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KA Biradarpatil
Ph.D Scholar (Agricultural
Entomology), University of
Agricultural Sciences, Dharwad,
Karnataka, India

ST Prabhu
Professor and Head, Department
of Agricultural Entomology,
College of Agriculture
Hanumanamatti, University of
Agricultural Sciences, Dharwad,
Karnataka, India

Corresponding Author:
KA Biradarpatil
Ph.D Scholar (Agricultural
Entomology), University of
Agricultural Sciences, Dharwad,
Karnataka, India

Evaluation of newer acaricides against yellow mite *polyphagotarsonemus latus* (Banks) on *Bt* cotton.

KA Biradarpatil, ST Prabhu

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Abstract

Field trial was conducted for two consecutive years during kharif 2017 and 2018 at farmer's field, Kadarmandalagi by using randomized block design (RBD). In both years, among the 12 treatments including untreated plot tested against yellow mite stages indicated that lowest mean population of yellow mite egg and active stages recorded in spiromesifen 280 SC @ 100 g.a.i/ ha and propargite 57 EC @ 570 g.a.i/ ha treated plots followed by diafenthiuron 50 WP @ 400 g.a.i/ ha and fenazaquin 10 EC @ 125 g.a.i/ ha. However, among the chemicals, predatory mite activity noticed more in bifenthrin 10 EC @ 80 g.a.i/ ha treated plot followed by buprofezin 25 SC @ 150 g.a.i/ ha treated plot. Seed cotton yield revealed that the treatment with propargite 57 EC @ 570 g.a.i/ ha recorded highest yield and net returns (26.99 q/ ha and 110348 Rs/ ha) and significantly superior compared to other treatments.

Keywords: Cotton, yellow mite, acaricide, management, yield

Introduction

Cotton (*Gossypium spp.*) is one of the important cash crops in India. It is often referred as "White Gold" or "King of fibers" and it belongs to the family Malvaceae. It is one of the most ancient and important commercial crop next only to food grains and is the principal raw material for a flourishing textile industry. Cotton finds mention in the *Rig Veda* and *Manu's Dharma Shastra* (Narayanan *et al.*, 2002). Cotton is harvested as 'seed cotton' which is then 'ginned' to separate the seed and lint. Despite the promising scenario in cotton, several factors are responsible for reduction in yield and quality deterioration of cotton in India. Insect pests form a vital factor. About 162 species of insects occur in cotton at various stages of growth of which 15 are key pests (Kannan *et al.*, 2004). The development of transgenic cotton has resulted in an immensely increase in the seed cotton yield and reduction in the number of insecticidal sprays from 3.10 to 1.17 and second generation *Bt* cotton has given solution to the bollworm complex to the large extent but at the same time they are susceptible to most of the sucking pests. In Karnataka, yellow mite, *Polyphagotarsonemus latus* is serious pest on chilli and causes considerable damage but in recent past years, it is assuming a major status on *Bt* cotton ecosystem also and causing puckering of leaves, reddening and stunted growth (Hosamani *et al.*, 2009). It was felt necessary to study evaluate acaricides to combat *P. latus* on *Bt* cotton.

Material and Methods

To evaluate different newer acaricides for the management of yellow mite, *P. latus*, a field experiment was laid out in randomized block design (RBD) at Farmer's field during *kharif* 2017-18 and 2018-19. The experiment consists of twelve treatments including an untreated control with three replications. *Bt* cotton hybrid MRC-7351 was raised with 90 cm x 60 cm spacing between the rows and plants, respectively. In each plot, five plants were randomly selected and tagged for observation.

Based on the incidence of yellow mite, acaricides were applied twice at 45 and 65 DAS. Pretreatment observations were recorded a day before application and post-treatment observations at 1, 3, 7 and 10 days after each application. Three young growing leaves were sampled from five tagged plants to record the number of eggs, active stages (Nymphs +

Adults) and predatory mite per leaf. All agronomic practices were followed as per the recommended package of practices and later data were subjected to analyzed statistically after ($\sqrt{x+0.5}$) transformations.

