Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2017; 5(3): 424-427

Received: 01-03-2017
Accepted: 02-04-2017

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# Efficacy of some novel insecticides against white fly (*Bemisia tabaci* Gennadius) in brinjal

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**Abstract**
An investigation was carried out to study the insecticidal management of whitefly (*Bemisia tabaci* Gennadius) in brinjal during Kharif 2015 at Crop Research Centre of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut. Efficacy of different newer insecticides viz., thiamethoxam 25 WG, imidacloprid 17.8 SL, acephate 20 SP, fipronil 5 SC, thiacloprid 240 SC and one conventional insecticide *i.e.* dimethoate 30 EC were evaluated against *Bemisia tabaci* revealed that thiamethoxam 25 WG @ 100g/ha was found most effective insecticide in reducing the population of whitefly followed by imidacloprid 17.8 SL @ 100 ml/ha. Dimethoate 30 EC @ 500 ml/ha was recorded less effective to reduce the white fly population. The highest fruit yield (127.05 q/ha) was obtained from thiamethoxam whereas higher cost benefit ratio (1:12.90) was obtained from treatment imidacloprid. The next highest fruit yield (126.14 q/ha) and cost benefit ratio (1:12.62) were obtained from imidacloprid and thiamethoxam, respectively. The lowest yield (117.43 q/ha) and cost benefit ratio (1:5.50) were obtained from the treatment dimethoate and thiacloprid, respectively.

**Keywords:** Efficacy, novel insecticides, *Bemisia tabaci,* brinjal

## 1. Introduction

Vegetables are rich and comparatively cheaper source of vitamins. Consumption of these items provides taste, palatability, increases appetite and provides fibre for digestion to prevent constipation. They also play key role in neutralizing the acids produced during digestion of foods and provide valuable roughages which help in movement of food in intestine. Some of the vegetables are good sources of carbohydrates, proteins, vitamin A, vitamin B, vitamin C and minerals. As per dietician, daily requirement of vegetables is 75 - 125 g of green leafy vegetables, 85 g of other vegetables and 85 g of roots and tubers with other food. Out of these vegetable brinjal is also play most important role in human life. Brinjal (*Solanum melongena* L.), which is also known as eggplant is an important solanaceous vegetable crop of sub-tropics and tropic regions. The per 100gm of edible portion contains calories (24.0), sodium (3.0 mg), moisture content (92.7%), copper (0.12mg), carbohydrates (4.0%), potassium (2.0mg), protein (1.4g), sulphur (44.0mg), fat (0.3g), chlorine (52.0mg), fibre (1.3g), vitamin A (124.0 I.U.), oxalic acid (18.0mg), folic acid (34.0µg), calcium (18.0mg), thiamine (0.04mg), magnesium (15.0mg), riboflavin (0.11mg), phosphorus (47.0mg), B-carotene (0.74µg), iron (0.38mg), vitamin C (12.0mg), zinc (0.22mg) and amino acids (0.22) [5]. It has also been recommended as an excellent remedy for those suffering from liver complaints [12]. In India, the crop is damaged by more than 30 insect pests right from germination to harvesting [9]. **S**hoot and fruit borer is most destructive and ubiquitous but whitefly, *Bemisia tabaci* Gennadius is an important sucking pest that cause a considerable damage to the brinjal plants [7]**.** White fly is widely distributed in tropical, subtropical and temperate region. Both nymphs and adults suck the sap from the lower leaf surface through their piercing and sucking mouth parts. Due to sucking the sap, yellow spots appear on the leaves followed by crinkling, curling and drying. On the other hand, the insect is a vector of various viruses and their honey dew attracts black sooty mold which inhibits photosynthesis thus reducing the yield. The recent impact has been devastating with yield losses ranging from 20 to 100 percent, depending upon the crop, season, and prevalence of the whitefly. Now a day's many new emerging chemicals including growth regulators and neonicotinoids are available in the market with good efficacy for pest control and safety to nontarget organisms. Evaluation of such chemicals for their bio-efficacy against crop pests is warranted [9]. Hence, it was thought to take up the studies on incidence of white fly in brinjal with ecologically sound management strategies, so that we can suggest to the farmer of this zone with least disturbance of agro-climatic conditions of Western Uttar Pradesh. Keeping in view of the seriousness of the pest and economic importance of this crop, the present investigation was planned to evaluate the effect of different novel insecticides against white fly under field conditions.

