



Evaluation of fipronil 5 SC (Mahaveer) against sucking insect pests of *Bt* cotton under Punjab conditions

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Abstract : Sucking pests are becoming menace in high production of cotton after the introduction of *Bt* cotton which was resistant against bollworms. In 21st century the sucking pests, whitefly, jassid, thrips and mealybug became the major pests of *Bt* cotton. Insecticides were evaluated at different interval to find out the effectiveness against thrips and whitefly. Population of thrips/3 leaves was significantly lower in fipronil 5SC @ 1500 ml/ha + one more after 10-15 DAS (8.45) and was found significantly effective against thrips followed by fipronil 5SC @ 1250 ml/ha + one more after 10-15 DAS (12.11) as compared to all other treatments after 7 DAS. Per cent reduction was also recorded against thrips in *Bt* cotton but very less in case of whitefly. Fipronil was found less effective against whitefly. However, all the treatments were better than control. No phytotoxicity was recorded during the study period.

Keywords: *Bt* cotton, fipronil, thrips, whitefly

"White Gold" or the "King of Fibre" is international cash crop grown for its fibre and oil. India being the second largest producer and exporter in the world, it is one of major source of raw material for Indian domestic textile industries. Cotton being second longest duration crop after sugarcane harbour number of insect pest that survive throughout the season. Worldwide 1326 pest species have being reported from sowing to maturity (Hargreaves, 1948) and 162 species were reported from India on cotton crop (Sundramurthy and Chitra, 1992). Bal and Dhawan (2008) recorded 134 arthropod species that include 54 species of pests found to be associate with cotton crop in Punjab. There are two types of insect pests that attack the crop including sucking type of mouthpart and chewing type of mouth parts. Sucking type includes whitefly, jassid, thrips and mealybug and chewing type include bollworms (American bollworm, spotted bollworm and pink bollworm). With the introduction of *Bt* cotton in 2002, the attack of bollworm reduces, the pesticide load also reduces a lot. But with time the sucking pests take over the cotton crop and their

infestation start increasing and sucking pests still remain a big huddle in high production of cotton yield (Shera *et al.*, 2013). Under Punjab condition numbers of times sucking pests have been emerge as a major pest and outbreak took place like mealy bug in 2005 and whitefly in 2015 under Punjab conditions. Gradually, thrips also becomes a major pest of cotton. Sucking pests (leafhopper, thrips, whitefly, miridbug, mealy bug and dusky cotton bug) account for about 22.85 per cent yield reduction in cotton (Satpute *et al.*, 1990). Whitefly, leaf hopper and thrips all are also found to feed on brinjal, okra and other economically important crops along with weeds found around the main crop that act as alternate host. In present scenario, the minor pest thrips now became major pest and has gained tremendous importance among top three ranking insect pest in cotton in terms of producer costs (Cook, 2018). Thrips rasp the leaf surface then it sucks the ooze out cell sap and the affected leaf showing silvery appearance. Due to number of indiscriminate and non judicious application of non recommended application of insecticide, number of problems like pests'

resistance, resurgence, secondary out break and environment pollution emerge out. For the management of insect pests in various crops after implementation of all control the last option for the management of huge population of insect pest is chemical control. Fipronil is a pyrazole insecticide that has excellent activity against all type of insects that include piercing and sucking and chewing type of mouth part infesting cotton crop and was discovered in 1987 by Rhone Poulenc scientist found effective when applied as seed treatment, as a bait or as a foliar spray (Colliot *et al.*, 1992). Earlier it was tested against grey weevil and dusky cotton bug in other countries but now this molecule has been tested under north Indian conditions against the cotton sucking pests.

MATERIALS AND METHODS

The experiment was conducted for consecutive three years 2015, 2016 and 2017 in two districts namely, Abohar and Mansa with two villages each at farmers' field. Niche area was selected having maximum population of the thrips and whitefly on *Bt* cotton to get feasible outcome from the experiment. The experiment was conducted during the peak activity period of the sucking pests. Spray was initiated when their population reached economic threshold level. Each trial was replicated thrice with spacing of 67.5 x 75 cm. Fipronil 5 SC (Mahaveer) and diafenthiuron 50 WP were tested against thrips and whitefly. The treatments details are given in