Results

Ovicidal action of newer acaricides on yellow mite eggs in *Bt* cotton during *kharif* 2017

The results on the efficacy of various treatments in reducing the yellow mite egg population are furnished here under

Pooled (1st and 2nd spray)

The pooled analysis of two sprays revealed that, among different chemical treatments, spiromesifen 280 SC @ 100 g.a.i/ ha was found to be quite promising by recording the least mean number of yellow mite egg and highest per cent reduction over control (0.55 yellow mite egg/ leaf and 92.40%) followed by diafenthiuron 50 WP @ 400 g.a.i/ ha (0.64 yellow mite egg/ leaf and 91.16%) while propargite 57 EC @ 570 g.a.i/ ha (0.75 yellow mite egg/ leaf and 89.64%), fenazaquin 10 EC @ 125 g.a.i/ ha (0.83 yellow mite egg/ leaf and 88.53%) and chlorfenapyr 10 SC @ 100 g.a.i/ ha (0.94 yellow mite egg/ leaf and 87.02%) were found to be next best treatments. However, the mean number of yellow mite egg (7.24/ leaf) was continued to be on higher side in untreated control (Table 1).

Ovicidal action of newer acaricides on yellow mite eggs in *Bt* cotton during *kharif* 2018

The data on the efficacy of various treatments in reducing the number of yellow mite egg are described below

Pooled (1st and 2nd spray)

The results on pooled analysis of two sprays recorded that, among the treatments spiromesifen 280 SC @ 100 g.a.i/ ha was found to be superior by recording the least number of yellow mite egg and highest per cent reduction of yellow mite egg (0.53 yellow mite egg/ leaf and 92.49%) followed by diafenthiuron 50 WP @ 400 g.a.i/ ha (0.63 yellow mite egg/ leaf and 91.07%) and propargite 57 EC @ 570 g.a.i/ ha (0.73 yellow mite egg/ leaf and 89.66%). However, fenazaquin 10 EC @ 125 g.a.i/ ha (0.82 yellow mite egg/ leaf and 88.38%) and chlorfenapyr 10 SC @ 100 g.a.i/ ha (0.90 yellow mite egg/ leaf and 87.25%) were found to be next best treatments. On the contrary, the number of yellow mite egg was continued to be on higher side in untreated control (7.06 yellow mite egg/ leaf) (Table 2).

Efficacy of newer acaricides against active stages of yellow mite in *Bt* cotton during *kharif* 2017

The results on the efficacy of various treatments in reducing the active stages of yellow mite population are furnished below

Pooled (1st and 2nd spray)

The results on the mean population of active stages of yellow mite after two sprays revealed that, among the treatments propargite 57 EC @ 570 g.a.i/ ha was found to be quite promising by recording the least population and highest per cent reduction of yellow mite (0.31 yellow mite/ leaf and 93.46%) and followed by spiromesifen 80 SC @ 100 g.a.i/ ha (0.34 yellow mite/ leaf and 92.83%) and diafenthiuron 50 WP @ 400 g.a.i/ ha (0.51 yellow mite/ leaf and 89.24%). However, fenazaquin 10 EC @ 125 g.a.i/ ha (0.53 yellow mite/ leaf and 88.82%), chlorfenapyr 10 SC @ 100 g.a.i/ ha

(0.61 yellow mite/ leaf and 87.13%) and fenpyroximate 5 EC 30 g.a.i/ ha (0.65 yellow mite/ leaf and 86.29%) were found to be next best treatments. On the contrary, the population of yellow mite (4.74 yellow mite/ leaf) was continued to be on higher side in untreated check (Table 3).

Efficacy of newer acaricides against active stages of yellow mite in *Bt* cotton during *kharif* 2018

The bioefficacy of acaricides against active stages of yellow mite are described below.

