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ENTOMOLOGY

Efficacy of Newer Insecticides Against Sucking Insect Pests of Greengram [*Vigna radiata* (L.) Wilczek]

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Abstract

A field experiment was conducted to find out the effective dose of some newer insecticides for the management of sucking insect pests of green gram. The treatments of experiment were Diafenthiuron 50 WP @ 187.5g a.i./ha, Diafenthiuron 50 WP @ 250g a.i./ha, Diafenthiuron 50 WP @ 312g a.i./ha, Spiromesifen 240 SC @ 90g a.i./ha, Spiromesifen 240 SC @ 120g a.i./ha, Spiromesifen 240 SC @ 150g a.i./ha, Sseed treatment with Thiamethoxam 35 FS+ Thiamethoxam 25 WG @ 3g/kg seed+25g a.i./ha, Thiamethoxam 25 WG (Std. Check) @ 25g a.i./ha and Triazophos 40 EC (Std. Check) @ 500g a.i./ha. The results of experiment revealed that Diafenthiuron 50 WP @ 312g a.i./ha was most promising treatment in reducing population of whitefly (*Bemisia tabaci*), jassid (*Empoasca kerri*) and flower thrips (*Caliothrips indicus*) after both sprays followed by Spiromesifen 240 SC @ 150g a.i./ha as compared to standard checks Thiamethoxam 25 WG @ 25g a.i./ha and Triazophos 40 EC @ 500g a.i./ha.

Highlights

- Diafenthiuron 50 WP @ 312g a.i./ha was most effective treatment in reducing population of whitefly (*B. tabaci*), jassid (*E. kerri*) and flower thrips (*C. indicus*).
- Spiromesifen 240 SC @ 150g a.i./ha is also found effective as compared to standard checks Thiamethoxam 25 WG @ 25g a.i./ha and Triazophos 40 EC @ 500g a.i./ha.

Keywords: Efficacy, Green gram, Sucking insect pests, Insecticides

Pulse is the common name for the members of Fabaceae (Leguminosae), a large plant family also called pea or legume family. Over a dozen of pulses are grown in India. Among these dry beans which include green gram and black gram are the most important pulse crops of the world, after chickpea and pigeon pea. Mung bean is grown in summer and *Kharif* season in northern India. In southern India, it is also grown in winter season. It requires hot climate and has the capacity to tolerate moisture stress. Mung bean is grown principally for its high quality seeds that are used in human diet, can be prepared by cooking, fermenting, milling or sprouting. They are utilized in making soups, curries bread, sweets, noodles, salads boiled dhalbean cake, confectionary, to fortify wheat flour in making vermicelli and many other culinary products like papad halwah and Vari *etc.* (Singh *et al*. 1988) There are various constraints for low production in green gram. Though having high production potential, their productivity is generally low as they are cultivated on poor lands with no or little inputs and are susceptible to several biotic and abiotic stresses, Out of these insect pests play a major role in low production. The most serious insect pests attacking on green gram includes whitefly (*Bemisia tabaci*), bean thrips (*Megalurothrips distalis*), gram pod borrer (*Helicoverpa armigera*) and legume pod borrer (*Maruca vitrata*) (Kooner *et al*. 2006). Bairwa and Singh (2016) and Singh *et al*. (2016) reported that whitefly (*Bemisia tabaci*), jassid (*Empoasca kerri*) and flower thrips (*Caliothrips indicus*) are the major sucking insect pests of eastern Uttar Pradesh. Whitefly, (*B. tabaci*) is vector of Mungbean Yellow Mosaic Virus (MYMV) and even low population densities *B. tabaci* is capable for wide range of transmission of MYMV (Sastry and Singh, 1973; Khattak *et al*. 2004). Although there are various risk associated with Insecticide application but, still is has been considered as one of the most effective and quickest method of reducing insect pest population in the field. More often it forms the only solution to manage the out breaks of insect pests. Keeping this view present study was conducted to find out the efficacy of certain newer insecticides against sucking insects pests of green gram.