Table 1. Two applications of treatments were given at an interval of 14 days. With the use of a knapsack sprayer, all treatments were applied to the foliage using 375 ltr. of water/hectare. The trial was sponsored by M/S Gharda Chemicals, limited to check the efficacy of these chemical against cotton sucking insect pests. The observations on the population of thrips and whitefly adults/3 leaves were recorded from 3 fully formed leaves/plant in 10 randomly selected plants in each plot before spray, 3, 7, 10 and 14 days after 1st and 2nd sprays. Per cent reduction in the population over control was also calculated from the field population:

$$\text{Reduction in insect population (\% over control)} = \frac{(\text{No. of insect in control} - \text{Number of insect in treatment})}{\text{No. of insect in control}} \times 100$$

$$\text{Increase in yield (\% over control)} = \frac{(\text{Yield in treated plot} - \text{Yield in control})}{\text{Yield in control}} \times 100$$

Seed cotton yield was recorded plot wise in at the time of first three major pickings and later on the cumulative of all the pickings were made converted to q/ha. The population of sucking pests on plant canopy recorded during trial was analyzed using CPCS1 programme (Singh and Cheema, 1990) after square root transformation.

Table 1. Treatment details:

Treatments No.	Treatment
T ₁	Fipronil (5%) SC @ 750 ml/ha at 40-60 days after sowing
T ₂	Fipronil (5%) SC (@1000 ml/ha) at 40- 60 days after sowing
T ₃	Fipronil (5%) SC (@1000 ml/ha) + One more after 10-15 days
T ₄	Fipronil (5%) SC (@ 1250 ml/ha) at 40- 60 days after sowing
T ₅	Fipronil (5%) SC (@1250 ml/ha) + One more after 10-15 days
T ₆	Fipronil (5%) SC (@ 1500ml/ha) at 40- 60 days after sowing
T ₇	Fipronil (5%) SC (@1500 ml/ha) + One more after 10-15 days
T ₈	Fipronil (5%) SC (@ 2000 ml/ha) at 40- 60 days after sowing
T ₉	Diafenthiuron 50WP @ 500 g/ha
T ₁₀	Control

Table 1. Efficacy of fipronil (5%) SC against for thrips in *Bt* cotton (Pooled 2015, 2016 and 2017)

Treatment	Population of thrip/three leaves				
	Pre-treatment	3 DAS	7 DAS	10 DAS	14 DAS
Fipronil (5%) SC @ 750ml/ha at 40-60 days after sowing	37.26	28.14(5.38)*	26.27(5.21)	26.83(5.26)	32.15(5.75)
Fipronil (5%) SC (@1000 ml/ha) at 40- 60 days after sowing	36.64	23.84(4.69)	23.55(4.95)	23.80(4.97)	28.37(5.41)
Fipronil (5%) SC (@1000 ml/ha)+ One More after 10-15 days	36.95	21.02(4.68)	21.80(4.76)	21.43(4.73)	23.05(4.90)
Fipronil (5%) SC (@ 1250 ml/ha) at 40- 60 days 37.64 after sowing	38.28	19.81(4.55)	19.57(4.52)	18.41(4.39)	21.05(4.68)
Fipronil (5%) SC (@1250 ml/ha)+ One More after 10-15 days	37.64	17.80(4.32)	16.80(4.20)	15.46(4.04)	18.10(4.36)
Fipronil (5%) SC (@ 1500ml/ha) at 40- 60 days after sowing	36.27	14.03(3.86)	14.84(3.96)	12.24(3.62)	17.02(4.23)
Fipronil (5%) SC (@1500 ml/ha)+ One More after 10-15 days	36.57	11.82(3.56)	13.80(3.83)	10.40(3.35)	15.99(4.11)
Fipronil (5%) SC (@ 2000ml/ha) at 40- 60 days after sowing	37.37	9.12(3.16)	9.53(3.22)	7.12(2.82)	13.84(3.84)
Diafenthiuron 50WP @ 500 g/ha	37.71	9.43(3.21)	9.56(3.23)	7.90(2.97)	13.35(3.77)
Control	38.55	39.38(6.35)	40.84(6.46)	42.07(6.56)	44.43(6.73)
CD (p=0.05)	NS	(0.17)	(0.15)	(0.16)	(0.16)
Second spray					
Fipronil (5%) SC @ 750ml/ha at 40-60 days after sowing	33.00(5.82) *	33.99(5.91)	35.32(6.02)	36.16(6.09)	37.90(6.23)
Fipronil (5%) SC (@1000 ml/ha) at 40- 60 days after sowing	29.23(5.49)	30.99(5.65)	32.65(5.79)	33.81(5.89)	35.50(6.03)
Fipronil (5%) SC (@1000 ml/ha)+ One More after 10-15 days	23.14(4.90)	16.97(4.22)	15.22(4.02)	17.83(4.32)	19.42(4.51)
Fipronil (5%) SC (@ 1250 ml/ha) at 40- 60 days after sowing	21.83(4.77)	22.89(4.88)	23.36(4.93)	24.62(5.05)	26.83(5.27)
Fipronil (5%) SC (@1250 ml/ha)+ One More after 10-15 days	19.12(4.48)	13.32(3.77)	12.62(3.68)	13.58(3.81)	15.49(4.05)
Fipronil (5%) SC (@ 1500ml/ha) at 40- 60 days after sowing	18.84(4.44)	20.39(4.62)	19.96(4.57)	20.49(4.63)	22.46(4.84)
Fipronil (5%) SC (@1500 ml/ha)+ One More after 10-15 days	17.67(4.31)	10.54(3.39)	9.45(3.22)	9.92(3.30)	12.25(3.63)
Fipronil (5%) SC (@ 2000ml/ha) at 40- 60 days after sowing	15.26(4.02)	15.39(4.04)	16.57(4.18)	19.86(4.56)	21.44(4.73)
Diafenthiuron 50WP @ 500 g/ha	14.91(3.97)	15.11(4.00)	16.71(4.20)	20.24(4.60)	22.13(4.80)
Control	44.84(6.76)	45.64(6.82)	48.47(7.02)	51.22(7.22)	53.18(7.35)
CD (p=0.05)	(0.16)	(0.14)	(0.12)	(0.13)	(0.15)