Pooled (1st and 2nd spray)

The results on mean yellow mite population after two sprays revealed that, propargite 57 EC @ 570 g.a.i/ ha was found to be best chemical by recording the least population and highest per cent reduction (0.31 yellow mite/ leaf and 93.61%) of yellow mite among the treatments and followed by spiromesifen 280 SC @ 100 g.a.i/ ha (0.35 yellow mite/ leaf and 92.78%) and diafenthiuron 50 WP @ 400 g.a.i/ ha (0.52 yellow mite/ leaf and 89.28%). However, fenazaquin 10 EC @ 125 g.a.i/ ha (0.54 yellow mite/ leaf and 88.86%), chlorfenapyr 10 SC @ 100 g.a.i/ ha (0.61 yellow mite/ leaf and 87.42%) and fenpyroximate 5 EC 30 g.a.i/ ha (0.66 yellow mite/ leaf and 86.39%) were found to be next best treatments. On the contrary, the population of yellow mite was continued to be on higher side (4.85 yellow mite/ leaf) in untreated control (Table 4)

Impact of newer acaricides on predatory mite *Amblyseius ovalis* (Evans) population in *Bt* cotton during *kharif* 2017

The data on the effect of various treatments on activity of predatory mite are described below.

Pooled (1st and 2nd spray)

The results on pooled analysis of two sprays recorded that, among the treatments bifenthrin 10 EC @ 80 g.a.i/ ha was found to be quite promising by recording the highest number of predatory mite and least per cent reduction of predatory mite (0.34 predatory mite/ leaf and 62.64%) followed by buprofezin 25 SC @ 150 g.a.i/ ha (0.31 predatory mite/ leaf and 65.93%) and dicofol 18.50 EC @ 85 g.a.i/ ha (0.29 predatory mite/ leaf and 68.13%). However, propargite 57 EC @ 570 g.a.i/ ha (0.07 predatory mite/ leaf and 92.31%) and spiromesifen 280 SC @ 100 g.a.i/ ha (0.09 predatory mite/ leaf and 90.11%) treatments were found to be highest negative effect on activity of predatory mite (Table 5).

Impact of newer acaricides on predatory mite *Amblyseius ovalis* (Evans) population in *Bt* cotton during *kharif* 2018

The effect of various treatments on activity of predatory mite population after first, second and pooled sprayings are furnished below.

Pooled (1st and 2nd spray)

The results on the mean population of active stages of predatory mite after two sprays revealed that, bifenthrin 10 EC @ 80 g.a.i/ ha was found superior by recording the highest population and least per cent reduction predatory mite (0.36 predatory mite/ leaf and 60.44%) among the treatments and followed by buprofezin 25 SC @ 150 g.a.i/ ha (0.33 predatory mite/ leaf and 63.74%) and dicofol 18.50 EC @ 85 g.a.i/ ha (0.31 predatory mite/ leaf and 65.93%). However, etoxazole 10 EC @ 40 g.a.i/ ha (0.29 predatory mite/ leaf and 68.13%) and hexythiazox 5.45 EC @ 25 g.a.i/ ha (0.24 predatory mite/ leaf and 73.63%) were found to be next best treatments. On

the contrary, the population of predatory mite (0.91 predatory mite/ leaf) was continued to be on higher side in untreated check (Table 6).

Seed cotton yield

Pooled data of two seasons on seed cotton yield revealed that propargite 57 EC @ 570 g.a.i/ ha (26.99 q/ ha) recorded significantly highest yield and was on par with spiromesifen 280 SC @ 100 g.a.i/ ha (26.30 q/ ha). Next best in order of superiority was diafenthiuron 50 WP @ 400 g.a.i/ ha (25.21 q/ ha) and was on par with fenazaquin 10 EC @ 125 g.a.i/ ha (24.22 q/ ha). However, untreated check recorded least yield (17.69 q/ha) and was inferior to rest of the treatments (Table 39).

With respect to cost effectiveness, propargite 57 EC @ 570 g.a.i/ ha proved to be the best economical treatments as realized by the highest net returns (Rs 110348). The next best treatments were spiromesifen 280 SC @ 100 g.a.i/ ha and diafenthiuron 50 WP @ 400 g.a.i/ ha by recording net returns Rs 106660 and Rs 100692 respectively (Table 7).