## 2. Materials and Methods

The present experiment was laid out in Randomized Block Design (RBD). Brinjal variety "Shyamla" were transplanted on Jun 10, 2015. There were total seven treatments along with untreated (control), each with three replications. The spacing between plant to plant and row to row was kept 60 cm. Normal fertilizers doses and recommended agronomical practices were adopted. The six insecticides viz., imidacloprid 17.8 SL @100 ml/ha, acephate 20 SP @100 ml/ha, thiacloprid 21.7 SC@500 ml/ha, fipronil 5 SC@ 750 ml/ha, thiamethoxam 25 WG@ 500gm/ha and one conventional insecticide dimethoate 30 EC @ 500ml/ha tested against white fly of brinjal. All the insecticides under study were applied as foliar spray using Knapsack sprayer. To determine the efficacy of chemicals, total four sprays of insecticides on brinjal crop were done. First spray was done when the crop was 30 days old. Second, third and fourth subsequent spraying was done at 15 days interval. The population of white fly was recorded on randomly selected and tagged Five plants in each plot from the three (one from top, middle and bottom) leaves at one day before and 3rd, 7th and 14th days after each spray. Fruit yield of all the treatments was recorded at weekly interval right from fruit formation till the harvest of crop. Cumulative yield of each picking was converted in to into q/ha along with increase in yield. Cost benefit ratio, net return per rupees invested, was calculated by using the following formula-

$$\text{Cost: benefit ratio} = \frac{\text{Cost of increased yield (Rs/ha)}}{\text{Cost of treatment (Rs/ha)}}$$

The data recorded during the course of investigation were subjected to statistical analysis by using analysis of variance technique (ANOVA) for Randomized Block Design to compare means of different treatments as suggested by [8].

## 3. Results and Discussion

### 3.1 Efficacy of different treatment against whitefly, *Bemisia tabaci*

The result revealed that all the treatments were significantly effective in reducing the population of whitefly (Table-1). Pre-treatment observations recorded one day before spray, the whitefly population ranged from 6.67 to 8.00 and it was non-significant among all the treatments. However, the data on whitefly/leaf was also recorded on 3rd, 7th and 14th day after spray.

Third day after first spray the minimum population (3.00 whiteflies/leaf) was recorded in the treatment thiamethoxam 25 WG @ 100 g/ha. It was followed by imidacloprid 17.8 SL @ 100 ml/ha and acephate 20 SP @ 100 ml/ha having 3.67 and 4.33 whiteflies/leaf, respectively. The fipronil 5 SC @ 750 ml/ha had 5.00 whiteflies/leaf followed by thiacloprid 240 SC @ 500 ml/ha and dimethoate 30 EC @ 500 ml/ha. Maximum population (8.00 whiteflies/leaf) was recorded in control plot.

Seventh day after first application, the whitefly population decreased slightly in all the treatments with exception of control and ranged from 2.33 to 5.33 whiteflies/leaf. Among all the treatments, thiamethoxam 25 WG @ 100 g/ha was observed best with minimum population (2.33 whiteflies/leaf). The next treatments in order were imidacloprid 17.8 SL @ 100 ml/ha and acephate 20 SP @ 100 ml/ha which recorded 3.00 and 3.67 whiteflies/leaf, respectively and were significantly superior over rest of the treatments in respect of reducing whiteflies population. The maximum whitefly population (8.33 whiteflies/leaf) was recorded in control plot.

The population of whitefly increased slightly in all the treatments on 14th day after first application. The minimum whitefly population (2.33 whiteflies/leaf) was again recorded with thiamethoxam 25 WG @ 100 g/ha and it was significantly superior over rest of the treatments. The other treatments to follow were imidacloprid 17.8 SL @ 100 ml/ha (3.33 whiteflies/leaf), acephate 20 SP @ 100 ml/ha (4.00 whiteflies/leaf), fipronil 5 SC @ 750 ml/ha (4.64 whiteflies/leaf) thiacloprid 240 SC @ 500 ml/ha (5.33 whiteflies/leaf) and dimethoate 30 EC @ 500 ml/ha (5.67 whiteflies/leaf). The highest whitefly population (7.67 whiteflies/leaf) was recorded in control plot.

