litura*.

## MATERIALS AND METHODS

A field experiment was carried out to evaluate the field efficacy of various insecticide es against *S. litura* on cabbage during the year 2013-14 at Agronomy Instructional Farm, Sardarkrushinagar Dantiwada Agricultural University,

Sardarkrushinagar in Randomized Block Design and replicated thrice with eleven treatments. The cabbage crop was raised by adopting standard recommended agronomical practices. The spray of respective chemical and non-chemical insecticides was applied as per the treatment. The first spray was applied on appearance of the larva of *S. litura*. The second spray was given at 10 days after first spray. The care was taken to have uniform coverage of the insecticides over crop canopy. Observations on number of larva were recorded from five randomly selected plants from each net plot before application of insecticides and 1, 3 and 7 days after spraying. The yield response of Golden acre variety to insecticides was recorded from net plot of each treatment separately and converted in to hectare basis. Statistical analysis of all the recorded data were subjected to analysis of variance in randomized block design with the procedure followed by Steel and Torrie (1980).

## RESULTS AND DISCUSSION

### First spray

The results on *S. litura* per plant before spraying are summarized in Table 1. The results showed that the difference in *S. litura* population per plant among different treatments before spray was non-significant, which indicated that *S. litura* population in cabbage crop was uniformly distributed in whole experimental plot.

Looking to the larval population per plant, one day after application, the lowest *S. litura* population was recorded in spinosad 45 SC @ 0.025 per cent (0.80/plant) and it was at

**Table 1: Efficacy of various insecticides against *S. litura* in cabbage**

Treatment	Number of <i>S. litura</i> larvae per plant							Yield (q/ha)
	Before Spray	First spray 1 DAS	3 DAS	7 DAS	Second spray 1 DAS	3 DAS	7 DAS	
Profenophos 40% + Cypermethrin 4%	1.60(2.06)	1.44(1.57)	1.37(1.38)	1.16(0.85)	1.25(1.06)	1.19(0.92)	1.10(0.71)	268.73
Indoxacarb 14.5 SC	1.66(2.26)	1.39(1.43)	1.27(1.11)	1.08(0.67)	1.13(0.78)	1.10(0.71)	1.05(0.60)	327.30
Spinosad 45 SC	1.68(2.32)	1.14(0.80)	1.05(0.60)	0.88(0.27)	1.05(0.60)	0.91(0.33)	0.83(0.19)	353.26
Emamectin benzoate 5 SG	1.64(2.19)	1.27(1.11)	1.19(0.92)	0.98(0.46)	1.16(0.85)	1.05(0.60)	0.95(0.40)	334.58
Rynaxypyr 20 SC	1.62(2.12)	1.49(1.72)	1.35(1.32)	1.19(0.92)	1.32(1.24)	1.22(0.99)	1.11(0.73)	296.58
Thiodicarb 75 WP	1.64(2.19)	1.46(1.63)	1.39(1.43)	1.22(0.99)	1.32(1.24)	1.25(1.06)	1.14(0.80)	281.02
<i>Bacillus thuringiensis</i> 5 × 10 <sup>7</sup> spores/mg	1.68(2.32)	1.60(2.06)	1.49(1.72)	1.40(1.46)	1.37(1.38)	1.33(1.27)	1.24(1.04)	250.82
SNPV @ 250 LE/ha	1.66(2.26)	1.62(2.12)	1.42(1.52)	1.32(1.24)	1.34(1.30)	1.31(1.22)	1.30(1.19)	263.52
<i>Beauveria bassiana</i> 2 × 10 <sup>8</sup> cfu/gm	1.68(2.32)	1.62(2.12)	1.51(1.78)	1.44(1.57)	1.40(1.46)	1.35(1.32)	1.27(1.11)	246.21
Neem oil 1500 ppm	1.66(2.26)	1.55(1.90)	1.46(1.63)	1.29(1.16)	1.35(1.32)	1.29(1.16)	1.19(0.92)	266.13
Untreated control	1.65(2.22)	1.66(2.26)	1.66(2.26)	1.68(2.32)	1.70(2.39)	1.72(2.46)	1.74(2.53)	216.70
S.Em ±	0.09	0.09	0.09	0.08	0.09	0.09	0.06	16.51
C.D. at 5 %	NS	0.25	0.26	0.24	0.25	0.26	0.19	48.72
CV %	9.43	10.04	10.91	11.45	11.31	12.19	9.50	10.13

√x+0.5 transformed values, figures in the parenthesis are retransformed value. DAS: Day(s) after spray. NS: Non-significant.

par with emamectin benzoate 5 SG @ 0.025 per cent (1.11/plant) and indoxacarb 14.5 SC @ 0.007 per cent (1.43/plant) and remained significantly superior over rest of the treatments. Rest of the treatments *viz.*, profenophos 40% + cypermethrin 4% @ 0.017 per cent (1.57/plant), thiodicarb 75 WP @ 0.075 per cent (1.63/plant), rynaxypyr 20 SC @ 0.006 per cent (1.72/plant), neem oil @ 0.5 per cent (1.90/plant), *Bacillus thuringiensis* 5 × 10<sup>7</sup> spores/mg @ 0.2 per cent (2.06/plant), SNPV @ 250 LE/ha (2.12/plant) and *Beauveria bassiana* 2 × 10<sup>8</sup> cfu/gm @ 0.4 per cent (2.12/plant) did not show their efficacy and remained at par with untreated control (2.26/plant).

