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## Efficacy of different insecticides on garlic thrips

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#### Abstract

A field experiment was conducted at Agronomy Farm, College of Agriculture, J.A.U., Junagadh (Gujarat) during Rabi 2013-14. The Effectiveness of different insecticides against garlic thrips, *Thrips tabaci* (Lindman). Among the eleven insecticides profenophos 0.05 per cent was found to be most effective against thrips and recorded the maximum bulb yield of garlic (4016 kg/ha). The highest incremental cost benefit ratio (1:38.97) was obtained with treatment profenophos 0.05 % and it was followed by Profenophos + Cypermethrin 0.044 % (1:36.40) and Imidacloprid 0.005 % (1:34.21).

**Keywords:** Insecticides, garlic, thrips, efficacy, cost benefit ratio

#### Introduction

Garlic is second most important bulb crop grown throughout the plains of India for spices and condiments. Many factors affecting the production and productivity of garlic, of which infestation of insect pests is the major one. According to Hill (1983) <sup>[1]</sup>, the major insect pests attacking garlic are garlic thrips, Groundnut thrips, Onion fly, Cut worm and Armyworm *etc.* Among the insect pests the thrips, *T. tabaci* family “Thripidae” order “Thysanoptera” is one of the common and the most destructive pest of garlic. The thrips is responsible for curling of leaves, low yield, and poor quality of bulbs. Leaf curling reduces the activity of photosynthesis and thus reduces the crop yield. The pest is polyphagous in habit occurring throughout the year on different cultivated and wild plant species. It is regularly occurring on garlic and onion crops during winter season in Gujarat. Due to infestation of the thrips 15.35 to 46.82 per cent losses in garlic bulb yield was recorded at Junagadh in Gujarat by Changela (1993) <sup>[2]</sup>. Chemical insecticides are the alternative that works as frontline defense sources to combat the problem of thrips in garlic. However, information on yield loss and chemical control of thrips on garlic is very scanty for South Saurashtra Agroclimatic Zone of Gujarat. With this objective, present investigations were planned to study the efficacy of different insecticides on garlic thrips.

#### Materials and Methods

The experiments was conducted for the effectiveness of insecticides on garlic thrips under open field condition at Instructional farm Junagadh, Junagadh Agricultural University, Junagadh. The Junagadh is situated in plot 10 m x 20 m with spacing 15 cm x 10 cm. The recommended package of agronomical practices was followed to raises good crop.

#### Methods of application of insecticides

First spray of respective insecticides (Table 1) was made on 23<sup>rd</sup> January, 2014 when thrips population crossed to ETL (15 thrips/plant As per recommendation of JAU) and second application was given at 20 days interval using manually operated knapsack sprayer with duromist nozzle at a constant pressure of 2.5 kg/cm<sup>2</sup>. Every care was taken to avoid drifting of insecticide to adjutants plot. Solution of each insecticide was used at the rate 600 liters/ ha.

#### Methods of recording observations

The effectiveness of the insecticides was evaluated on the basis of reduction of thrips population per plant as well as bulb yield. For recording observations on thrips population, 10 plants were selected randomly in each plot and number of nymphal stage of the thrips per plant was counted and recorded before 24 hours as well as 4, 8, and 14 days after both spray. Mean data of thrips during each observation was calculated. The bulb yield from each plot was recorded at harvest from each net plot.

$$\text{Per cent reduction in thrips population} = \frac{X_1 - X_2}{X_1} \times 100$$

Where,

**X1**= Thrips population in unprotected plots

**X2** = Thrips population in protected plots

#### Statistical analysis of data

The data on number of thrips per plant were analyzed after transforming them into square root while, the data on yield per plot was converted on hector basis and were analyzed. The data on reduction of thrips population after the insecticidal application

were analyzed periodically and pooled them over periods and sprays to see the consistency of the treatment performance. Percentage of yield increase over control was calculated by using following formula.

$$\text{Per cent yield increase over control} = \frac{X_1 - X_2}{X_1} \times 100$$