Materials and Methods

The present study was conducted during *Kharif* season of 2015 at the Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi to evaluate the efficacy of different doses of newer insecticides against sucking insect pests; whitefly (*B. tabaci*), jassid (*E. kerri*) and flower thrips (*C. indicus*) of green gram. The experiment was carried out in Randomized Block Design (RBD) consisting 10 treatments including control and these treatments were replicated thrice. Mungbean variety HUM-12 which is commonly cultivated in this area was grown in plots having 10 rows, plot size 4×3 meter in each plot. The plant spacing between rows and plants were maintained 30 cm and 10 cm, respectively. The crop was raised under normal agronomic practices, except plant protection measures. The spray mixture of each treatment was prepared by mixing required quantity of the insecticide in water to make it equivalent to 600 l/ha. The observations on whitefly and jassid population were recorded using rectangular split cage, while thrips population was recorded by visual count from randomly selected ten flowers from each plot at 1 day before, 3, 7 and 10 days after spraying (DAS). The spray mixtures were freshly prepared for each treatment and amount of formulation was calculated using following formula:

$$\text{Amount of formulation} = \frac{\text{Concentration required (\%)} \times \text{Volume required (Litre)}}{\text{Concentration to toxicant in insecticidal formulation}}$$

Results and Discussion

Efficacy of different newer insecticides against whitefly

Observation recorded before spraying of chemicals showed that the population of whitefly was almost homogenously distributed throughout the experimental field and varied between 10.4 whitefly/cage to 12.3 whitefly/cage (Table 1). After first spray data revealed that Diafenthiruon 50 WP @ 312g ai/ha was most effective in reducing the whitefly population. It was reduced from 11.1 to 2.09 whitefly /cage followed by Spiromesifen 240 SC @ 150g a.i/ha which was found to reduce whitefly population from 10.40 to 2.94 whitefly / cage in their mean population observed at 3, 7 and 10 days after spraying as compared to standard check of Thiamethoxam 25 WG @ 25g a.i./ha in which reduction observed from 11.83 whitefly/cage to 3.75 whitefly/cage and Triazophos 40 EC @ 500g a.i./ha from 11.23 whitefly/cage to 4.31 whitefly/ cage, respectively

Data of second spray revealed that Diafenthiuorn 50 WP @ 312g a.i./ha was found most effective in reducing mean population of whitefly from 11.27 whitefly/cage to 2.00 whitefly/cage at 3,7, and 10 days after spraying followed by Spiromesifen 240 SC @ 150g a.i./ha from 10.83 whitefly/cage to 2.73 whitefly/cage as compared to standard check of Thiamethoxam 25 WG @ 25g a.i./ha in which reduction was observed from 11.83 whitefly/cage to 3.75 whitefly/cage and Triazophos 40 EC @ 500g a.i./ha from 11.23 whitefly/cage to 4.31 whitefly/ cage, respectively in mean reduction of whitefly population (Table 1 & Fig 1). The present findings are conformity with Sreekanth and Reddy (2011) who reported that Diafenthiuron was most effective in reducing whitefly population. Patel *et al*. (2010) also reported that chemical insecticide of thio-urea class, diafenthiuron was most effective and provide maximum number of reduction in population of whitefly.

Efficacy of different newer insecticides against jassid

The mean population of jassid recorded one day before first spraying in experimental field ranged from 6.87jassid/cage to 7.37 jassid/cage (Table 2).

Table 1. Efficacy of different newer insecticides against whitefly, Bemisia tabaci during Kharif season of 2015

