Int.J.Curr.Microbiol.App.Sci (2018) *7*(7): 2904-2915

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 7 Number 07 (2018)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2018.707.340

Bio-efficacy of Different Ready-Mix Insecticides against Thrips, *Scirtothrips dorsalis* Hood Infesting Bt Cotton

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Keywords

Bio-efficacy, Bt cotton, Ready-mix insecticides, Thrips

Article Info

Accepted:
20 June 2018
Available Online:
10 July 2018

A B S T R A C T

With a view to evaluate bio-efficacy of different ready-mix insecticidesagainst thrips, *Scirtothrips dorsalis* in *Bt* cotton, an experiment was conducted under field condition at Anand Agricultural University, Anand during *Kharif* 2017-18. Among the six ready-mix insecticides evaluated, acephate 50% + imidacloprid 1.8% SP and thiamethoxam 12.6% + lambda-cyhalothrin 9.5% ZC were found more effective on the basis population of thrips, whereas fipronil 5% SC and buprofezin 15% + acephate 35% WP were mediocre in their effectiveness. The maximum seed cotton yield (2691 kg/ha) was recorded in treatment of acephate + imidacloprid followed by thiamethoxam + lambda-cyhalothrin (2645 kg/ha), fipronil (2621 kg/ha) and buprofezin + acephate(2598 kg/ha). The highest (1: 8.57) NICBR obtained with the treatment of thiamethoxam + lambda-cyhalothrin followed by acephate +imidacloprid (1: 7.44), buprofezin + acephate (1: 5.58) and fipronil (1: 4.73).

Introduction

Cotton, the king of fibre reside one of the momentous and important cash crop exercising profound influence on economics and social affairs of the world. As per world cotton scenario, commercial cotton is grown in 77 countries and 123 countries are involved in the cotton related activities. The area under cotton cultivation in the world is about 29.22 million hectares with annual production of 105.71 million bales. India was leading in raw cotton production in the world during 2016-17 and production was upto 35.1 million bales of 480 lb from 10.5 million hectares with a productivity of 568 kg/ha. Gujarat, Maharashtra and Telangana reside the major cotton growing states contributing around 70 per cent of the area and 67 per cent of cotton production in India. Gujarat ranks second in area (24.00lakh ha) and first in production (95.00 lakh bales of 170 kg) in the country (Anon., 2017). Almost 148 insect pests have been reported during the whole season of cotton, out of which 17 have been designated as major insect pests of cotton crop (Abbas, 2004). After introduction of *Bt* cotton, the population of sucking insect pests gradually increased. Among the different sucking insect pests attacking on cotton, owing to climate change thrips, *S. dorsalis* is one of the major concerned in cotton ecosystem. Four species

of thrips are found on cotton in Vietnam, though *S. dorsalis* and *Thripspalmi* Karny are the most important species. Both species are highly polyphagous, occurring on many annual crops and weeds (Capinera, 2001).

Materials and Methods

Field experiment was conducted at Anand Agricultural University, Anand during *kharif* season 2017-18 in Randomized Block Design with eight treatments and three replications with a view to evaluate bio-efficacy of different ready-mix insecticidesagainst *S. dorsalis* infesting *Bt* cotton. Cotton cultivar RCH-II was sown, with a spacing of 120 cm between two rows and 60 cm within the rows in gross and net area of 6.0 x 4.8 m and 4.8 x 2.4 m, respectively. Treatment wise application of insecticides was given at ETL (five thrips per leaf) on the plant by using high volume sprayer. Subsequent three sprays were given at 15 days interval. The observations on cotton thrips were recorded from five randomly selected plants per plot before spraying and 1, 3, 5, 7, 10 and 15 days after each sprays. The number of thrips per five leaves (three upper and two middle) were observed. The data obtained were analyzed by following standard statistical technique (Steel and Torrie, 1980).

Results and Discussion

The population of thrips was homogeneous in all the treatments before spray as treatment difference was non-significant. All the evaluated insecticides were significantly superior to control up to 15 days of spray.

