

Original Research Article

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Bio Efficacy of Different Novel Insecticides against Cotton Thrips, *T. tabaci* in Transgenic Cotton

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ABSTRACT

Keywords

Cotton thrips, insecticides, efficacy

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To assess the efficacy of different insecticides for the management of cotton Thrips, an experiment was conducted at Regional Agricultural Research Station, Lam, Guntur during 2011-12. Among the different tested insecticides Fipronil 5% SC@ 50g.a.i/ha has shown 76.7 per cent reduction of thrips, followed by Fipronil 80% WG@ 50g.a.i/ha, Acephate 75% SP@ 750g.a.i/ha and Imidacloprid 70% WG@21g.a.i/ha has shown 74.5, 71.6 and 69.0 per cent reduction over the control after ten days after treatment. Furthermore, it has recorded highest yield of 13.5 q/ha when compared to other treatments.

Introduction

Cotton is an important fibre crop of global significance cultivated in more than seventy countries. It is an important raw material for the Indian textile industry and plays a key role in the national economy in terms of both employment generation and foreign exchange. India thus enjoys the distinction of being the earliest country in the world to domesticate and to utilize its fibre to manufacture fabric (Mayee *et al.*, 2004). In India cotton ecosystem harbours about 162 insect pest species and the monetary value of estimated

yield losses due to insect pests has been estimated to be Rs 3,39,660 million annually (Dhaliwal *et al.*, 2010). Among the sap feeders aphids *Aphis gossypii* (Glover), Leafhoppers *Amrascabiguttula biguttula* (Ishida), thrips *Thrips tabaci* (Linn) and whitefly *Bemisia tabaci* are deadly pests. A Cotton grower in India depends heavily on synthetic pesticides to combat sucking pests.

At least 2-3 sprays are directed against sucking pests. Due to continuous and indiscriminate use of synthetic insecticides, there is resistance and hence the efficacy has become

less reliable. To overcome this problem discovery of novel substances with different biochemical targets are needed.

A number of broad-spectrum insecticides, with a comparatively longer residual effect, are being sprayed, as a common practice by the farmers. In India, at least 2-3 sprays are directed against the sucking pests (Acharya *et al.*, 2002). This practice wipes off the useful fauna from the field and leads to complex pest problem and flare up of one or other pest, in such situation, there is every need to suggest more selective insecticide, which have less deleterious effects on the beneficials

Several potent insecticides have been recommended for managing sucking pests, but the use of insecticides have resulted in the development of resistance, resurgence, secondary pest out breaks, disruption of natural enemy complex and environmental pollution (Dhaliwal and Arora, 2001).

The newer molecules have a higher stability and superiority over the conventional insecticides to control the pest population density at field level (Vinoth Kumar *et al.*, 2009). Fipronil 5% SC @ 50-75 gm a.i. ha⁻¹ dose was found optimum against aphids, leafhoppers and thrips of cotton (Wadnerkar *et al.*, 2003). Imidacloprid 70 WG @ 40 g a.i. ha⁻¹ provided good protection against aphids, thrips, whiteflies and leafhoppers of cotton (Naveen *et al.*, 2010). The investigation was therefore under taken for the suitable management practices to combat the thrips damage.

Materials and Methods

The experiment was laid out in Randomized Block Design with ten treatments including control and replicated thrice with plot size of 6.3 m X 5.4 m . Standard agronomic practices were adopted to raise a good crop of cotton.

Bt cotton hybrid RCH-2BG-II was selected for this experiment. Treatment particulars are presented in table-1.

Seed treatment

For delinted seed, 5 ml of gum per kg seed was evenly distributed through thorough shaking in a polythene bag into which 5 g of imidacloprid 70 WS was added for uniform coating over the seed. Then the treated seed was shade dried for about 10 minutes and used for sowing.