Treatments Detail	Mean whitefly population/ cage									
	1st Spray					2nd Spray				
	Before Spray	3 DAS	7 DAS	10 DAS	Mean	Before Spray	3 DAS	7 DAS	10 DAS	Mean
Diafenthiuron 50 WP @ 187.5g a.i./ha	12.3 (3.57)	7.50 (2.83)^{de}	5.40 (2.43)^{ef}	4.07 (2.14)^{f}	5.55 (2.46)^{de}	11.13 (3.41)	6.93 (2.73)^{ef}	5.17 (2.83)^{f}	3.67 (2.04)^{f}	5.26 (2.38)^{e}
Diafenthiuron 50 WP @ 250g a.i./ha	11.6 (3.48)	6.47 (2.6)^{cd}	4.27 (2.18)^{d}	3.03 (1.88)^{d}	4.59 (2.23)^{cde}	11.17 (3.42)	6.43 (2.63)^{cde}	3.80 (2.07)^{d}	2.50 (1.73)^{d}	4.24 (2.15)^{d}
Diafenthiuron 50 WP @ 312g a.i./ha	11.1 (3.41)	3.67 (2.04)^{a}	1.77 (1.51)^{a}	0.85 (1.16)^{a}	2.09 (1.57)^{a}	11.27 (3.43)	3.60 (2.02)^{a}	1.73 (1.49)^{a}	0.07 (1.08)^{a}	2.00 (1.53)^{a}
Spiromesifen 240 SC @ 90g a.i./ha	11.7 (3.49)	8.27 (2.96)^{e}	5.63 (2.48)^{f}	4.30 (2.19)^{f}	6.07 (2.54)^{e}	11.50 (3.46)	7.77 (2.88)^{f}	6.07 (2.56)^{g}	4.60 (2.26)^{g}	6.14 (2.57)^{f}
Spiromesifen 240 SC @ 120g a.i./ha	11.7 (3.49)	7.33 (2.80)^{de}	4.67 (2.27)^{de}	3.37 (1.97)^{de}	5.12 (2.35)^{de}	11.13 (3.41)	6.77 (2.70)^{de}	4.40 (2.21)^{e}	2.97 (1.86)^{e}	4.71 (2.26)^{d}
Spiromesifen 240 SC @ 150g a.i./ha	10.4 (3.31)	4.90 (2.32)^{b}	2.57 (1.57)^{b}	1.37 (1.37)^{b}	2.94 (1.81)^{ab}	10.83 (3.37)	4.77 (2.29)^{b}	2.30 (1.67)^{b}	1.13 (1.28)^{b}	2.73 (1.75)^{b}
Seed Treatment with thiamethoxam 35 FS+ Thiamethoxam 25 WG @ 3g/kg seed+25g a.i./ha	10.9 (3.38)	5.57 (2.46)^{bc}	3.37 (1.97)^{c}	2.10 (1.61)^{c}	3.68 (2.01)^{bc}	11.13 (3.41)	5.52 (2.46)^{bc}	2.87 (1.83)^{c}	1.60 (1.45)^{c}	3.33 (1.91)^{c}
Thiamethoxam 25 WG (Std. Check) @ 25g a.i./ha	11.1 (3.41)	6.20 (2.59)^{cd}	4.20 (2.17)^{d}	3.03 (1.88)^{d}	4.48 (2.21)^{cd}	11.83 (3.37)	5.87 (2.52)^{cd}	3.03 (1.88)^{c}	1.80 (1.52)^{c}	3.57 (1.97)^{c}
Triazophos 40 EC (Std. Check) @ 500g a.i./ha	11.7 (3.49)	7.03 (2.74)^{de}	5.17 (2.38)^{ef}	3.73 (2.06)^{ef}	5.31 (2.39)^{de}	11.23 (3.43)	6.30 (2.61)^{ef}	3.97 (2.11)^{d}	2.67 (1.78)^{de}	4.31 (2.17)^{d}
Untreated Control	10.8 (3.36)	9.80 (3.21)^{f}	9.10 (3.10)^{g}	8.73 (3.04)^{g}	9.21 (3.12)^{f}	10.70 (3.35)	9.97 (3.24)^{g}	9.57 (3.17)^{h}	8.90 (3.07)^{h}	9.48 (3.16)^{g}
CD at 5 %	NS	0.25	0.18	0.14	0.19	NS	4.94	0.09	0.11	0.30
S Em.±	NS	0.08	0.06	0.05	0.06	NS	1.65	0.03	0.04	0.08

Figure in parentheses are $\sqrt{x+0.5}$ *transformed value, DAS = Days after spray*

Values followed by the same letters are not significantly different at 5% level by DMRT