Discussion

The post treatment mean indicated the superiority of spiromesifen 280 SC @ 100 g.a.i/ ha in reducing number of yellow mite egg followed by diafenthiuron 50 WP @ 400 g.a.i/ ha, propargite 57 EC @ 570 g.a.i/ ha and fenazaquin 10 EC @ 125 g.a.i/ ha. For the reduction of active stages of yellow mite, propargite 57 EC @ 570 g.a.i/ ha showed significant superiority and the next best treatments were spiromesifen 280 SC @ 100 g.a.i/ ha, diafenthiuron 50 WP @ 400 g.a.i/ ha and fenazaquin 10 EC @ 125 g.a.i/ ha. However, among the chemicals, predatory mite activity noticed more in bifenthrin 10 EC @ 80 g.a.i/ ha treated plot followed by buprofezin 25 SC @ 150 g.a.i/ ha treated plot.

Seed cotton yield revealed that the treatment with propargite 57 EC @ 570 g.a.i/ ha recorded highest yield and net returns (26.99 q/ ha and 110348 Rs/ ha) and significantly superior compared to other treatments. Next best treatments were

spiromesifen 280 SC @ 100 g.a.i/ ha, diafenthiuron 50 WP @ 400 g.a.i/ ha and fenazaquin 10 EC @ 125 g.a.i/ ha

Documented evidences of using newer acaricides against yellow mite egg in cotton are very limited. Present results obtained with the application of spiromesifen 280 SC @ 100 g.a.i/ ha corroborates with earlier results of Samanta A. *et al.* (2017) who noticed that, among the treatments, spiromesifen 24SC @ 120 g a.i. ha-1 and diafenthiuron 50 WP @ 375 g a.i. ha-1 were observed to be very much effective against yellow mite. Results with respect to effect of acaricides on active stages are in agreement with Chinniah (2013) also reported that propargite 57% EC @3ml/ lit., spiromesifen 240 SC @0.7ml/ lit., abamectin 1.8% EC @ 0.5ml/ lit. and fenpyroximate 5% EC @ 0.8ml/ lit. were equally effective in suppressing mite population.

Except in bifenthrin 10 EC @ 80 g.a.i/ ha and buprofezin 25 SC @ 150 g.a.i/ ha, remaining all acaricide were highly detrimental to predatory mite in both seasons (*kharif* 2017 and *kharif* 2018). It may be probably due to good control of yellow mite, which resulted in poor activity or survival of this obligate predatory mite, *A. ovalis*. However, in present study prey to predator ratio is wider so pest population may be increase in future. Scanty literature is available on the safety or effect of various acaricides on the activity of predatory mite under field conditions. However, ill effects of acaricides on predatory mites was reported by Hegde (1993) and Smitha (2002) in cotton and chilli ecosystem, respectively. Chandrashekarappa (1995) documented similar results under laboratory conditions. With decrease in the mite population, the predatory mite population also decreased accordingly. This shows density dependent predatory prey interaction.

As a result cotton yield obtained from these acaricide (propargite 57 EC, spiromesifen 280 SC, diafenthiuron 50 WP and fenazaquin 10 EC) treatments were statistically on par and thus it may be suggested to use any of these acaricides for satisfactory control of yellow mite in *Bt* cotton (eggs as well as active stages) and to obtain good yield from cotton crop.

Table 1: Ovicidal action of newer acaricides on yellow mite eggs in *Bt* cotton during *kharif* 2017 (pooled)