*Figures in the parentheses are square root transformed values

RESULTS AND DISCUSSION

During the period of investigation, thrips, *Thrips tabaci* and whitefly, *Bemisia tabaci* appeared as the major insect pests among the sucking insect pest complex.

Thrips (*Thrips tabaci* Lindeman)

The experiments were conducted on sucking pests during 2015, 2016 and 2017 and the results were pooled to find out the best treatment against these sucking pests. Before the insecticidal treatment, different plots harboured 36.27 to 38.55 thrips/3 leaves and

the treatments were statistically *at par* among themselves before spray. After 1st application of insecticides (Table 1.), the population of thrips/3 leaves was significantly lower in fipronil 5SC @ 2000 ml/ha at 40-60 days after sowing (9.53) being *at par* with diafenthiuron 50WP @ 500 g/ha (9.55) followed by fipronil 5SC @ 1500 ml/ha and one more after 10-15 days (13.80) as

compared to all other treatments after 7 days of sprays. After 10 DAS, the population start increasing gradually over the period but was significantly lower in fipronil 5SC @ 2000 ml/ha at 40-60 days after sowing (7.12 thrips/3 leaves) being *at par* with diafenthiuron 50WP @ 500 g/ha (7.90 thrips/3 leaves) as compared to all other treatments. After 14 days of first

Table 2. Efficacy of fipronil (5%) SC against for whitefly in *Bt* cotton (Pooled 2015, 2016 and 2017)