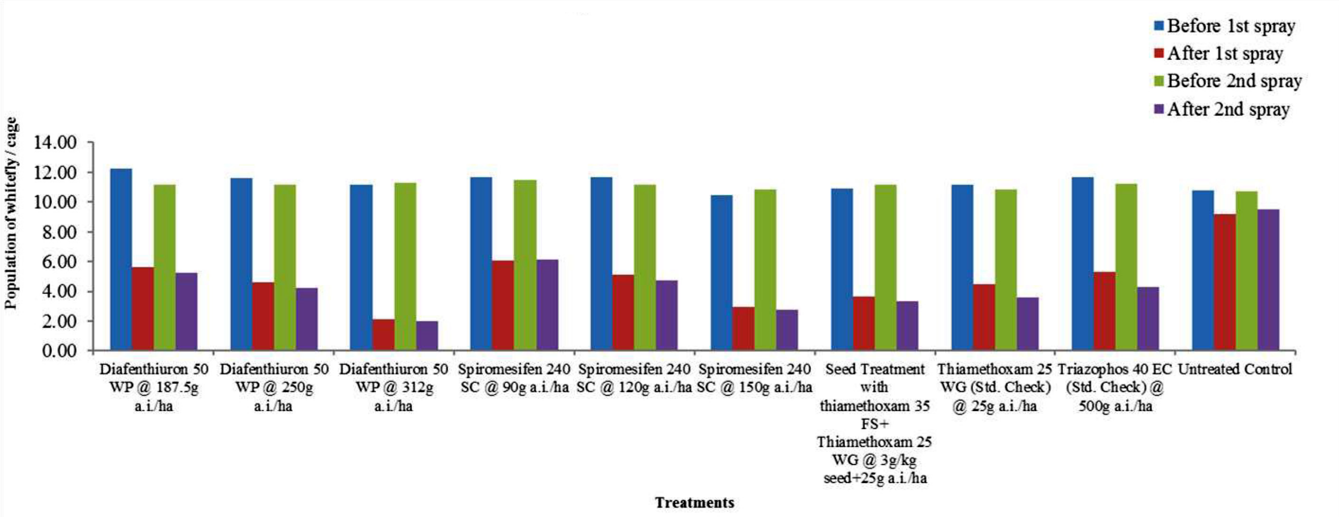

Fig. 1: Mean population of whitefly before and after 1st and 2nd spray

Table 2: Efficacy of different newer insecticides against Jassid, *Empoasca kerri* during *Kharif* season of 2015