First spray

The lowest (4.84/leaf) population of thrips recorded in plots treated with acephate 50% + imidacloprid 1.8% SP and it was at par with thiamethoxam 12.6% + lambda-cyhalothrin 9.5% ZC (5.07/leaf), fipronil 5% SC (5.16/leaf) and buprofezin 15% + acephate 35% WP (5.31/leaf)at one day after first spray (Table 1). These four insecticides found significantly superior to rest of the treatments. Among the evaluated insecticides, the highest (8.26/leaf) population of *S. dorsalis* aid-memoire in plots treated with profenophos 40% + cypermethrin 4% ECand it was at par with β-cyfluthrin 8.49% + imidacloprid 19.8% OD (7.97/leaf) and deltamethrin 1% + triazophos 35% EC (8.14/leaf). More or less similar bent of efficacy was observed at three days after spray.

Population of thrips was noticed the minimum(2.46/leaf) in plots treated with acephate + imidaclopridand it was at par with thiamethoxam + lambda-cyhalothrin (2.89/leaf), fipronil (3.62/leaf) and buprofezin + acephate (3.70/leaf) after five days of spray. Of the evaluated insecticides, the maximum (7.06/leaf) population of thrips was found in plots treated with profenophos + cypermethrin and it was at par with β-cyfluthrin + imidacloprid (6.52/leaf) and deltamethrin + triazophos (6.63/leaf). Analogous results were observed at seven days after first spray.

Likewise, ten days after spray, acephate + imidacloprid (2.26/leaf), thiamethoxam + lambda-cyhalothrin (2.39/leaf), fipronil (2.60/leaf) and buprofezin + acephate (2.70/leaf) were the most effective and at par with each other. The treatments β-cyfluthrin + imidacloprid (5.12/leaf), deltamethrin + triazophos (5.26/leaf) and profenophos + cypermethrin (5.65/leaf) were least effective.

Again fifteen days after first spray, acephate + imidacloprid recorded the lowest (4.65/leaf) thrips population and it was at par with thiamethoxam + lambda-cyhalothrin (4.88/leaf), fipronil (4.98/leaf) and buprofezin + acephate (5.21/leaf). The plots treated withprofenophos + cypermethrin recorded the

maximum (8.20/leaf) thripspopulation and it was at par with β-cyfluthrin + imidacloprid (7.85/leaf) and deltamethrin + triazophos (7.97/leaf).

Pooled over periods results (Table 1) of first spray revealed thatacephate + imidacloprid (3.22/leaf), thiamethoxam + lambda-cyhalothrin (3.50/leaf), fipronil (3.70/leaf) and buprofezin + acephate (3.87/leaf) were found significantly superior than all the evaluated insecticides.The plots treated with profenophos + cypermethrin recorded the highest (6.95/leaf) thrips population and it was at par with β-cyfluthrin + imidacloprid (6.52/leaf) and deltamethrin + triazophos (6.63/leaf).

Second spray

One day after second spray (Table 2), acephate + imidacloprid (3.66/leaf), thiamethoxam + lambda-cyhalothrin (3.83/leaf), fipronil (4.04/leaf) and buprofezin + acephate (4.17/leaf) were effective in reducing the thrips population. The plots treated with profenophos + cypermethrin recorded the maximum (7.28/leaf)thrips population and it was at par with β-cyfluthrin + imidacloprid (6.58/leaf) and deltamethrin + triazophos (7.01/leaf).

Thrips, *S. dorsalis* population was noticed the lowest (3.03/leaf) in plots treated with acephate + imidacloprid and it was at par with thiamethoxam + lambda-cyhalothrin (3.34/leaf), fipronil (3.54/leaf) and buprofezin + acephate (3.78/leaf) after three days of spray. Among the evaluated insecticides, the highest (6.63/leaf) population of *S. dorsalis* recorded in plots treated with profenophos + cypermethrin and it was at par with β-cyfluthrin + imidacloprid (6.16/leaf) and deltamethrin + triazophos (6.36/leaf). More or less similar results were observed at five days after second spray.

Minimum (1.72/leaf) population of thrips registered in plots treated with acephate + imidacloprid and it was at par with thiamethoxam + lambda-cyhalothrin (1.96/leaf), fipronil (2.06/leaf) and buprofezin + acephate (2.29/leaf) at seven days after second spray. These four treatments found significantly superior to rest of the insecticides. Amidst the evaluated insecticides, the maximum (5.36/leaf) population of *S. dorsalis* recorded in plots treated with profenophos + cypermethrinand it was at par with β-cyfluthrin + imidacloprid (4.84/leaf) and deltamethrin + triazophos (5.02/leaf). More or less akin trend of efficacy was observed at 10 and 15 days after second spray.