Where,

**X1**= Yield in treated plot (kg/ha)

**X2**= Yield in control plot (kg/ha)

**Table 1:** Details of insecticides used for efficacy against thrips infesting garlic

Treat. No.	Name of insecticides	Conc. (%)	ml or g per 10 lit. of water	Treat. No.	Name of insecticides	Conc. (%)	ml or g per 10 lit. of water
T <sub>1</sub>	Cypermethrin 25 EC	0.009	4 ml	T <sub>7</sub>	Diafenthiuron 50 WP	0.07	14 g
T <sub>2</sub>	Fipronil 5 SC	0.01	20 ml	T <sub>8</sub>	Profenophos + Cypermethrin (44 EC)	0.044	10 ml
T <sub>3</sub>	Imidacloprid 17.8 SL	0.005	3 ml	T <sub>9</sub>	Thiacloprid 48 SC	0.024	5 ml
T <sub>4</sub>	Spinosad 45 SC	0.009	2 ml	T <sub>10</sub>	Fonicamid 50 WG	0.02	4 g
T <sub>5</sub>	Lamda Cyhalothrin 5 EC	0.005	10 ml	T <sub>11</sub>	Clothianidin 50 WDG	0.025	5 g
T <sub>6</sub>	Profenophos 50 EC	0.05	10 ml	T <sub>12</sub>	Water spray (Control)	---	---

#### Results and Discussion

Pooled result of two sprays

Pooled result on 4th day

**Table 2:** Effectiveness of different insecticides against thrips population in garlic (Pooled of periods over sprays)

S. No	Treatments	Number of thrips/plant (pooled of two sprays)				Pooled over spray
		Before spray	Days after spraying			
			4	8	14	
1	Cypermethrin 0.009 %	8.38 (73.71)	5.02 (25.45) [73.02]	5.87 (34.67) [64.98]	7.04 (50.83) [46.68]	5.98 (36.98) [61.57]
2	Fipronil 0.01 %	8.34 (72.70)	4.12 (17.23) [81.73]	4.62 (21.57) [78.21]	4.97 (25.30) [73.46]	4.57 (21.37) [77.79]
3	Imidacloprid 0.005 %	8.05 (68.20)	4.28 (18.70) [80.17]	4.88 (24.17) [75.59]	5.13 (27.00) [71.68]	4.77 (23.29) [75.80]
4	Spinosad 0.009 %	7.95 (66.08)	4.49 (20.57) [78.19]	4.72 (22.53) [77.25]	4.82 (23.95) [74.88]	4.68 (22.35) [76.77]
5	Lamda Cyhalothrin 0.005 %	8.28 (72.41)	5.49 (30.47) [67.70]	6.47 (42.05) [57.53]	7.17 (52.32) [45.11]	6.38 (41.61) [56.76]
6	Profenophos 0.05 %	8.02 (66.55)	4.03 (16.48) [82.53]	4.36 (19.37) [80.43]	4.64 (22.33) [76.57]	4.34 (19.39) [79.85]
7	Diafenthiuron 0.07 %	8.50 (75.90)	6.06 (37.42) [60.33]	6.55 (43.10) [56.47]	7.44 (56.80) [40.41]	6.69 (45.77) [52.43]
8	Profenophos + Cypermethrin 0.044 %	8.22 (69.85)	4.32 (19.03) [79.83]	4.75 (22.75) [77.02]	4.87 (24.40) [74.40]	4.65 (22.06) [77.07]
9	Thiacloprid 0.024 %	8.03 (68.33)	4.94 (25.02) [73.47]	5.81 (33.95) [65.71]	5.74 (33.15) [65.22]	5.50 (30.71) [68.08]
10	Fonicamid 0.02 %	8.19 (69.61)	4.55 (21.08) [77.65]	4.87 (23.97) [75.79]	4.95 (25.17) [73.60]	4.79 (23.41) [75.67]
11	Clothianidin 0.025 %	8.03 (68.58)	5.05 (25.97) [72.46]	5.97 (35.80) [63.84]	5.82 (33.98) [64.35]	5.61 (31.92) [66.83]
12	Control	8.64 (78.43)	9.58 (94.33)	9.94 (99.02)	9.71 (95.33)	9.74 (96.23)
	S.Em. +	0.30	0.32	0.21	0.22	0.17
	C.D. at 5%	NS	1.02	0.60	0.65	0.52
	C. V. %	9.08	10.97	9.08	9.25	6.45