The results pertaining to *S. litura* population per plant, three days after application, the lowest larval population was recorded in spinosad 45 SC @ 0.025 per cent (0.60/plant) and it was at par with emamectin benzoate 5 SG @ 0.025 per cent (0.92/plant) and indoxacarb 14.5 SC @ 0.007 per cent (1.11/plant). Treatment with emamectin benzoate 5 SG @ 0.025 per cent remained at par with all other chemical insecticides *viz.*, indoxacarb 14.5 SC @ 0.007 per cent, rynaxypyr 20 SC @ 0.006 per cent (1.32/plant), profenophos 40% + cypermethrin 4% @ 0.017 per cent (1.38/plant), thiodicarb 75 WP @ 0.075 per cent (1.43/plant) and biorational pesticide SNPV @ 250 LE/ha (1.52/plant). Looking to the efficacy of biorationals and biopesticides, treatment with SNPV @ 250 LE/ha, neem oil @ 0.5 per cent (1.63/plant), *Bacillus thuringiensis* 5 × 10<sup>7</sup> spores/mg @ 0.2 per cent (1.72/plant) and *Beauveria bassiana* 2 × 10<sup>8</sup> cfu/gm @ 0.4 per cent (1.78/plant) were ineffective against *S. litura* and they were at par with untreated control (2.26/plant).

After 7 days of first spray, spinosad 45 SC @ 0.025 per cent recorded the lowest *S. litura* population (0.27/plant) and it was at par with emamectin benzoate 5 SG @ 0.025 per cent (0.46/plant) and indoxacarb 14.5 SC @ 0.007 per cent (0.67/plant). However, the emamectin benzoate 5 SG @ 0.025 per cent remained at par with indoxacarb 14.5 SC @ 0.007 per cent, profenophos 40% + cypermethrin 4% @ 0.017 per cent (0.85/plant), rynaxypyr 20 SC @ 0.006 per cent (0.92/plant) and thiodicarb 75 WP @ 0.075 per cent (0.99/plant). Among the non chemical pesticides all the treatments *viz.*, neem oil @ 0.5 per cent (1.16/plant), SNPV @ 250 LE/ha (1.24/plant) and *Bacillus thuringiensis* 5 × 10<sup>7</sup> spores/mg @

0.2 per cent (1.46/plant) except *Beauveria bassiana* 2 × 10<sup>8</sup> cfu/gm @ 0.4 per cent (1.57/plant) were significantly superior over untreated control (2.32/plant).

The data (Table 1) recorded on first day after second spray indicated that all the treatments were significantly superior over untreated control (2.39/plant). Spinosad 45 SC @ 0.025 per cent proved as the best treatment, which recorded the minimum *S. litura* population of 0.60 larva per plant. However, indoxacarb 14.5 SC @ 0.007 per cent (0.78/plant), emamectin benzoate 5 SG @ 0.025 per cent (0.85/plant) and profenophos 40% + cypermethrin 4% @ 0.017 per cent (1.06/plant) also remained at par with spinosad 45 SC @ 0.025 per cent. Looking to the data on larval population per plant all the treatments remained at par in efficacy and significantly superior over untreated control except spinosad 45 SC @ 0.025 per cent and indoxacarb 14.5 SC @ 0.007 per cent. The larval population recorded per plant in various treatments was emamectin benzoate 5 SG @ 0.025 per cent (0.85/plant), rynaxypyr 20 SC @ 0.006 per cent and thiodicarb 75 WP @ 0.075 per cent (1.24/plant), SNPV @ 250 LE/ha (1.30/plant), neem oil @ 0.5 per cent (1.32/plant), *Bacillus thuringiensis* 5 × 10<sup>7</sup> spores/mg @ 0.2 per cent (1.38/plant) and *Beauveria bassiana* 2 × 10<sup>8</sup> cfu/gm @ 0.4 per cent (1.46/plant) and all these treatments remained at par with each other and significantly superior over untreated control.

The results pertaining to *S. litura* population per plant, three days after application all the treatments were significantly superior over untreated control (2.46/plant). The lowest *S. litura* population was recorded in spinosad 45 SC @ 0.025 per cent (0.33/plant) and it was at par with emamectin benzoate 5 SG @ 0.025 per cent (0.60/plant) and indoxacarb 14.5 SC @ 0.007 per cent (0.71/plant). The treatment with indoxacarb 14.5 SC remained at par with all other treatments in efficacy and recorded the larval population in ascending order as profenophos 40% + cypermethrin 4% @ 0.017 per cent (0.92/plant), rynaxypyr 20 SC @ 0.006 per cent (0.99/plant), thiodicarb 75 WP @ 0.075 per cent (1.06/plant), neem oil @ 0.5 per cent (1.19/plant), SNPV @ 250 LE/ha (1.22/plant), *Bacillus thuringiensis* 5 × 10<sup>7</sup> spores/mg @ 0.2 per cent (1.27/plant) and *Beauveria bassiana* 2 × 10<sup>8</sup> cfu/gm @ 0.4 per cent (1.32/plant) and performed significantly superior over untreated control.