Treatment	Dosage (g.a.i/ha)	No. of eggs per leaf					Mean	Percent reduction over control
		1 DBS	1 DAS	3 DAS	7 DAS	10 DAS		
T1- Diafenthiuron 50 WP	400	3.75 ^a	2.23 (1.65) ^{ab}	0.32 (0.90) ^{ab}	0.00 (0.71) ^a	0.00 (0.71) ^a	0.64	91.16
T2- Propargite 57 EC	570	3.38 ^a	2.43 (1.71) ^{abc}	0.47 (0.98) ^{abc}	0.10 (0.77) ^a	0.00 (0.71) ^a	0.75	89.64
T3- Fenazaquin 10 EC	125	3.78 ^a	2.56 (1.75) ^{abc}	0.62 (1.06) ^{abc}	0.15 (0.81) ^{ab}	0.00 (0.71) ^a	0.83	88.53
T4- Chlorfenapyr 10 SC	100	4.21 ^a	2.69 (1.78) ^{abcd}	0.76 (1.12) ^{bcd}	0.31 (0.90) ^{abc}	0.00 (0.71) ^a	0.94	87.02
T5- Fenpyroximate 5 EC	30	4.01 ^a	2.98 (1.87) ^{bcd}	0.89 (1.18) ^{bcd}	0.42 (0.96) ^{bcd}	0.00 (0.71) ^a	1.07	85.22
T6- Buprofezin 25 SC	150	4.28 ^a	3.48 (2.00) ^{cd}	1.26 (1.32) ^{cd}	0.77 (1.13) ^d	0.30 (0.89) ^b	1.45	79.97
T7- Bifenthrin 10 EC	80	4.25 ^a	3.58 (2.02) ^d	1.37 (1.37) ^d	0.82 (1.15) ^d	0.34 (0.91) ^b	1.54	78.72
T8- Spiromesifen 240 SC	100	4.30 ^a	2.03 (1.59) ^a	0.15 (0.80) ^a	0.00 (0.71) ^a	0.00 (0.71) ^a	0.55	92.40
T9- Hexythiazox 5.45 EC	25	4.38 ^a	3.08 (1.89) ^{bcd}	0.98 (1.22) ^{bcd}	0.54 (1.02) ^{ab}	0.12 (0.79) ^{ab}	1.18	83.70
T10- Etoxazole 10 SC	40	4.30 ^a	3.16 (1.91) ^{bcd}	1.06 (1.21) ^{bcd}	0.62 (1.06) ^{ab}	0.24 (0.86) ^{ab}	1.27	82.46
T11- Dicofol 18.50 EC	85	4.06 ^a	3.27 (1.94) ^{bcd}	1.17 (1.29) ^{bcd}	0.70 (1.10) ^{ab}	0.26 (0.87) ^{ab}	1.35	81.35
T12- Untreated control		6.30 ^a	7.05 (2.74) ^e	7.08 (2.75) ^e	7.39 (2.81) ^e	7.45 (2.83) ^e	7.24	
S.Em.±		--	0.090	0.045	0.071	0.052		
C.D. at 5%		--	0.263	0.132	0.209	0.152		
C.V. (%)		NS	7.286	5.725	10.627	9.403		

Table 2: Ovicidal action of newer acaricides on yellow mite eggs in *Bt* cotton during *kharif* 2018 (pooled)