Treatment	Population of whitefly/three leaves				
	Pre treatment	3 DAS	7 DAS	10 DAS	14 DAS
Fipronil (5%) SC @ 750ml/ha at 40-60 days after sowing	17.84(4.34) *	15.07(4.00)	14.81(3.97)	17.84(4.34)	18.87(4.45)
Fipronil (5%) SC (@1000 ml/ha) at 40-60 days after sowing	17.92(4.34)	14.33(3.91)	13.25(3.77)	17.80(4.33)	18.49(4.41)
Fipronil (5%) SC (@1000 ml/ha) + One More after 10-15 days	17.13(4.25)	13.88(3.85)	13.27(3.77)	14.64(3.95)	16.38(4.16)
Fipronil (5%) SC (@ 1250 ml/ha) at 40-60 days after sowing 37.64	17.87(4.34)	12.71(3.70)	11.93(3.59)	14.24(3.90)	15.92(4.11)
Fipronil (5%) SC (@1250 ml/ha) + One More after 10-15 days	17.11(4.25)	11.70(3.56)	11.51(3.53)	12.88(3.72)	14.53(3.94)
Fipronil (5%) SC (@ 1500ml/ha) at 40-60 days after sowing	17.02(4.24)	11.62(3.55)	10.85(3.44)	13.42(3.79)	14.40(3.92)
Fipronil (5%) SC (@1500 ml/ha) + One More after 10-15 days	17.46(4.29)	10.83(3.43)	10.28(3.35)	12.43(3.66)	13.58(3.81)
Fipronil (5%) SC (@ 2000ml/ha) at 40-60 days after sowing	17.53(4.30)	9.80(3.28)	9.24(3.20)	12.81(3.71)	13.60(3.82)
Diafenthiuron 50WP @ 500 g/ha	17.73(4.32)	8.84(3.13)	7.17(2.85)	8.00(3.00)	10.54(3.39)
Control	17.41(4.29)	17.87(4.29)	18.26(4.38)	18.30(4.39)	19.63(4.54)
CD (p=0.05)	(0.03)	(0.06)	(0.07)	(0.06)	(0.04)
Second spray					
Fipronil (5%) SC @ 750ml/ha at 40-60 days after sowing	18.77(4.44) *	19.28(4.50)	19.03(4.47)	22.39(4.83)	24.31(5.02)
Fipronil (5%) SC (@1000 ml/ha) at40- 60 days after sowing	18.25(4.38)	18.63(4.43)	18.25(4.38)	21.60(4.75)	23.62(4.96)
Fipronil (5%) SC (@1000 ml/ha)+One More after 10-15 days	17.20(4.26)	13.72(3.83)	13.05(3.74)	15.86(4.10)	17.57(4.30)
Fipronil (5%) SC (@1250 ml/ha) at40- 60 days after sowing	17.16(4.26)	18.27(4.39)	18.67(4.43)	21.55(4.74)	23.31(4.92)
Fipronil (5%) SC (@1250 ml/ha)+One More after 10-15 days	16.54(4.18)	11.62(3.55)	12.74(3.70)	15.13(4.01)	17.04(4.24)
Fipronil (5%) SC (@1500ml/ha) at40- 60 days after sowing	16.07(4.13)	16.94(4.23)	17.15(4.26)	19.79(4.55)	22.28(4.82)
Fipronil (5%) SC (@1500 ml/ha)+One More after 10-15 days	16.62(4.19)	9.77(3.28)	10.02(3.31)	13.91(3.85)	16.64(4.20)
Fipronil (5%) SC (@ 2000ml/ha) at40- 60 days after sowing	16.15(4.13)	17.46(4.29)	18.37(4.40)	21.45(4.73)	23.58(4.95)
Diafenthiuron 50WP @ 500 g/ha	12.69(3.69)	13.84(3.85)	15.65(4.08)	17.42(4.29)	19.30(4.50)
Control	20.05(4.58)	20.89(4.67)	21.92(4.78)	24.32(5.03)	26.03(3.19)
CD (p=0.05)	(0.11)	(0.06)	(0.07)	(0.16)	(0.15)

*Figures in the parentheses are square root transformed values

Treatment	Seed cotton yield (q/ha)						
	Expt 1	Expt 1I	Expt 1II	Expt 1V	Expt V	Pooled	Percent increase over control
Fipronil (5%) SC @ 750 ml/ha at 40-60 days after sowing	22.33	21.97	22.87	23.33	22.77	22.65	10.46
Fipronil (5%) SC (@1000 ml/ha) at 40-60 days after sowing	22.95	22.56	23.51	23.67	23.23	23.18	12.51
Fipronil (5%) SC (@ 1000 ml/ha) + One More after 10-15 days	23.96	23.60	24.49	24.63	24.23	24.18	16.13
Fipronil (5%) SC (@ 1250 ml/ha) at 40-60 days after sowing	23.10	22.73	23.60	24.03	23.73	23.44	13.48
Fipronil (5%) SC (@ 1250 ml/ha) + One More after 10-15 days	23.93	23.73	24.40	24.77	24.50	24.27	16.44
Fipronil (5%) SC (@ 1500ml/ha) at 40-60 days after sowing	24.06	23.73	24.62	24.79	24.49	24.34	16.68
Fipronil (5%) SC (@ 1500 ml/ha)+ One More after 10-15 days	24.63	24.37	25.13	25.57	25.30	25.00	18.88
Fipronil (5%) SC (@ 2000 ml/ha) at 40-60 days after sowing	24.90	24.60	25.20	25.50	25.30	25.10	19.20
Diafenthiuron 50WP @ 500 g/ha	24.73	24.80	25.10	25.73	25.60	25.19	19.49
Control	19.62	19.30	20.37	20.83	21.29	20.28	
CD (p=0.05)	1.92	1.24	1.29	1.17	1.20	0.22	
Mean of three replications							