Treatments Detail	Mean jassid population/ cage									
	1st Spray					2nd Spray				
	Before Spray	3 DAS	7 DAS	10 DAS	Mean	Before Spray	3 DAS	7 DAS	10 DAS	Mean
Diafenthiuron 50 WP @ 187.5g a.i./ha	7.30 (2.79)	5.57 (2.64)^{f}	4.10 (2.14)^{f}	3.00 (1.87)^{f}	4.22 (2.16)^{f}	5.23 (2.39)	3.60 (2.02)^{de}	2.37 (1.69)^{fg}	1.67 (1.47)^{f}	2.54 (1.73)^{fg}
Diafenthiuron 50 WP @ 250g a.i./ha	7.13 (2.76)	5.03 (2.35)^{ef}	3.50 (2.00)^{e}	2.30 (1.67)^{de}	3.16 (2.01)^{e}	4.73 (2.29)	3.00 (1.87)^{bcd}	1.80 (1.52)^{de}	1.13 (1.28)^{d}	1.98 (1.56)^{cde}
Diafenthiuron 50 WP @ 312g a.i./ha	6.97 (2.73)	3.03 (1.88)^{a}	1.33 (1.35)^{a}	0.47 (0.98)^{a}	1.61 (1.41)^{a}	4.83 (2.31)	1.80 (1.52)^{a}	0.67 (1.08)^{a}	0.20 (0.84)^{a}	0.80 (1.14)^{a}
Spiromesifen 240 SC @ 90g a.i./ha	7.37 (2.80)	5.60 (2.47)^{f}	4.23 (2.18)^{f}	3.23 (1.93)^{f}	4.36 (2.19)^{f}	5.03 (2.35)	3.83 (2.08)^{g}	2.63 (1.77)^{g}	1.83 (1.53)^{f}	2.77 (1.79)^{g}
Spiromesifen 240 SC @ 120g a.i./ha	7.07 (2.75)	5.17 (2.38)^{ef}	3.50 (2.00)^{e}	2.40 (1.70)^{e}	3.69 (2.03)^{e}	5.37 (2.42)	3.37 (1.97)^{ef}	2.13 (1.62)^{ef}	1.40 (1.38)^{e}	2.30 (1.66)^{ef}
Spiromesifen 240 SC @ 150g a.i./ha	6.87 (2.71)	3.60 (2.02)^{b}	1.93 (1.56)^{b}	0.83 (1.15)^{b}	2.12 (1.58)^{b}	4.70 (2.28)	2.43 (1.71)^{b}	1.03 (1.24)^{b}	0.43 (0.97)^{b}	1.30 (1.31)^{b}
Seed Treatment with thiamethoxam 35 FS+ Thiamethoxam 25 WG @ 3g/kg seed+25g a.i./ha	6.97 (2.73)	3.47 (2.11)^{bc}	2.63 (1.77)^{c}	1.52 (1.42)^{c}	2.71 (1.77)^{c}	4.77 (2.29)	2.77 (1.81)^{c}	1.37 (1.37)^{c}	0.70 (1.10)^{c}	1.61 (1.42)^{bc}
Thiamethoxam 25 WG (Std. Check) @ 25g a.i./ha	7.03 (2.74)	4.40 (2.21)^{cd}	3.03 (1.88)^{d}	2.00 (1.58)^{d}	3.14 (1.89)^{d}	5.00 (2.35)	2.40 (1.84)^{cd}	1.57 (1.44)^{cd}	0.87 (1.17)^{c}	1.78 (1.48)^{cd}
Triazophos 40 EC (Std. Check) @ 500g a.i./ha	7.10 (2.70)	4.67 (2.23)^{de}	3.30 (1.95)^{de}	2.17 (1.63)^{de}	3.38 (1.95)^{de}	4.80 (2.30)	3.10 (1.96)^{ef}	2.00 (1.58)^{ef}	1.27 (1.33)^{de}	2.12 (1.60)^{def}
Untreated Control	7.23 (2.78)	6.60 (2.66)^{g}	6.13 (2.58)^{g}	5.77 (2.50)^{g}	6.17 (2.58)^{g}	5.40 (2.43)	4.83 (2.3)^{h}	4.07 (2.14)^{h}	3.67 (2.04)^{g}	4.19 (2.16)^{h}
CD at 5 %	NS	0.10	0.11	0.09	0.18	NS	0.16	0.11	0.08	0.12
S Em.±	NS	0.03	0.04	0.03	0.06	NS	0.05	0.04	0.03	0.04

Figure in parentheses are $\sqrt{x+0.5}$ *transformed value, DAS = Days after spray*

Values followed by the same letters are not significantly different at 5% level by DMRT