**Notes:** (1) DAS= Days after spraying

(2) Figures in the parentheses are retransformed values those outside are square root transformed value

(3) Figures in [ ] are per cent reduction over control

The pooled data presented in Table 2 on percentage reduction of thrips on 4th day after application of different insecticides revealed that profenophos 0.05 per cent proved to be the most effective treatment which gave 82.53 per cent reduction of the thrips, however it was followed by fipronil 0.005 per cent, imidacloprid 0.005 per cent, profenophos 40% + cypermethrin 4% @ 0.044 per cent, spinosad 0.009 per cent and flonicamid 0.02 as they registered 81.73, 80.17, 79.83, 78.19 and 77.65 per cent pest reduction, respectively. Thiacloprid 0.024 per cent, cypermethrin 0.009 per cent, and clothianidin 0.025 per cent was found at second ranked effective which gave 73.47, 73.02 and 72.46 per cent thrips reduction. Lamda cyhalothrin 0.005 per cent and diafenthiuron 0.07 per cent found significantly least effective against garlic thrips which gave 67.70 and 60.33 per cent thrips reduction.

#### Pooled result on 8th day

The data presented in Table 2 on percentage reduction of thrips on 8th day after application of the different insecticides revealed that profenophos 0.05 per cent proved to be the top most effective treatment which gave 80.43 per cent pest reduction, and it was followed by fipronil 0.005 per cent, spinosad 0.009 per cent, profenophos 40% + cypermethrin 4% @ 0.044 per cent, flonicamid 0.02 per cent and imidacloprid 0.005 per cent as they registered 78.21, 77.25, 77.02, 75.79 and 75.59 per cent pest reduction, respectively. Thiacloprid 0.024 per cent, cypermethrin 0.009 per cent, and clothianidin 0.025 per cent was found at second ranked effective which gave 65.71, 64.98 and 63.84 per cent pest reduction. Lamda cyhalothrin 0.005 per cent and diafenthiuron 0.07 per cent found significantly least effective against garlic thrips which gave 57.53 and 56.47 per cent pest reduction.

#### Pooled result on 14th day

The data presented in Table 2 on percentage reduction of thrips recorded on 14th day after application of the different insecticides revealed that profenophos 0.05 per cent proved to be the top most effective treatment which gave 76.57 per cent reduction of the thrips and it was followed by spinosad 0.009 per cent, profenophos 40% + cypermethrin 4% @ 0.044 per cent, flonicamid 0.02 per cent, fipronil 0.005 per cent and imidacloprid 0.005 per cent as they registered 74.88, 74.40, 73.60, 73.46 and 71.68 per cent pest reduction, respectively. Thiacloprid 0.024 per cent and clothianidin 0.025 per cent was found at second ranked effective which gave 65.22 and 64.35 per cent thrips reduction. Cypermethrin 0.009 per cent, lamda cyhalothrin 0.005 per cent and diafenthiuron 0.07 per cent found significantly least effective against garlic thrips which gave 46.68, 45.11 and 40.41 per cent pest reduction on 14th day after their application.

#### Pooled over sprays

Two applications of the different eleven insecticides were made and the thrips reduction on 4th, 8th and 14th day after each application was recorded. All the data on the thrips reduction were pooled over the two spray applications to find out the overall effectiveness of the insecticides. The data presented on pooled over sprays in Table 9 and depicted in Figure 8 revealed that profenophos 0.05 per cent proved to be the most effective treatment with 79.85 per cent reduction of the thrips and it was at par with fipronil 0.005 per cent, profenophos 40% + cypermethrin 4% @ 0.044 per cent, spinosad 0.009 per cent, and imidacloprid 0.005 per cent and