Looking to the data on pooled over periods of second spray (Table 2), the lowest (2.46/leaf) population of thrips recorded in plots treated with acephate + imidaclopridand it was at par with thiamethoxam + lambda-cyhalothrin (2.70/leaf) and fipronil (2.89/leaf). The next effective treatment was buprofezin + acephate (3.11/leaf).

Third spray

The minimum (2.12/leaf) incidence of thrips observed in plots treated with acephate + imidaclopridand it was at par with thiamethoxam + lambda-cyhalothrin (2.39/leaf), fipronil (2.56/leaf) and buprofezin + acephate (2.67/leaf) at one day after third spray (Table 3).

These four doses found significantly superior to rest of the insecticides. Of the evaluated insecticides, the maximum (6.21/leaf) population of *S. dorsalis* recorded in plots treated with profenophos + cypermethrin and it was at par with β-cyfluthrin + imidacloprid (5.45/leaf) and deltamethrin + triazophos (5.80/leaf).

Similarly, three days after spray, acephate + imidacloprid registered the lowest (1.72/leaf) thrips incidence and it was at par with thiamethoxam + lambda-cyhalothrin (2.19/leaf), fipronil (2.36/leaf) and buprofezin + acephate (2.63/leaf). The plots treated with profenophos + cypermethrin recorded the highest (4.98/leaf) thrips population and it was at par with β-cyfluthrin + imidacloprid (4.25/leaf) and deltamethrin + triazophos (4.38/leaf). Resembling trend of efficacy was observed at five days after spray.

Based on the number of thrips were recorded at seven days after third spray, acephate + imidacloprid (0.38/leaf) found the most effective followed by thiamethoxam + lambda-cyhalothrin (0.67/leaf), fipronil (0.87/leaf) and buprofezin + acephate (0.92/leaf). The treatments β-cyfluthrin + imidacloprid (2.63/leaf), deltamethrin + triazophos (2.70/leaf) and profenophos + cypermethrin (3.07/leaf) were least effective. Similar results were observed at ten days after third spray.

The cent percent reduction was observed in plots treated with acephate + imidacloprid and thiamethoxam + lambda-cyhalothrin and it was at par with fipronil (0.19/leaf) after 15 days of spray. The next effective treatment was buprofezin + acephate (0.46/leaf).Among the evaluated insecticides, the maximum (1.72/leaf) population of thrips recorded in plots treated with profenophos + cypermethrin and it was at par with β-cyfluthrin + imidacloprid (1.16/leaf) and deltamethrin + triazophos (1.46/leaf).

Pooled over periods results (Table 3) of third spray asserted that acephate + imidacloprid (0.75/leaf) was found significantly superior than all the evaluated insecticides except thiamethoxam + lambda-cyhalothrin (0.99/leaf) and fipronil (1.19/leaf), followed by buprofezin + acephate (1.38/leaf).The plots treated withprofenophos + cypermethrin recorded the highest (3.50/leaf) thrips population and it was at par with β-cyfluthrin + imidacloprid (2.96/leaf) and deltamethrin + triazophos (3.15/leaf).

Pooled over sprays

Pooled over sprays results (Table 3 and Fig. 1) showed thatacephate + imidacloprid (2.03/leaf) was found significantly superior than all the evaluated insecticides except thiamethoxam + lambda-cyhalothrin (2.29/leaf).

The next effective treatment was fipronil (2.49/leaf) and buprofezin + acephate (2.67/leaf). The plots treated with profenophos + cypermethrin recorded the maximum (5.36/leaf) *S. dorsalis* population and it was at par with β-cyfluthrin + imidacloprid (4.84/leaf) and deltamethrin + triazophos (5.02/leaf).

Thus, from the above results, it can be deduced that the acephate + imidacloprid and thiamethoxam + lambda-cyhalothrin were found more effective on the basis of population of thrips, whereas fipronil and buprofezin + acephate were mediocre in their effectiveness.