Application of treatments

A measured quantity of insecticidal solution /powder was mixed with a little quantity of water and stirred well, after which the remaining quantity of water was added to obtain the required concentration of spray fluid. Sprayings were given by using a hand compression knapsack high volume sprayer, during morning hours.

The plot in each treatment was sprayed with respective insecticides ensuring uniform coverage of insecticide. The sprayer and the accessories were thoroughly washed before changing the insecticides and also rinsed with the spray fluid of the chemical to be applied next. The first spraying was given at 60 DAS when the incidence of sucking pest population was sufficiently built up in the experimental plots. A total of three sprays were given during the course of season at ten days interval.

Recording observations

The incidence of sucking pests viz., aphids, leafhoppers, whiteflies and thrips were recorded by counting the number of nymphs and adults per three leaves, per plant on five randomly selected plants per plot at 3, 7 and 10 days after treatment.

The seed cotton yield from each plot was recorded twice separately in kg/plot and converted into q/ha

Results and Discussion

Mean efficacy of different novel insecticides against thrips

Mean data on thrips at 3 DAT ranged from 3.2 to 16.6/ three leaves presented in table- (Table-2, 3, Fig. 1). . Fipronil 5% SC @ 50 g a.i.ha⁻¹(3.2 / three leaves) was the most effective treatment followed by fipronil 80% WG @ 50 g a.i. ha⁻¹(3.5/ three leaves) and acephate 75% SP @ 750 g a.i. ha⁻¹(4.0/ three leaves) which were on par with each other.

The next best treatments; imidacloprid 70% WG @21 g a.i. ha⁻¹ (4.4/three leaves), spirotetramat150 OD @ 90 g a.i. ha⁻¹(4.7/ three leaves), spiromesfin 240 SC @ 40 g a.i. ha⁻¹ (5.0/three leaves) and thiacloprid 21.7% SC @ 24 g a.i. ha⁻¹(5.5/three leaves) .The treatments, diafenthiuron 50% WP @ 375 g a.i. ha⁻¹(6.3/three leaves) and buprofezin 25% SC @150 g a.i. ha⁻¹(6.8/three leaves) were on par with each other and significantly superior over untreated control.

Similar trend was observed at 7 and 10 DAT. At 7DAT population ranged from 3.5to17.0/three leaves. Fipronil 5% SC @ 50 g a.i.ha⁻¹(3.5 / three leaves) was the effective treatment followed by fipronil 80% WG @ 50 g a.i. ha⁻¹(3.8/ three leaves) and acephate 75% SP @ 750 g a.i. ha⁻¹(4.3/ three leaves).

The next best treatments were imidacloprid 70% WG (4.6/three leaves), spirotetramat 150 OD @ 90 g a.i. ha⁻¹(5.1/three leaves),spiromesfin 240 SC @ 40 g a.i. ha⁻¹(5.5/ three leaves), thiacloprid 21.7% SC @ 24 g a.i. ha⁻¹ (6.1/three leaves) .The treatments, diafenthiuron 50% WP @ 375 g a.i. ha⁻¹ (6.9/three leaves) and buprofezin

25% SC @150 g a.i. ha⁻¹ (7.3/three leaves) were on par with each other and superior over untreated control.

The thrips population ranged from 4.0 to17.5/ three leaves at 10DAT. Fipronil 5% SC @ 50 g a.i.ha⁻¹(4.0/three leaves) was the most effective treatment followed by fipronil 80% WG @ 50 g a.i. ha⁻¹(4.4/ three leaves) and acephate 75% SP @ 750 g a.i. ha⁻¹(4.9/three leaves).

The next best treatments were imidacloprid 70% WG @21 g a.i. ha⁻¹(5.3/three leaves), spirotetramat 150 OD @ 90 g a.i. ha⁻¹(5.7/three leaves),spiromesfin 240 SC @ 40 g a.i. ha⁻¹(6.1/three leaves) and thiacloprid 21.7% SC @ 24 g a.i. ha⁻¹ (6.8/three leaves) .The treatments, diafenthiuron 50% WP @ 375 g a.i. ha⁻¹(7.4/three leaves) and buprofezin 25% SC @150 g a.i. ha⁻¹ (8.0/three leaves) were on par with each other and significantly superior over untreated control.