All Almost same trend of whitefly population was recorded on 3rd, 7th and 14th day after the second and third spray (Table 1). The order of effectiveness of these treatments was thiamethoxam > imidacloprid > acephate > fipronil > thiacloprid > dimethoate.

The data revealed that 3rd day after fourth application, no whitefly population was recorded in thiamethoxam 25 WG @ 100 g/ha treated plots and it was found best among all the treatments (Table-1). The other treatments in order were imidacloprid 17.8 SL @ 100 ml/ha and acephate 20 SP 100 ml/ha which recorded 0.33 and 1.00 whitefly/leaf, respectively. The maximum population (6.33 whiteflies/leaf) was recorded in control plot.

Seventh day of fourth application, the treatment thiamethoxam 25 WG @ 100 g/ha again proved to be most effective treatment with minimum population of 0.33 whitefly/leaf and it was followed by imidacloprid 17.8 SL @ 100 ml/ha, acephate 20 SP @ 100 ml/ha and fipronil 5 SC @ 750 ml/ha where whitefly population ranged from 0.67 to 1.33 whiteflies/leaf. The maximum population 5.00 whiteflies/leaf was recorded in control plot.

Observations recorded on 14th day after fourth application revealed that the lowest population (0.33 whiteflies/leaf) was recorded with thiamethoxam 25 WG @ 100 g/ha and it was significantly superior over rest of treatments. The treatment acephate 20 SP @ 100 ml/ha had 1.67 whiteflies/leaf followed by fipronil 5 SC @ 750 ml/ha (1.67 whiteflies/leaf), thiacloprid 240 SC @ 500 ml/ha (2.00 whiteflies/leaf) and dimethoate 30 EC @ 500 ml/ha (5.00 whiteflies/leaf). The maximum whitefly population (2.33 whiteflies/leaf) was recorded in control plot. The order of effectiveness of these treatments was thiamethoxam > imidacloprid > acephate > fipronil > thiacloprid > dimethoate.

It is evident from the above findings that all the treatments were effective in reducing whitefly population at different intervals after each spray in comparison to untreated control. The most effective treatment was thiamethoxam 25 WG @ 100 g/ha followed by imidacloprid 17.8 SL 100 ml/ha for the control of whitefly in present study. The effectiveness of thiamethoxam and imidacloprid for the control of *B. tabaci* in recent time has also been reported by [10, 4, 15, 2]. Acephate and fipronil were found effective in present studies, which are in agreement with the results obtained by [6, 3, 13, 14]. The efficacy of thiacloprid against whitefly recorded in conformity with many other earlier reports like [1, 11]. The results pertaining the effect of dimethoate in present studies are in accordance with the reports of [2].

### 3.2 Yield and Economics of treatments

The maximum yield 136.23 q/ha was obtained with application of thiamethoxam 500 g/ha followed by imidacloprid 100 ml/ha, acephate 100 ml/ha, fipronil 750 ml/ha and thiacloprid 500 ml/ha with the yield of 129.14, 123.27, 122.11 and 119.95 q/ha, respectively (Table-2). Among the different treatments lowest yield (117.43 q/ha) was found in case of dimethoate 500 ml/ha. Cost benefit ratio of the treatments showed that imidacloprid 17.8 SL ranked first indicating the maximum return Rs. 33.40 per rupee invested followed by thiamethoxam 500 g/ha, acephate 100 ml/ha, dimethoate 500 ml/ha and fipronil 750 ml/ha with 1:21.23, 1: 20.25, 1: 9.55 and 1: 9.19 cost benefit ratio, respectively. The lowest cost benefit ratio (1: 5.50) was obtained in thiacloprid 500 ml/ha. [15] also reported that the application of imidacloprid was the most effective against whitefly and getting maximum fruit yield and highest cost–benefit ratio.