Effect on seed cotton yield

The data on seed cotton yield were recorded in various insecticidal treatments as well as in control during study and are presented in Table 4 and Figure 2.

Maximum (2691kg/ha) seed cotton yield was recorded in plots treated with acephate + imidacloprid and it was at par with thiamethoxam + lambda-cyhalothrin (2645kg/ha), fipronil (2621kg/ha) and buprofezin + acephate (2598kg/ha). These four insecticidal treatments found relatively more effective.

Table.1 Bio-efficacy of ready-mix insecticides against *S. dorsalis* infesting *Bt* cotton after first spray

Sr. No.	Treatments	Conc. in %	No. of thrips/ leaf days after spray							Pooled over periods
			Before spray	1	3	5	7	10	15	
T_1	Thiamethoxam 12.6% + Lambda -cyhalothrin 9.5% - 22.1 ZC	0.0088	3.07 (8.92)	2.36a (5.07)	1.98a (3.42)	1.84a (2.89)	1.80a (2.74)	1.70a (2.39)	2.32a (4.88)	2.00a (3.50)
T_2	Profenophos 40% + Cypermethrin 4% - 44 EC	0.088	3.23 (9.93)	2.96b (8.26)	2.67b (6.63)	2.75b (7.06)	2.54b (5.95)	2.48b (5.65)	2.95b (8.20)	2.73b (6.95)
T_3	Deltamethrin 1% + Triazophos 35% - 36 EC	0.045	2.89 (7.85)	2.94b (8.14)	2.63b (6.42)	2.67b (6.63)	2.46b (5.55)	2.40b (5.26)	2.91b (7.97)	2.67b (6.63)
T_4	β-cyfluthrin 8.49% + Imidacloprid 19.8 % - 28.30 OD	0.010	3.08 (8.99)	2.91b (7.97)	2.62b (6.36)	2.65b (6.52)	2.44b (5.45)	2.37b (5.12)	2.89b (7.85)	2.65b (6.52)
T_5	Acephate 50% + Imidacloprid 1.8% - 51.8 SP	0.100	3.00 (8.50)	2.31a (4.84)	1.90a (3.11)	1.72a (2.46)	1.71a (2.42)	1.66a (2.26)	2.27a (4.65)	1.93a (3.22)
T_6	Buprofezin 15% + Acephate 35% - 50 WP	0.125	2.87 (7.74)	2.41a (5.31)	2.05a (3.70)	2.05a (3.70)	1.86a (2.96)	1.79a (2.70)	2.39a (5.21)	2.09a (3.87)
T_7	Fipronil 5% SC	0.015	2.75 (7.06)	2.38a (5.16)	2.00a (3.50)	2.03a (3.62)	1.80a (2.74)	1.76a (2.60)	2.34a (4.98)	2.05a (3.70)
T_8	Control (water spray)	-	3.20 (9.74)	3.43c (11.26)	3.50c (11.75)	3.43c (11.26)	3.38c (10.92)	3.38c (10.92)	3.45c (11.40)	3.43c (11.26)
S. Em. ±	T	-	0.17	0.15	0.16	0.18	0.15	0.15	0.15	0.07
	P	-	-	-	-	-	-	-	-	0.05
	T x P	-	-	-	-	-	-	-	-	0.15
	C.V. %	-	9.87	9.37	11.27	13.17	11.64	12.00	9.94	10.78

Notes: Figures in parentheses are retransformed values of $\sqrt{x + 0.5}$

Treatment mean with letter(s) in common are non-significant by DNMRT at 5% level of significance

Table.2 Bio-efficacy of ready-mix insecticides against *S. dorsalis* infesting *Bt* cotton after second spray