fipronil 5SC @ 1500 ml/ha + one more after 10-15 DAS (10.28) as compared to all other treatments. After 10 DAS, the whitefly population/three leaves was significantly lower in diafenthiuron 50WP @ 500 g/ha (8.00) followed by fipronil 5SC @ 2000 ml/ha (12.81 whitefly/3 leaves) and fipronil 5SC @ 1500 ml/ha (13.83 whitefly/3 leaves) as compared to all other treatments. After 2nd application of insecticides in selective treatments, it was significantly lower in fipronil 5SC @ 1500 ml/ha + one more after 10-15 DAS (10.02 whitefly/3 leaves) and fipronil 5SC @ 1250 ml/ha + one more after 10-15 DAS (12.74 whitefly/3 leaves) and were *at par* with each other as compared to all other treatments

after 7 DAS. After 10 days of spray, it was significantly lower in fipronil 5SC @ 1500 ml/ha + one more after 10-15 DAS (13.91 whitefly/3 leaves) being *at par* with fipronil 5SC @ 1250 ml/ha + one more after 10-15 DAS (15.13 whitefly/3 leaves) followed by fipronil 5SC @ 1000 ml/ha + one more after 10-15 DAS (15.86 whitefly/3 leaves) as compared to all other treatments with increase in the whitefly population (Table 2). It was found less effective against whitefly as compared to thrips. Kumar *et al.*, (2017) support our finding and reported shows imidacloprid 17.8 SL @ 100ml/ha and thiamethoxam 25 WG @ 100gm/ha are more successful at controlling the whitefly population

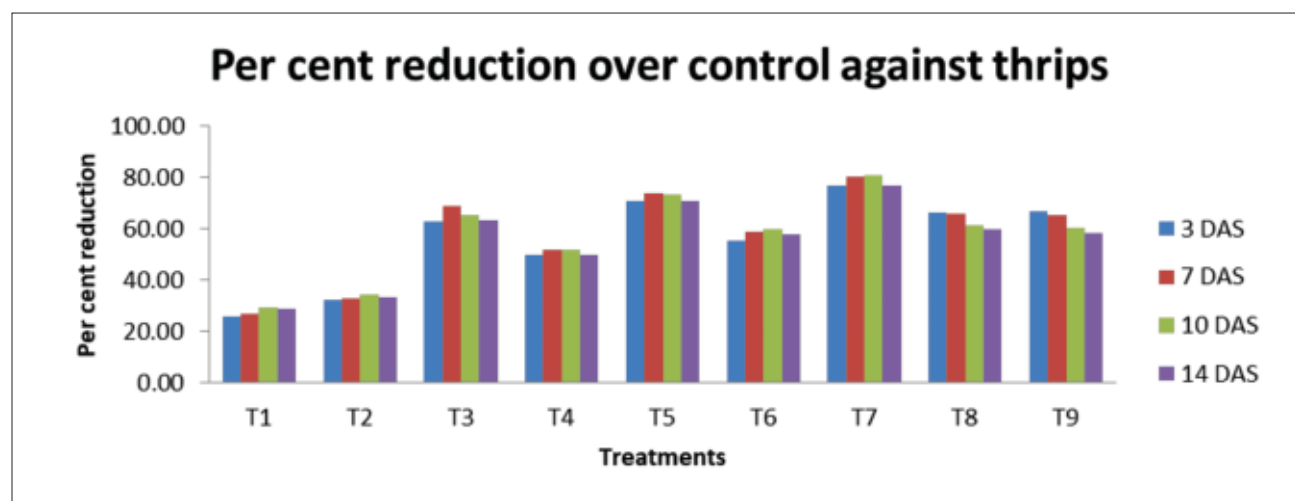


Fig. 1. Per cent reductions in thrips population in different treatments over contro