Per cent reduction of thrips population at 10 DAT, indicated highest reduction in fipronil 5% SC @ 50 g a.i. ha⁻¹(76.7%) followed by fipronil 80% WG @ 50 g a.i. ha⁻¹ (74.5%) and acephate 75% SP @ 750 g a.i. ha⁻¹ (71.6%). The next best treatments were imidacloprid 70% WG @21 g a.i. ha⁻¹(69.0%), spirotetramat 150 OD @ 90 g a.i. ha⁻¹ (67.0%), spiromesfin 240 SC @ 40 g a.i. ha⁻¹(64.7%) and thiacloprid 21.7% SC @ 24 g a.i. ha⁻¹ (60.8%).The treatments, diafenthiuron 50% WP @ 375 g a.i. ha⁻¹ and buprofezin 25% SC @150 g a.i. ha⁻¹ recorded reduction of 57.5% and 54.3% respectively.

Per cent reduction in observed during first, second and third spray at 10DAT was 64.1%, 76.7% and 88.6% respectively. These findings conformity with that Mau *et al.*, (1998) reported that fipronil @ 0.01% was highly effective against *T. tabaci* infesting

onion. Kadam and Dethe (2002) findings revealed that fipronil 5 SC at the rate of 40 to 60 g a.i. ha⁻¹, when applied as a schedule of four sprays at an interval of 15 days by initiating the first spray 4 weeks after transplanting, was effective in lowering the thrips count to 3.32-9.63 as against a count of 13.44-23.43 in untreated control in chilli.

Rupal and Dethe (2002) reported that four sprays of fipronil 5 SC @ 40 -60 g a.i. ha⁻¹ gave 91.2 % mortality of *S. dorsalis* in chilli. Jadhav *et al.*, (2004) indicated that fipronil 5 SC @ 100 g a.i. ha⁻¹ resulted in 2.2 leafhoppers per leaf and 1.2 thrips per leaf at seven days after application in chilli.

Ghosh *et al.*, (2009) reported that fipronil 5 SC @ 75 g a.i. ha⁻¹ gave 88.8 % mortality of *S. dorsalis* in chilli. Patil *et al.*, (2009) recorded that fipronil 5% SC @ 800g/ ha registered least number of thrips (8.47 / 3 leaves) and significantly highest seed cotton yield of 27.23 q/ha (2007) and 27.50 q/ha

(2008) was harvested. Information of fipronil agents cotton thrips is limited.however these findings corroborate with findings on thrips of other crops like onion and chilli. (Rohini, 2010) reported that fipronil 5 SC at 0.01% effective against thrips population. Fipronil 5% SC recorded least number of thrips 3.51 per three leaves in cotton (Zanwar *et al.*, 2012)

The next best treatments were acephate 75% SP @ 750 g a.i. ha⁻¹ and Imidacloprid 70% WG @ 21 g a.i. ha⁻¹.The present findings are in agreement with Ameta and Sharma (2005) who reported that imidacloprid 70 WG at 35 g a.i. ha⁻¹ caused the highest reduction in population of thrips in cotton at 1, 3, 5 and 7 days after first and second sprays. Wahla *et al.*, (1997) reported that Confidor 200 SL at 40 ml/ acre was the most effective against cotton thrips. Saleem *et al.*, (2001) reported that Confidor200 SL effectively controlled thrips up to seven days after the spray in cotton.