Sr. No.	Treatments	Conc. in %	No. of thrips/ leaf days after spray						Pooled over periods
			1	3	5	7	10	15	
T_1	Thiamethoxam 12.6% + Lambda -cyhalothrin 9.5% - 22.1 ZC	0.0088	2.08a (3.83)	1.96a (3.34)	1.74a (2.53)	1.57a (1.96)	1.48a (1.69)	1.94a (3.26)	1.79a (2.70)
T_2	Profenophos 40% + Cypermethrin 4% - 44 EC	0.088	2.79b (7.28)	2.67b (6.63)	2.38b (5.16)	2.42b (5.36)	2.24c (4.52)	2.68b (6.68)	2.53c (5.90)
T_3	Deltamethrin 1% + Triazophos 35% - 36 EC	0.045	2.74b (7.01)	2.62b (6.36)	2.36b (5.07)	2.35b (5.02)	2.21c (4.38)	2.60b (6.26)	2.48c (5.65)
T_4	β-cyfluthrin 8.49% + Imidacloprid 19.8 % - 28.30 OD	0.010	2.66b (6.58)	2.58b (6.16)	2.32b (4.88)	2.31b (4.84)	2.14bc (4.08)	2.56b (6.05)	2.43c (5.40)
T_5	Acephate 50% + Imidacloprid 1.8% - 51.8 SP	0.100	2.04a (3.66)	1.88a (3.03)	1.70a (2.39)	1.49a (1.72)	1.38a (1.40)	1.85a (2.92)	1.72a (2.46)
T_6	Buprofezin 15% + Acephate 35% - 50 WP	0.125	2.16a (4.17)	2.07a (3.78)	1.82a (2.81)	1.67a (2.29)	1.61a (2.09)	2.06a (3.74)	1.90b (3.11)
T_7	Fipronil 5% SC	0.015	2.13a (4.04)	2.01a (3.54)	1.78a (2.67)	1.60a (2.06)	1.55a (1.90)	2.00a (3.50)	1.84ab (2.89)
T_8	Control (water spray)	-	3.47c (11.54)	3.44c (11.33)	3.37c (10.86)	3.49c (11.68)	3.45d (11.40)	3.42c (11.20)	3.44d (11.33)
S. Em. ±	T	-	0.15	0.16	0.15	0.17	0.16	0.15	0.04
	P	-	-	-	-	-	-	-	0.06
	T x P	-	-	-	-	-	-	-	0.16
	C.V. %	-	10.23	11.68	12.12	14.30	13.45	10.64	12.46

Notes: Figures in parentheses are retransformed values of $\sqrt{x + 0.5}$

Treatment mean with letter(s) in common are non-significant by DNMRT at 5% level of significance

Table.3 Bio-efficacy of ready-mix insecticides against *S. dorsalis* infesting *Bt* cotton after third spray and pooled over sprays

Sr. No.	Treatments	Conc. in %	No. of thrips/ leaf days after spray						Pooled over periods	Pooled over sprays
			1	3	5	7	10	15		
T_1	Thiamethoxam 12.6% + Lambda -cyhalothrin 9.5% - 22.1 ZC	0.0088	1.70a (2.39)	1.64a (2.19)	1.30a (1.19)	1.08a (0.67)	0.87a (0.26)	0.71a (0.00)	1.22a (0.99)	1.67a (2.29)
T_2	Profenophos 40% + Cypermethrin 4% - 44 EC	0.088	2.59b (6.21)	2.34b (4.98)	2.11b (3.95)	1.89b (3.07)	1.56b (1.93)	1.49c (1.72)	2.00c (3.50)	2.42c (5.36)
T_3	Deltamethrin 1% + Triazophos 35% - 36 EC	0.045	2.51b (5.80)	2.21b (4.38)	2.06b (3.74)	1.79b (2.70)	1.50b (1.75)	1.40c (1.46)	1.91c (3.15)	2.35c (5.02)
T_4	β-cyfluthrin 8.49% + Imidacloprid 19.8 % - 28.30 OD	0.010	2.44b (5.45)	2.18b (4.25)	2.02b (3.58)	1.77b (2.63)	1.46b (1.63)	1.29c (1.16)	1.86c (2.96)	2.31c (4.84)
T_5	Acephate 50% + Imidacloprid 1.8% - 51.8 SP	0.100	1.62a (2.12)	1.49a (1.72)	1.24a (1.04)	0.94a (0.38)	0.71a (0.00)	0.71a (0.00)	1.12a (0.75)	1.59a (2.03)
T_6	Buprofezin 15% + Acephate 35% - 50 WP	0.125	1.78a (2.67)	1.77a (2.63)	1.41a (1.49)	1.19a (0.92)	1.07a (0.64)	0.98b (0.46)	1.37b (1.38)	1.78b (2.67)
T_7	Fipronil 5% SC	0.015	1.75a (2.56)	1.69a (2.36)	1.35a (1.32)	1.17a (0.87)	1.01a (0.52)	0.83ab (0.19)	1.30ab (1.19)	1.73b (2.49)
T_8	Control (water spray)	-	3.37c (10.86)	3.29c (10.32)	3.30c (10.39)	3.23c (9.93)	3.24c (10.00)	3.34d (10.66)	3.29d (10.32)	3.39d (10.99)
S. Em. ±	T	-	0.15	0.11	0.12	0.10	0.11	0.07	0.06	0.04
	P	-	-	-	-	-	-	-	0.04	0.03
	T x P	-	-	-	-	-	-	-	0.11	0.08
	C.V. %	-	12.08	9.57	9.57	10.19	13.50	9.12	11.25	11.39