flonicamid 0.02 per cent with 77.79, 77.07, 76.77, 75.80 and 75.67 per cent pest reduction, respectively. Thus it can be concluded that profenophos 0.05 per cent, fipronil 0.005 per cent, profenophos 40% + cypermethrin 4% @ 0.044 per cent, spinosad 0.009 per cent, and imidacloprid 0.005 per cent and flonicamid 0.02 per cent were equally effective and were top most among the eleven insecticides evaluated against thrips, *T. tabaci* infesting garlic at Junagadh. Wide range of insecticides has been evaluated for their efficacy against thrips, *T. tabaci* either on onion or on garlic by various workers at different places. Profenophos 40% + cypermethrin 4% @ 0.044 per cent was reported to be the most effective against *T. tabaci* on onion or on garlic by several research workers (Raghvani *et al.* 2000; Chandrakar and Shrivastava 2001) [7, 1]. Zezlina and Blazic (2003) [11] observed that spinosad exhibited the highest mortality of onion thrips. Vala (2007) [9] evaluated the profenophos 40% + cypermethrin 4% @ 0.044 per cent fipronil 0.005 per cent and profenophos 0.05 per cent found highly effective for the control of the thrips, in onion crop. Verma *et al.* (2012) [10] reported maximum per cent reduction in thrips population by imidacloprid 0.009 per cent followed by fipronil 0.005 per cent. Shaikh (2013) [8] reported that the profenofos 0.05 per cent and spinosad 0.014 per cent treatment was the effective against thrips, in onion crop. Thus finding of earlier research workers are in close agreement with the present finding.

**Table 3:** Yield of garlic bulb in various insecticidal treatments

S. No	Treatments	Yield (kg/ha)	Yield increase over control (%)
1.	Cypermethrin 0.009 %	2940	16.85
2.	Fipronil 0.01 %	3993	58.70
3.	Imidacloprid 0.005 %	3743	48.77
4.	Spinosad 0.009 %	3816	51.67
5.	Lamda Cyhalothrin 0.005 %	2923	16.17
6.	Profenophos 0.05 %	4016	59.62
7.	Diafenthiuron 0.07 %	2843	12.99
8.	Profenophos + Cypermethrin 0.044 %	3905	55.20
9.	Thiacloprid 0.024 %	3160	25.60
10.	Flonicamid 0.02 %	3626	44.11
11.	Clothianidin 0.025 %	3140	24.80
12.	Control	2516	
	S.Em. +	198.63	-
	C.D. at 5%	583	-
	C. V. %	10.16	-

#### Yield

Looking to the yield, crop treated with profenophos 0.05 per cent recorded highest yield of 4016 kg/ha (59.62 per cent increased) and it was statistically at par with the yield received from the crop treated with fipronil 0.01 per cent (58.70 per cent increased), profenophos + cypermethrin 0.044 per cent (55.20 per cent increased), spinosad 0.009 per cent (51.67 per cent increased), imidacloprid 0.005 per cent (48.77 per cent increased) and flonicamid 0.02 % per cent (44.11 per cent increased). The crop treated with cypermethrin 0.009 per cent, lamda cyhalothrin 0.005 per cent and diafenthiuron 0.07 per cent were found least effective for the control of garlic thrips, because the yield received from the crop treated with these insecticides was at par with yield of untreated (control) crop (2516 kg/ha).

Raghvani *et al.* (2000) [7] reported that application of Polytrin-C (a profenophos 40% + cypermethrin 4%) 0.044 per cent found most effective and recorded lowest population of

*Caliothrips indicus* (Bagnall) and higher yield of garlic bulbs. Gajera *et al.* (2009) [3] revealed that spinosad @ 0.0045 per cent combined with endosulfan @ 0.035 per cent recorded the highest mortality, whereas, endosulfan @ 0.007 per cent and spinosad @ 0.009 per cent were the next best treatments. Patel (2011) [6] revealed that deltamethrin emerged as most effective by recording significantly lower thrips population in garlic followed by cypermethrin and diafenthiuron and also

reported that Deltamethrin 0.028 per cent registered significantly higher (7.11 t/ha) bulb yield followed by cypermethrin (6.33 t/ha) and diafenthiuron (5.67t/ha). Singh *et al.* (2013) reported that fipronil 5% SC @ 1 ml/ liter gave best performance in controlling thrips in garlic.