**Table 1:** Efficacy of different treatments on the reduction white fly population.

| Treatments | Dose/ha | No. of white flies/leaf | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Frist spray | | | | Second spray | | | Third spray | | | Forth spray | | |
| | | 1 DBS | 3 DAS | 7 DAS | 14 DAS | 3 DAS | 7 DAS | 14 DAS | 3 DAS | 7 DAS | 14 DAS | 3 DAS | 7 DAS | 14 DAS |
| Imidacloprid | 100 ml/ha | *7.67 **(2.94) | 3.67 (2.15) | 3.00 (1.99) | 3.33 (2.08) | 2.33 (1.84) | 2.67 (1.91) | 2.67 (1.91) | 1.33 (1.52) | 1.67 (1.63) | 1.67 (1.63) | 0.33 (1.15) | 0.67 (1.28) | 0.67 (1.28) |
| Acephate | 100 ml/ha | 7.33 (2.88) | 4.33 (2.30) | 3.67 (2.15) | 4.00 (2.23) | 2.67 (1.91) | 3.00 (1.99) | 3.33 (2.08) | 1.67 (1.63) | 1.33 (1.52) | 2.00 (1.72) | 1.00 (1.41) | 1.33 (1.52) | 1.67 (1.63) |
| Thiacloprid | 500 ml/ha | 7.67 (2.94) | 5.67 (2.58) | 5.00 (2.44) | 5.33 (2.49) | 4.00 (2.23) | 4.33 (2.30) | 4.33 (2.30) | 2.33 (1.82) | 2.67 (1.91) | 3.00 (1.99) | 1.33 (1.52) | 1.67 (1.63) | 2.00 (1.72) |
| Fipronil | 750 ml/ha | 6.67 (2.76) | 5.00 (2.44) | 4.33 (2.30) | 4.67 (2.37) | 3.33 (2.08) | 3.67 (2.15) | 4.00 (2.23) | 2.00 (1.73) | 2.33 (1.82) | 2.33 (1.82) | 1.33 (1.52) | 1.33 (1.52) | 1.67 (1.63) |
| Thiamethoxam | 500 gm/ha | 8.00 (3.00) | 3.00 (1.99) | 2.33 (1.82) | 2.33 (1.82) | 1.67 (1.63) | 1.33 (1.52) | 1.67 (1.63) | 1.00 (1.41) | 1.00 (1.41) | 1.33 (1.52) | 00 (1.00) | 0.33 (1.15) | 0.33 (1.15) |
| Dimethoate (Check) | 500 ml/ha | 7.00 (2.82) | 6.00 (2.64) | 5.33 (2.51) | 5.67 (2.58) | 4.33 (2.30) | 4.67 (2.38) | 5.00 (2.44) | 3.33 (2.08) | 4.00 (2.23) | 4.33 (2.30) | 1.67 (1.63) | 2.00 (1.73) | 2.33 (1.82) |
| Control | - | 7.67 (2.94) | 8.00 (3.00) | 8.33 (3.05) | 7.67 (2.94) | 8.00 (3.00) | 8.67 (3.10) | 7.67 (2.94) | 7.33 (2.88) | 7.00 (2.82) | 6.67 (2.76) | 6.33 (2.70) | 5.00 (2.44) | 4.67 (2.38) |
| SEm (±) | | 0.04 | 0.04 | 0.04 | 0.05 | 0.03 | 0.06 | 0.05 | 0.05 | 0.05 | 0.05 | 0.04 | 0.05 | 0.05 |
| CD at 5% | | NS | 0.13 | 0.10 | 0.16 | 0.10 | 0.19 | 0.17 | 0.16 | 0.16 | 0.16 | 0.14 | 0.15 | 0.16 |

DBS= Days before spray, DAS= Days after spray, Average of three replications, **Figure in parenthesis are square root transformed values

**Table 2:** Economics of different treatment against whitefly

| Name of treatment | Yield (q/ha) | Yield saved over control (q/ha) | Value of saved yield (Rs./ha) | Total cost of treatment application (Rs./ha) | Net income (Rs./ha) | Cost : benefit ratio |
|---|---|---|---|---|---|---|
| Imidacloprid | 129.14 | 18.99 | 28485 | 828 | 27657 | 1: 33.40 |
| Acephate | 123.27 | 13.12 | 19680 | 926 | 18754 | 1: 20.25 |
| Thiacloprid | 119.95 | 09.80 | 14700 | 2260 | 12440 | 1: 5.50 |
| Fipronil | 122.11 | 11.96 | 17940 | 1760 | 16180 | 1: 9.19 |
| Thiamethoxam | 136.23 | 26.08 | 39120 | 1760 | 37360 | 1: 21.23 |
| Dimethoate (Check) | 117.43 | 07.28 | 10920 | 1035 | 9885 | 1: 9.55 |
| Control | 110.15 | | | | | |

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