Notes: Figures in parentheses are retransformed values of $\sqrt{x + 0.5}$

Treatment mean with letter(s) in common are non-significant by DNMRT at 5% level of significance

Table.4 Effect of various ready-mix insecticides on seed cotton yield and economics

Sr. No.	Treatments	Yield (kg/ha)	Increase in yield over control (%)	NICBR
T_1	Thiamethoxam 12.6% + Lambda - cyhalothrin 9.5% - 22.1 ZC	2645a	63.57	1:8.57
T_2	Profenophos 40% + Cypermethrin 4% - 44 EC	2040b	26.16	1:2.32
T_3	Deltamethrin 1% + Triazophos 35% - 36 EC	2077b	28.45	1:3.41
T_4	β-cyfluthrin 8.49% + Imidacloprid 19.8 % - 28.30 OD	2106b	30.24	1:3.87
T_5	Acephate 50% + Imidacloprid 1.8% - 51.8 SP	2691a	66.41	1:7.44
T_6	Buprofezin 15% + Acephate 35% - 50 WP	2598a	60.67	1:5.82
T_7	Fipronil 5% SC	2621a	62.09	1:4.73
T_8	Control (water spray)	1617c	-	-
S. Em. $\pm$		113.64	-	-
C. V. (%)		9.59	-	-

Note: Treatment mean with letter(s) in common are non-significant by DNMRT at 5% level of significance

Fig.1 Bio-efficacy of different ready-mix insecticides against *S. dorsalis* infesting *Bt* cotton (Pooled over sprays)