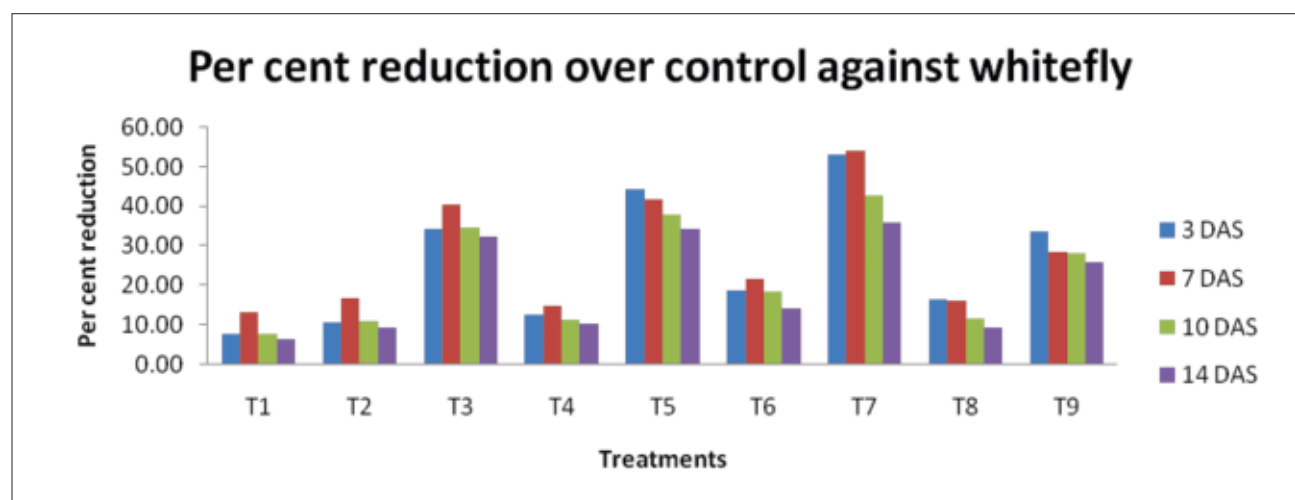


Fig. 2. Per cent reductions in whitefly population in different treatments over control

than fipronil 5 SC 750ml/ha.

Per cent reduction:

Thrips: From Fig. 1. it is clear that second application of insecticides after 10-15 days interval reduce the whitefly population. After second spray at 7 days after spray fipronil 5SC @ 1500 ml/ha + one more after 10-15 DAS gave maximum per cent reduction in the thrips population (76.91) followed by fipronil 5SC @ 1250 ml/ha + one more after 10-15 DAS (70.82). Diafenthiuron 50 WP @ 500g/ha, fipronil 5SC @ 2000ml/ha at 40-60 days after sowing and fipronil 5SC @ 1000 ml/ha + one more after 10-15 DAS recorded more 60 per cent reduction in population was recorded as compared to all other treatments. After 7 DAS similar trend was observed in which fipronil 5SC @ 1500 ml/ha + one more after 10-15 DAS and fipronil 5SC @ 1250 ml/ha + one more after 10-15 DAS gave more than 70 per cent reduction in the thrips population followed other treatments. Rao *et al.*, (2022) reported good efficacy of fipronil against *T. palmi* which can be used as part of IPM in cotton crop that gave more than 60 per cent reduction in population and more than 80 per cent reduction under laboratory conditions.

Whitefly: Per cent reduction was very low as after second spray population of whitefly increases in all the treatment and showed less than 30 per cent reduction in whitefly population except fipronil 5SC @ 1250 ml/ha + one more after 10-15 DAS that gave 44.38 per cent as depicted in Fig. 2. Zanwar and Shelke (2022) reported significantly lowest thrips population when applied fipronil 5 SC @ 50 g a.i./ha and diafenthiuron 50WP and fipronil 5 SC recorded significantly low population of whitefly. Kumar *et al.*, (2019) recorded restricted management for other sucking pests as it is responsible for whitefly resurgence and exact mechanism is unknown.

Seed cotton yield: The pooled analysis of all the experiments revealed significantly higher

seed cotton yield in fipronil 5SC @ 2000 ml/ha at 40-60 days after sowing and fipronil 5 SC (@ 1500 ml/ha) + one more after 10-15 days (25.10 and 25.00 q/ha) being *at par* with diafenthiuron 50WP @ 500 g/ha (25.19 q/ha) as compared to all other treatments were recorded. However, all the treatments gave higher seed cotton yield in comparison to control (Table 3). Badgujar *et al.*, (2014) also reported highest yield with fipronil 5 SC and lower incidence of thrips was observed. It did not show any phytotoxicity to cotton in all the treatments in the experiments conducted during study period.

Thrips are new generation pests as earlier this is not a pest but from 2016-2017 onwards this pests gain importance and start causing economic loss the farmer. It can be concluded that, fipronil 5SC @ 2000 ml/ha at 40-60 days found effective for the control of thrips in cotton and has also recorded the highest seed cotton being *at par* with standard check diafenthiuron 50WP. Fipronil 5SC at all the tested dosages did not causing any phytotoxicity to the crop. Hence, Fipronil 5SC can be a good product for the effective management of thrips in cotton.

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