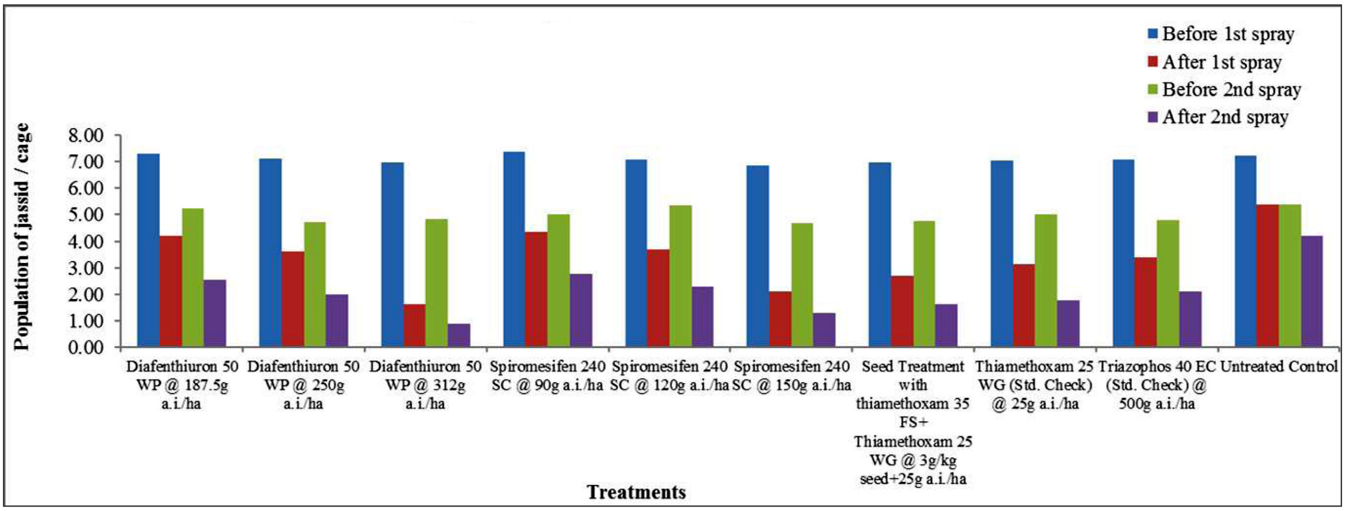

Fig. 2: Mean population of jassid before and after 1st and 2nd spray

Table 3: Efficacy of different newer insecticides against thrips, *Caliothrips indicus* during *Kharif* season of 2015

Treatments Detail	Mean thrips population/ 10 flowers									
	1st Spray					2nd Spray				
	Before Spray	3 DAS	7 DAS	10 DAS	Mean	Before Spray	3 DAS	7 DAS	10 DAS	Mean
Diafenthiuron 50 WP @ 187.5g a.i./ha	5.80	4.30	2.97	2.00	3.09	5.30	4.20	2.37	1.67	2.69
	(2.51)	(2.19)^{e}	(1.86)^{f}	(1.58)^{f}	(1.88)^{f}	(2.41)	(2.08)^{d}	(1.75)^{ef}	(1.47)^{e}	(1.77)^{fg}
Diafenthiuron 50 WP @ 250g a.i./ha	5.77	3.87	2.40	1.47	2.58	5.03	2.70	2.00	1.10	2.12
	(2.50)	(2.09)^{de}	(1.70)^{de}	(1.40)^{de}	(1.73)^{de}	(2.35)	(1.94)^{cd}	(1.58)^{cde}	(1.26)^{d}	(1.60)^{de}
Diafenthiuron 50 WP @ 312g a.i./ha	5.53	2.13	0.93	0.30	1.12	5.00	1.90	0.77	0.20	0.92
	(2.46)	(1.62)^{a}	(1.20)^{a}	(0.89)^{a}	(1.24)^{a}	(2.35)	(1.52)^{a}	(1.13)^{a}	(0.84)^{a}	(1.16)^{a}
Spiromesifen 240 SC @ 90g a.i./ha	5.57	4.20	2.17	2.10	3.09	5.10	4.30	2.93	2.00	3.02
	(2.46)	(2.17)^{e}	(1.86)^{f}	(1.61)^{f}	(1.88)^{f}	(2.37)	(2.15)^{d}	(1.85)^{d}	(1.58)^{f}	(1.86)^{g}
Spiromesifen 240 SC @ 120g a.i./ha	5.90	4.07	2.73	1.77	2.86	5.37	3.50	2.37	1.37	2.48