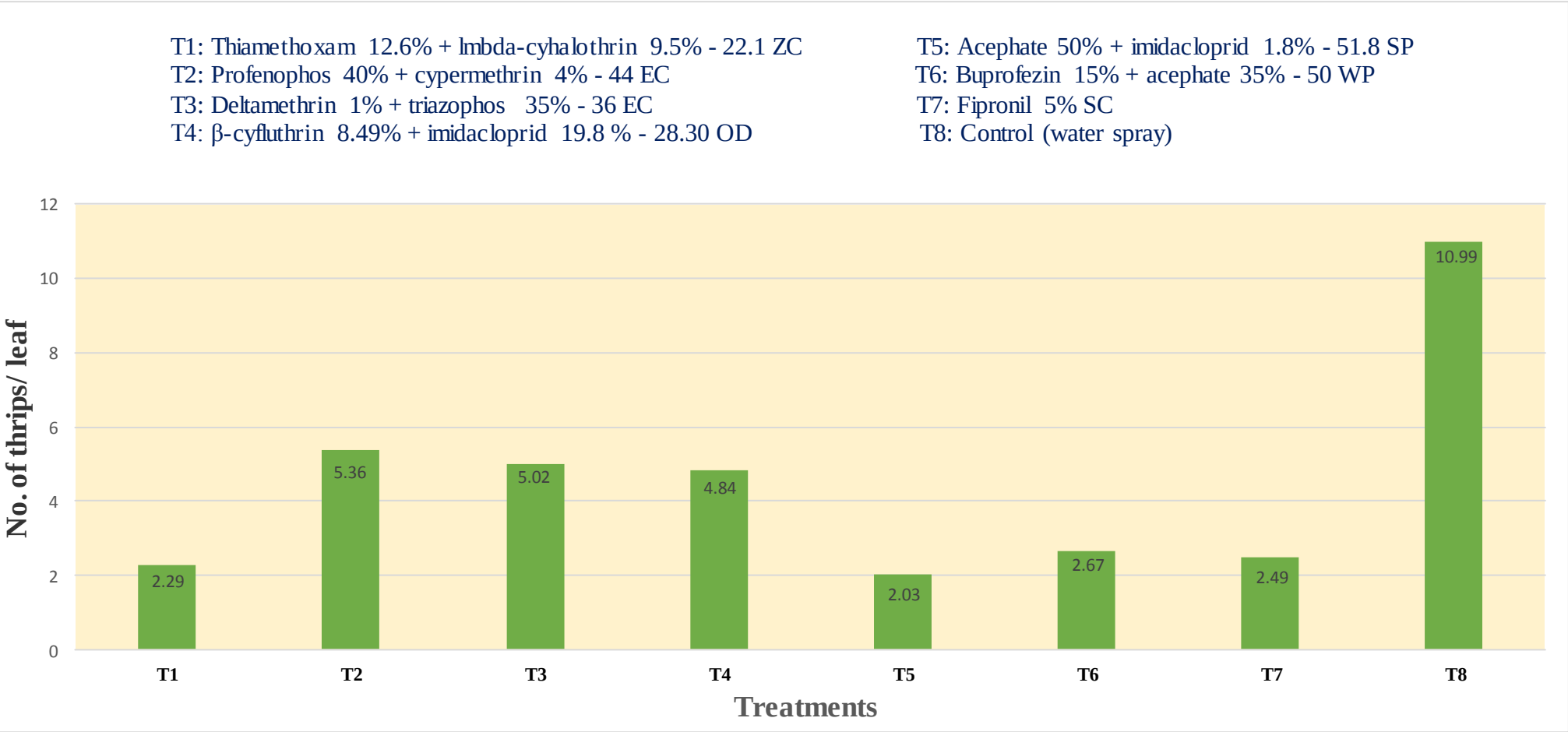
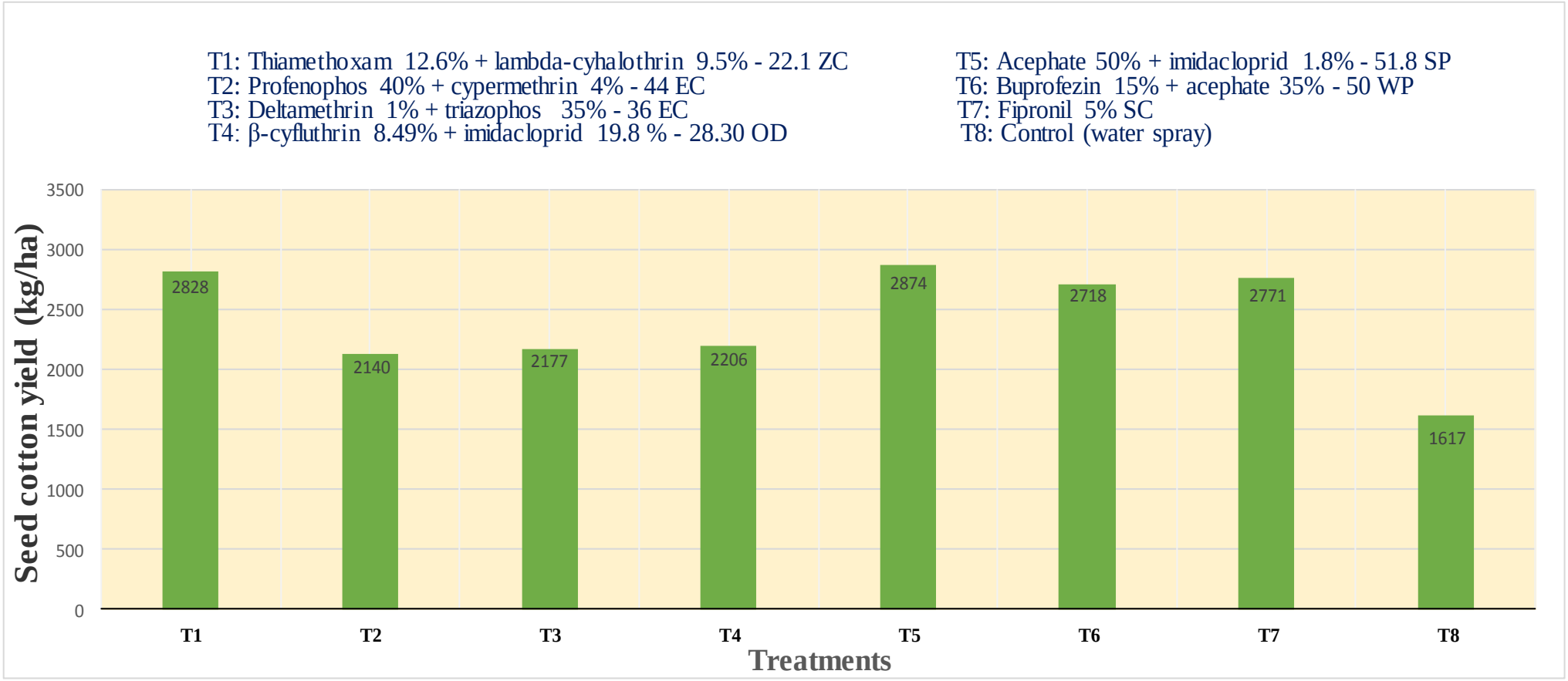