After 7 days of spray, all the treatments were significantly superior over untreated control (2.53/plant). Among different treatments, spinosad 45 SC @ 0.025 per cent recorded the lowest *S. litura* population, which recorded only 0.19 larva per plant and it was at par with emamectin benzoate 5 SG @ 0.025 per cent (0.40/plant) and found significantly superior over rest of the treatments. However, emamectin benzoate 5 SG @ 0.025 per cent was at par with indoxacarb 14.5 SC @ 0.007 per cent (0.60/plant), profenophos 40% + cypermethrin 4% @ 0.017 per cent (0.71/plant), rynaxypyr 20 SC @ 0.006 per cent (0.73/plant) and thiodicarb 75 WP @ 0.075 per cent (0.80/plant) which registered as second effective group against *S. litura*. Among the treatments, botanical pesticide neem oil @ 0.5 per cent (0.92/plant) and biorationals viz., *Bacillus thuringiensis* 5 × 10<sup>7</sup> spores/mg @ 0.2 per cent (1.04/plant), *Beauveria bassiana* 2 × 10<sup>8</sup> cfu/gm @ 0.4 per cent (1.11/plant) and SNPV @ 250 LE/ha (1.19/plant) were also found effective and they remained at par with chemical treatments viz., rynaxypyr 20 SC @ 0.006 per cent and thiodicarb 75 WP @ 0.075 per cent. Thus, based on first and second spray the results clearly indicated that the spinosad 45 SC @ 0.025 proved as the most effective treatment in controlling this pest under field conditions followed by emamectin benzoate 5 SG against *S. litura*. Similarly non chemical pesticides viz., *Bacillus thuringiensis* 5 × 10<sup>7</sup> spores/mg, SNPV @ 250 LE/ha, *Beauveria bassiana* 2 × 10<sup>8</sup> cfu/gm and neem oil have also proved their superiority as against untreated control. Looking to the safety point of view, neem oil as well as biorational pesticides can be incorporated in IPM programmes against *S. litura*.

Prasad and Wadhvani (2011) reported that increase in yield of cauliflower was better with ROKET [147.8] against 95.2 for highest dose of 750 LE for SLNPV, the cost benefit ratio was 1:12:56, 1:15:24, and 1:22:77 with 750, 500 and 250 LE per hectare, respectively as compared to 1:42:21 with ROKET. The above results clearly indicated that synthetic insecticide, although superior in yield but looking to their drawbacks, overall performance was better with bio-pesticide SLNPV, therefore successfully advocating the inclusion of bio-pesticides in Integrated Pest Management Program [IPM].

Mallareddy (2004) reported that spinosad was the most effective against *S. litura* in cabbage. Gadhiya et al. (2014) also reported that chlorantraniprole 0.006%, spinosad 0.018% and emamectin benzoate 0.002% were higher effective against *S. litura*. Singh et al. (2014) noted that spinosad 45EC, novaluran 10EC, indoxacarb 14.5 SC, *B. bassiana* and SNPV were comparatively more effective against *S. litura* on cauliflower. The above reports are strongly in support of the present findings.

#### Cabbage head yield

The yield of cabbage head in different treatments varied from 216.70 to 353.26q/ha. The highest yield of cabbage was

recorded in the treatment of spinosad 45 SC (353.26 q/ha) and it was at par with emamectin benzoate 5 SG (334.58 q/ha) and indoxacarb 14.5 SC (327.30 q/ha). However, the emamectin benzoate 5 SG was at par with Indoxacarb 14.5 SC and rynaxypyr 20 SC (296.58 q/ha). Rest of the treatments viz., thiodicarb 75 WP (281.02 q/ha), profenophos 40% + cypermethrin 4% (268.73 q/ha), neem oil (266.13 q/ha), SNPV @ 250 LE/ha (263.52 q/ha), *Bacillus thuringiensis* 5 × 10<sup>7</sup> spores/mg (250.82 q/ha) and *Beauveria bassiana* 2 × 10<sup>8</sup> cfu/gm (246.21 q/ha) remained at par with each other in yield. Neem oil performed better and remained significantly superior over untreated control. Whereas, all the biorational pesticides viz., SNPV, *Bacillus thuringiensis* and *Beauveria bassiana* were failed to produce higher yield and remained at par with untreated control (216.70 q/ha).

Dharmendra et al. (2011) obtained the highest yield in spinosad (237.50 q/ha) followed by lufenuron (225.00 q/ha), rynaxypyr (205.00 q/ha) and abamectin (180.00 q/ha). The above reports are strongly in support to the present findings.

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