	(2.53)	(2.14)^{de}	(1.80)^{ef}	(1.51)^{ef}	(1.81)^{ef}	(2.42)	(2.05)^{d}	(1.69)^{def}	(1.37)^{de}	(1.70)^{ef}
Spiromesifen 240 SC @ 150g a.i./ha	5.37	2.67	1.27	0.62	1.52	4.70	2.20	1.20	0.43	1.34
	(2.42)	(1.78)^{b}	(1.33)^{b}	(1.06)^{b}	(1.39)^{b}	(2.28)	(1.70)^{b}	(1.30)^{b}	(0.97)^{b}	(1.32)^{b}
Seed Treatment with thiamethoxam 35 FS+ Thiamethoxam 25 WG @ 3g/kg seed+25g a.i./ha	5.33	3.13	1.70	0.97	1.93	5.03	3.00	1.53	0.67	1.66
	(2.46)	(1.91)^{bc}	(1.48)^{c}	(1.21)^{c}	(1.53)^{c}	(2.35)	(1.81)^{bc}	(1.43)^{bc}	(1.08)^{c}	(1.44)^{bc}
Thiamethoxam 25 WG (Std. Check) @ 25g a.i./ha	5.47	3.47	2.20	1.40	2.36	4.93	2.80	1.87	0.93	1.98
	(2.44)	(1.99)^{cd}	(1.64)^{d}	(1.38)^{d}	(1.67)^{d}	(2.33)	(1.91)^{cd}	(1.54)^{cd}	(1.20)^{d}	(1.55)^{cd}
Triazophos 40 EC (Std. Check) @ 500g a.i./ha	5.87	3.90	2.40	1.60	2.63	5.27	3.20	2.30	1.20	2.36
	(2.52)	(2.10)^{de}	(1.70)^{de}	(1.45)^{de}	(1.75)^{def}	(2.40)	(2.02)^{d}	(1.67)^{de}	(1.30)^{e}	(1.66)^{def}
Untreated Control	6.07	5.73	5.17	4.77	5.22	5.77	5.50	4.57	3.87	4.57
	(2.56)	(2.50)^{f}	(2.38)^{g}	(2.29)^{g}	(2.39)^{g}	(2.50)	(2.40)^{e}	(2.25)^{g}	(2.09)^{g}	(2.25)^{h}
CD at 5 %	NS	0.15	0.14	0.11	0.13	NS	0.17	0.18	0.10	0.11
SEm.±	0.06	0.05	005	0.04	0.04	0.07	0.06	0.05	0.04	0.04