Table.1 Particulars of insecticides used

S.No.	Chemical name	Chemical class	a.i. ha ⁻¹
T ₁	Diafenthiuron 50% WP	Thiourea	375
T ₂	Fipronil 5%SC	Phenylpyrazole	50
T ₃	Spirotetramat150 OD	Ketoenols	90
T ₄	Imidacloprid 70% WG	Neonicotinoids	21
T ₅	Fipronil 80% WG	Phenylpyrazole	50
T ₆	Buprofezin 25% SC	Insect growth regulator	150
T ₇	Spiromesifen 240 SC	Spirocyclitetrone acids	40
T ₈	Thiacloprid 21.7% SC	Neonicotinoids	24
T ₉	Acephate 75% SP	Organophosphate	750

Table.2 Bioefficacy of different novel insecticides against thrips, *T.tabaci*

S.NO	Treatments	First spray				Second spray				Third spray			
		3DAT*	7DAT*	10DAT*	% reduction over control at 10DAT**	3DAT*	7DAT*	10DAT*	% reduction over control at 10DAT**	3DAT*	7DAT*	10DAT*	% reduction over control at 10DAT**
T1	Diafenthurion50% WP	7.9 (2.99) ^b	8.2 (3.03) ^{bc}	8.7 (3.12) ^{ab}	47.5 (43.61) ^a	6.1 (2.66) ^b	7.3 (2.89) ^b	7.7 (2.94) ^b	56.0 (47.4) ^{bc}	4.8 (2.41) ^c	5.1 (2.46) ^{cd}	5.7 (2.58) ^{ef}	69.0 (56.19) ^{ef}
T2	Fipronil 5% SC	5.1 (2.46) ^a	5.4 (2.53) ^a	5.9 (2.63) ^a	64.1 (53.28) ^a	3.3 (2.07) ^a	3.5 (2.13) ^a	4.0 (2.24) ^a	76.7 (61.3) ^a	1.4 (1.55) ^a	1.6 (1.61) ^a	2.1 (1.75) ^a	88.6 (70.31) ^a
T3	Spirotetramat 150 OD	6.5 (2.73) ^{ab}	6.9 (2.80) ^{abc}	7.6 (2.93) ^{ab}	54.2 (47.42) ^a	4.9 (2.42) ^{ab}	5.3 (2.52) ^{ab}	5.6 (2.57) ^{ab}	67.9 (55.5) ^{ab}	2.8 (1.95) ^b	3.1 (2.02) ^b	3.9 (2.21) ^{bcd}	78.5 (62.43) ^{bcd}
T4	Imidacloprid 70% WG	6.1 (2.67) ^{ab}	6.4 (2.72) ^{abc}	7.2 (2.86) ^{ab}	55.4 (48.25) ^a	4.5 (2.34) ^{ab}	4.9 (2.42) ^{ab}	5.3 (2.52) ^{ab}	69.0 (56.2) ^{ab}	2.5 (1.88) ^b	2.7 (1.91) ^b	3.5 (2.11) ^{abcd}	81.1 (64.24) ^{abcd}
T5	Fipronil 80% WG	5.3 (2.50) ^a	5.7 (2.58) ^{ab}	6.4 (2.72) ^{ab}	60.6 (51.27) ^a	3.7 (2.16) ^{ab}	3.9 (2.21) ^{ab}	4.2 (2.28) ^a	75.5 (60.4) ^a	1.5 (1.59) ^{ab}	1.7 (1.65) ^{ab}	2.5 (1.88) ^{ab}	86.3 (68.27) ^{ab}
T6	Buprofezin25%SC	8.4 (3.07) ^b	8.8 (3.13) ^c	9.4 (3.22) ^b	43.2 (41.09) ^b	6.6 (2.76) ^b	7.5 (2.91) ^b	8.0 (3.00) ^b	54.28 (47.48) ^c	5.3 (2.52) ^c	5.5 (2.54) ^d	6.6 (2.76) ^f	63.8 (53.01) ^f
T7	Spiromesfin 240 SC	6.9 (2.80) ^{ab}	7.3 (2.89) ^{abc}	7.9 (2.98) ^{ab}	52.7 (46.54) ^a	5.3 (2.50) ^{ab}	5.9 (2.62) ^b	6.3 (2.70) ^b	62.3 (52.4) ^{abc}	3.0 (2.00) ^b	3.4 (2.10) ^{bc}	4.5 (2.27) ^{cde}	75.4 (60.03) ^{cde}
T8	Thiacloprid 21.7% SC	7.3 (2.88) ^{ab}	7.7 (2.96) ^{abc}	8.2 (3.03) ^{ab}	50.3 (45.19) ^a	5.7 (2.59) ^b	6.8 (2.79) ^b	7.3 (2.88) ^b	56.0 (48.6) ^{bc}	3.5 (2.13) ^{bc}	3.9 (2.21) ^c	4.9 (2.42) ^{def}	73.5 (59.02) ^{def}
T9	Acephate 75% SP	5.7 (2.58) ^{ab}	6.1 (2.67) ^{abc}	6.8 (2.79) ^{ab}	58.9 (50.17) ^a	4.1 (2.27) ^{ab}	4.5 (2.34) ^{ab}	4.8 (2.41) ^{ab}	73.5 (59.3) ^a	2.1 (1.77) ^{ab}	2.4 (1.84) ^{ab}	3.1 (2.02) ^{abc}	83.1 (65.76) ^{abc}
T10	Control (untreated)	15.1 (4.02) ^c	15.9 (4.12) ^d	16.5 (4.19) ^c		16.9 (4.23) ^c	17.3 (4.28) ^c	17.5 (4.30) ^c		17.7 (4.32) ^d	17.9 (4.35) ^c	18.3 (4.40) ^e	
	F-TEST	Sig	sig	sig	sig	Sig	sig	Sig	sig	sig	sig	sig	Sig
	SEm	0.14	0.14	0.17	3.58	0.17	0.15	0.15	3.13	0.10	0.09	0.11	1.13
	CD (P=0.05)	0.43	0.43	0.52	10.6	0.51	0.45	0.45	9.30	0.30	0.28	0.34	5.84