### Economics

**Table 4:** Yield and economics of different insecticidal treatments applied for the control of garlic thrips

S. No	Treatments	Quantity of insecticide (for two spray lit or kg /ha)	Cost of insecticide (/ha)	Cost of treatment (/ha)	Yield (kg/ha)	Net gain (kg/ha)	Gross realization (/ha)	Net realization (/ha)	ICBR
1	Cypermethrin 0.009 %	0.43	236	1036	2940	424	108780	15688	1:15.14
2	Fipronil 0.01 %	2.4	2496	3296	3993	1477	147741	54649	1:16.58
3	Imidacloprid 0.005 %	0.34	527	1327	3743	1227	138491	45399	1:34.21
4	Spinosad 0.009 %	0.24	3504	4304	3816	1300	141192	48100	1:11.18
5	Lamda Cyhalothrin 0.005 %	1.2	600	1400	2923	407	108151	15059	1:10.76
6	Profenophos 0.05 %	1.2	624	1424	4016	1500	148592	55500	1:38.97
7	Diafenthiuron 0.07 %	1.68	4216	5016	2843	327	105191	12099	1:2.41
8	Profenophos + Cypermethrin 0.044 %	1.2	612	1412	3905	1389	144485	51393	1:36.40
9	Thiacloprid 0.025 %	0.63	1380	2180	3160	644	116920	23828	1:10.93
10	Fonicamid 0.02 %	0.48	3744	4544	3626	1110	134162	41070	1:9.03
11	Clothianidin 0.025 %	0.6	8700	9500	3140	624	116180	23088	1:2.43
12	Control	-	-	-	2516	-	93092	-	-

1). 600 liter spray solution used/ application/ ha

2). Labour charges: Rs. 400/ha/spray

3). Market price of garlic: Rs. 37/kg.

The data on economics of two applications of the different eleven insecticides given against thrips of garlic during *rabi* 2013-14 are presented in Table 4. The maximum net realization of 55500 /ha with ICBR 1: 38.97 was obtained from the treatment of profenophos 0.05 per cent followed by fipronil 0.01 per cent (54649 /ha, ICBR 1: 16.58), profenophos + cypermethrin 0.044 per cent (51393 /ha, ICBR 1: 36.40), spinosad 0.009 per cent (48100 /ha ICBR 1: 11.18), imidacloprid 0.005 per cent (45399 /ha, ICBR 1: 34.21), fonicamid 0.02 per cent (41070 /ha ICBR 1: 9.03) and thiacloprid 0.025 per cent (23828 /ha, ICBR 1: 10.93). The results clearly indicated that among the eleven insecticides evaluated against garlic thrips, the two application of profenophos 0.05 per cent followed by fipronil 0.01 per cent and profenophos + cypermethrin 0.044 per cent, spinosad 0.009 per cent, imidacloprid 0.005 per cent and fonicamid 0.02 per cent found top most effective with 80 to 76 per cent pest reduction resulted in higher yield (59 to 44 %) increased and higher net monetary return (55500 /ha to 41070 /ha).

Mau and Gusukuma (1999) [5] worked out economics of different insecticidal treatments and showed that fipronil 0.005 % gave the highest cost benefit ratio. Raghvani *et al.* (2000) [7] also reported that in respect of maximum bulb yield, profenophos 40% + cypermethrin 4% was the best insecticide. Vala (2007) [9] reported that profenophos + cypermethrin 0.044 per cent was found highly effective for the control of the thrips and gave higher bulb yield, followed by fipronil 0.005 per cent and profenophos 0.05 per cent. Verma *et al.* (2012) observed the crop sprayed with imidacloprid resulted in minimum number of thrips and gave highest garlic yield (172.49 q/ha) followed by fipronil. Thus the present findings are more or less in agreement with findings presented by the earlier workers.

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