Fig.2 Effect of different insecticidal treatments on seed cotton yield



The lowest (2040 kg/ha) yield of seed cotton was recorded in plots treated with profenophos + cypermethrinand it was at par with β-cyfluthrin + imidacloprid (2106 kg/ha) and deltamethrin + triazophos (2077 kg/ha).

Increase in yield over control in cotton crop was worked out for different insecticidal treatments and indicated that maximum (66.41%) increase in yield over control was found in plots treated with acephate + imidacloprid followed by thiamethoxam + lambda-cyhalothrin (63.57%), fipronil (62.09%) and buprofezin + acephate (60.67%). Among the tested insecticides, minimum (26.16%) increase in yield found in plots treated with profenophos + cypermethrin followed by deltamethrin + triazophos (28.45%) and β-cyfluthrin + imidacloprid (30.24%).

Economics

Looking to the NICBR, the highest (1: 8.57) return obtained with the treatment of thiamethoxam + lambda-cyhalothrin followed by acephate +imidacloprid (1: 7.44), buprofezin+ acephate (1: 5.58) and fipronil (1: 4.73). The NICBR calculated 1: 3.87 and 1: 3.41 with treatments of β-cyfluthrin + imidacloprid and deltamethrin + triazophos, respectively. The poor NICBR (1: 2.32) was recorded with the treatments of profenofos + cypermethrin.

Thiamethoxam 12.6% + lambda-cyhalothrin 9.5% ZC was the best treatment in reducing population of thrips and thereby increasing yield of tea (Samanta *et al.*, 2017). Udikeri *et al.*, (2009) showed thiomethoxam + lambda cyhalothrin 247 SC found more effective in reducing the thrips on cotton. Wagh *et al.*, (2016) concluded that fipronil 5 SC 0.0075 per cent was most effective against onion thrips and produced maximum yield of onion bulbs. As per the report of Sathyan *et al.*, (2017), the lowest population of thrips per three buds was recorded in fipronil 5 SC 0.15 per cent in rose at Kerala. These testing of different insecticides on different crops are in close agreement with the present finding.

In conclusion, among the seven ready-mix insecticides evaluated, acephate 50% + imidacloprid 1.8% SP and thiamethoxam 12.6% + lambda-cyhalothrin 9.5% ZC were found the most effective in reducing the incidence of *S. dorsalis* in *Bt* cotton and the seed cotton yield of treatments 2691 and 2645 kg/ha, respectively. Looking to the NICBR, the highest (1: 8.57) return obtained with the treatment of thiamethoxam + lambda-cyhalothrin followed by acephate + imidacloprid (1: 7.44).

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How to cite this article:

Padaliya, S.R., R.K. Thumar, M.G. Borad and Patel, N.K. 2018. Bio-efficacy of Different Ready-Mix Insecticides against Thrips, *Scirtothrips dorsalis* Hood Infesting Bt Cotton. *Int.J.Curr.Microbiol.App.Sci.* 7(07): 2904-2915. doi: https://doi.org/10.20546/ijcmas.2018.707.340