*Figures in parentheses are square root transformed values.

**Figures in parentheses are angular transformed values.

Numbers followed by same superscript are not statistically different.

Sig : Significant.

NS : Non-significant.

DAT : Days after treatment

Table.3 Mean efficacy of different novel insecticides against thrips, *T.tabaci*

S.NO	Treatments	3DAT*	7DAT*	10DAT*	% reduction over control at 10DAT **
T1	Diafenthurion50% WP	6.3 (2.69) ^{cd}	6.9 (2.79) ^{ef}	7.4 (2.88) ^{ef}	57.5 (49.41) ^{ef}
T2	Fipronil 5% SC	3.2 (2.03) ^a	3.5 (2.09) ^a	4.0 (2.21) ^a	76.7 (61.70) ^a
T3	Spirotetramat 150 OD	4.7 (2.37) ^{abc}	5.1 (2.45) ^{bcd}	5.7 (2.57) ^{bcd}	67.0 (55.20) ^{cd}
T4	Imidacloprid 70% WG	4.4 (2.30) ^{ab}	4.6 (2.35) ^{abcd}	5.3 (2.50) ^{abc}	69.0 (56.50) ^{bc}
T5	Fipronil 80% WG	3.5 (2.09) ^a	3.8 (2.15) ^{ab}	4.4 (2.29) ^{ab}	74.5 (60.15) ^{ab}
T6	Buprofezin25% SC	6.8 (2.78) ^d	7.3 (2.86) ^f	8.0 (2.99) ^f	54.3 (47.48) ^f
T7	Spiromesfin 240% SC	5.0 (2.44) ^{bc}	5.5 (2.53) ^{cde}	6.1 (2.65) ^{cde}	64.7 (53.79) ^{cde}
T8	Thiacloprid 21.7% SC	5.5 (2.53) ^{bcd}	6.1 (2.65) ^{def}	6.8 (2.78) ^{def}	60.8 (51.39) ^{de}
T9	Acephate 75% SP	4.0 (2.21) ^{ab}	4.3 (2.28) ^{abc}	4.9 (2.41) ^{abc}	71.6 (58.16) ^{abc}
T10	Control (untreated)	16.6 (4.19) ^e	17.0 (4.25) ^g	17.5 (4.30) ^g	
	F-TEST	sig	Sig	sig	sig
	SEm	0.06	0.05	0.05	0.85
	CD(P=0.05)	0.31	0.29	0.27	4.41