Figure in parentheses are $\sqrt{x + 0.5}$ *transformed value, DAS = Days after spray*

Values followed by the same letters are not significantly different at 5% level by DMRT

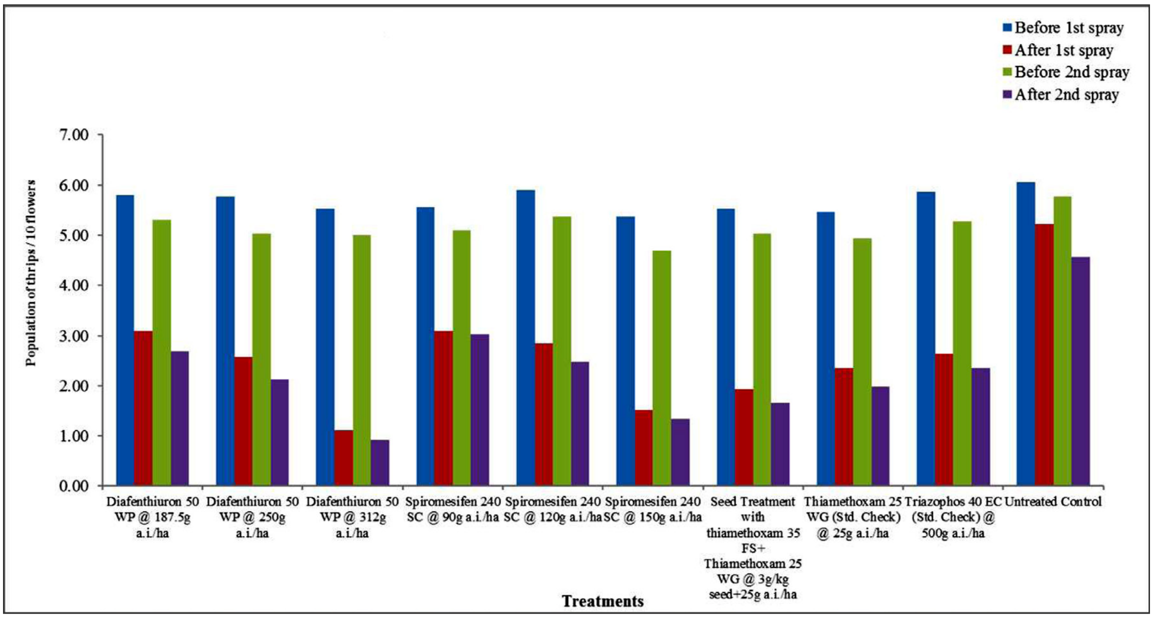

Fig. 3: Mean population of thrips before and after 1st and 2nd spray

The post spray data showed that diafenthiruon 50 WP @ 312g a.i./ha was most superior to reduce the population of jassid from 6.97 jassid/cage to 1.61/cage (mean population) observed at 3, 7 and 10 days after spraying followed by spiromesifen 240 SC @ 150g a.i./ha which was found to reduce jassid population from 6.87 jassid /cage to 2.12 jassid/cage as compared to standard check of thiamethoxam 25 WG @ 25g a.i./ha and triazophos 40 EC @ 500g a.i/ha, which reduction in population of jassid was from 7.03 jassid /cage to 3.14 jassid /cage and 7.10 jassid /cage to 3.38 jassid/cage, respectively.

Similarly second spray observed that among the different treatments, diafenthiuorn @ 312g a.i./ha was found most effective in reducing mean population of jassid from 4.83 jassid/cage to 0.80 jassid /cage at 3,7, and 10 days after spraying followed by spiromesifen 240 SC @150g a.i./ha with a reduction in jassid population from 4.74 jassid/cage to 0.43 jassid/cage than standard check of thiamethoxam 25 WG@25g a.i./ha and triazophos 40 EC @500G a.i./ha which was found to reduce population of jassid from 50.3 jassid/cage and 4.83 jassid/cage to 1.78 jassid/cage and 2.12 jassid/cage, respectively (Table 2 & Fig. 2). Patel and Patel (2014) also found that insecticide of thio-urea class, diafenthiuron is effective against jassid with maximum reduction.

Efficacy of different newer insecticides against flower thrips

Data of first spraying revealed that diafenthiruon 50 WP @ 312g a.i./ha was found to be most superior in reducing the population of flower thrips which was reduced from 5.53 thrips/10 flowers to 1.12/10 flowers at 3,7 and 10 days after spraying followed by spiromesifen 240 SC @150g a.i./ha reduced thrips population from 5.37 thrips/10 flowers to 1.52 thrips/10 flowers as compared to standard check of thiamethoxam 25 WG @25g a.i/ha and triazophos 40 EC @500G a.i./ha which reduced population from 5.47 thrips/10 flowers and 5.87 thrips/10 flowers to 2.36 thrips/10 flowers and 2.63 thrips/10 flowers, respectively.

Post application data of second spraying indicated that diafenthiuorn 50 WP @ 312g a.i./ha was found most promising in reducing mean population of thrips from 5.00 thrips/10 flowers to 0.92 thrips/10 flowers at 3, 7 and 10 days after spraying followed by spiromesifen 240 SC @ 150g a.i./ha from 4.70 thrips/10 flowers to 1.34 thrips/10 flowers as compared to standard check of thiamethoxam 25 WG @25g a.i./ha and triazophos 40 EC @500g a.i./ha, where reduction in population from 2.36 thrips/10 flowers to 1.98 thrips /10 flowers and 5.27 thrips/10 flowers to 4.93 thrips /10 flowers, respectively (Table 2 & Fig. 3). Ranjit and Krishnamoorthy (2016) reported that diafenthiuron is most effective in reducing thrips population at their different doses.

Conclusion

On the basis of experimental findings, It may be concluded that two spray of these chemicals *i.e.*, Diafentheuron 50 WP @ 312g a.i./ha and Spiromesifen 240 SC @ 150g a.i/ha were found to be most effective in reducing population of whitefly, jassid and flower thrips. In other hands other treatments with Combination of seed treatment with Thiamethoxam 35 FS + Thiamethoxam 25 WG @ 3g/kg seed+25g a.i./ha was also found to be effective in controlling the insect pest population.

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