* Figures in parentheses are square root transformed values.

**Figures in parentheses are angular transformed values.

Numbers followed by same superscript are not statistically different.

Sig : Significant.

NS : Non-significant.

DAT : Days after treatment

Table.4 Seed cotton yield

S.NO	Treatments	YIELD(q/ha)
T1	Diafenthurion50% WP	12.7
T2	Fipronil 5% SC	13.5
T3	Spirotetramat 150 OD	9.3
T4	Imidacloprid 70% WG	11.1
T5	Fipronil 80% WG	13.4
T6	Buprofezin25% SC	12.2
T7	Spiromesfin 240 SC	10.1
T8	Thiacloprid 21.7% SC	8.6
T9	Acephate 75% SP	11.4
T10	Control (untreated)	7.2
	F-TEST	sig
	SEm	0.40
	CD(P=0.05)	2.07

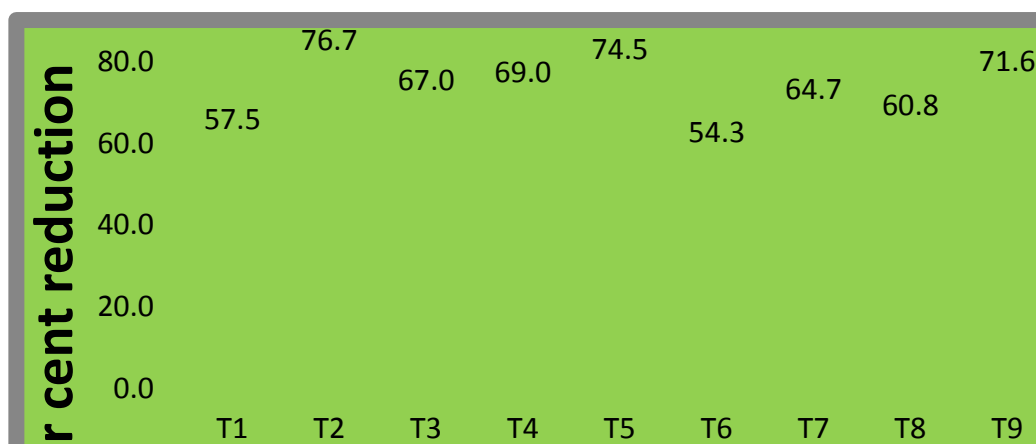


Fig.1 Mean per cent reduction of thrips over control at 10 days after treatment

T1: Diafenthiuron 50% WP	-375 ga.i. ha ⁻¹	T2: Fipronil 5% SC	- 50 ga.i. ha ⁻¹
T3: Spirotetramat 150% OD	- 90 ga.i. ha ⁻¹	T4: Imidacloprid 70% WG	-21 g a.i. ha ⁻¹
T5: Fipronil 80% WG	- 50 ga.i. ha ⁻¹	T6: Buprofezin 25% SC	-150 g a.i. ha ⁻¹
T7: Spiromesfin 240% SC	- 40 ga.i. ha ⁻¹	T8: Thiacloprid 21.7% SC	- 24 a.i. ha ⁻¹
T9: Acephate 75% SP	- 750 ga.i. ha ⁻¹		

Overall in the management of cotton thrips, Fipronil 5% SC @ 50g.a.i/ha and Fipronil 80% WG @ 50g.a.i/ha are superior over other treatments.

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