Treatment	Dosage (g.a.i/ha)	No. of eggs per leaf					Mean	Percent reduction over control
		1 DBS	1 DAS	3 DAS	7 DAS	10 DAS		
T1- Diafenthiuron 50 WP	400	4.52 ^a	2.21 (1.64) ^{ab}	0.29 (0.89) ^{ab}	0.00 (0.71) ^a	0.00 (0.71) ^a	0.63	91.07
T2- Propargite 57 EC	570	3.91 ^a	2.38 (1.70) ^{abc}	0.44 (0.97) ^{abc}	0.11 (0.77) ^a	0.00 (0.71) ^a	0.73	89.66
T3- Fenazaquin 10 EC	125	4.12 ^a	2.52 (1.74) ^{abc}	0.58 (1.04) ^{abc}	0.15 (0.81) ^{ab}	0.00 (0.71) ^a	0.82	88.38
T4- Chlorfenapyr 10 SC	100	3.83 ^a	2.62 (1.77) ^{abcd}	0.71 (1.10) ^{bcd}	0.26 (0.87) ^{abc}	0.00 (0.71) ^a	0.90	87.25
T5- Fenpyroximate 5 EC	30	4.35 ^a	2.91 (1.85) ^{bcd}	0.85 (1.16) ^{bcd}	0.40 (0.95) ^{bcd}	0.00 (0.71) ^a	1.04	85.27
T6- Buprofezin 25 SC	150	4.20 ^a	3.32 (1.95) ^{bcd}	1.25 (1.32) ^{cd}	0.81 (1.15) ^d	0.33 (0.91) ^b	1.45	79.46
T7- Bifenthrin 10 EC	80	4.34 ^a	3.41 (1.97) ^d	1.35 (1.36) ^d	0.84 (1.16) ^d	0.34 (0.91) ^b	1.48	79.04
T8- Spiromesifen 240 SC	100	4.09 ^a	1.97 (1.57) ^a	0.17 (0.82) ^a	0.00 (0.71) ^a	0.00 (0.71) ^a	0.53	92.49
T9- Hexythiazox 5.45 EC	25	3.96 ^a	3.03 (1.88) ^{bcd}	0.98 (1.22) ^{bcd}	0.54 (1.02) ^{cd}	0.12 (0.77) ^{ab}	1.28	81.87
T10- Etoxazole 10 SC	40	4.12 ^a	3.10 (1.90) ^{bcd}	1.06 (1.21) ^{bcd}	0.66 (1.08) ^{cd}	0.20 (0.82) ^{ab}	1.26	82.15
T11- Dicofol 18.50 EC	85	4.19 ^a	3.22 (1.93) ^{bcd}	1.17 (1.29) ^{cd}	0.71 (1.10) ^d	0.27 (0.88) ^{ab}	1.34	81.02
T12- Untreated control		6.18 ^a	6.56 (2.65) ^e	7.19 (2.77) ^e	7.20 (2.77) ^e	7.28 (2.79) ^e	7.06	
S.Em.±	--	--	0.087	0.075	0.049	0.023		
C.D. at 5%	--	--	0.255	0.221	0.143	0.068		
C.V. (%)		NS	9.417	11.270	8.375	5.266		

Table 3: Efficacy of newer acaricides against active stages of yellow mite in *Bt* cotton during *kharif* 2017 (pooled)

Treatment	Dosage (g.a.i/ha)	No. of active stages per leaf					Mean	Percent reduction over control
		1 DBS	1 DAS	3 DAS	7 DAS	10 DAS		
T1- Diafenthiuron 50 WP	400	2.65 ^a	1.43 (1.39) ^{abc}	0.59 (1.04) ^{abc}	0.00 (0.71) ^a	0.00 (0.71) ^a	0.51	89.24
T2- Propargite 57 EC	570	2.67 ^a	1.23 (1.31) ^a	0.00 (0.71) ^a	0.00 (0.71) ^a	0.00 (0.71) ^a	0.31	93.46
T3- Fenazaquin 10 EC	125	2.48 ^a	1.48 (1.40) ^{abc}	0.64 (1.06) ^{abc}	0.00 (0.71) ^a	0.00 (0.71) ^a	0.53	88.82
T4- Chlorfenapyr 10 SC	100	2.91 ^a	1.54 (1.43) ^{abc}	0.72 (1.10) ^{bcd}	0.17 (0.81) ^{ab}	0.00 (0.71) ^a	0.61	87.13
T5- Fenpyroximate 5 EC	30	2.60 ^a	1.62 (1.45) ^{abc}	0.76 (1.12) ^{bcd}	0.20 (0.82) ^{ab}	0.00 (0.71) ^a	0.65	86.29
T6- Buprofezin 25 SC	150	2.53 ^a	1.91 (1.55) ^{bc}	0.96 (1.21) ^{cd}	0.34 (0.92) ^b	0.21 (0.83) ^b	0.86	81.86
T7- Bifenthrin 10 EC	80	2.89 ^a	1.95 (1.56) ^c	0.96 (1.21) ^{cd}	0.35 (0.92) ^b	0.24 (0.85) ^b	0.88	81.43
T8- Spiromesifen 240 SC	100	2.77 ^a	1.34 (1.36) ^{ab}	0.00 (0.71) ^a	0.00 (0.71) ^a	0.00 (0.71) ^a	0.34	92.83
T9- Hexythiazox 5.45 EC	25	2.64 ^a	1.72 (1.49) ^{bc}	0.84 (1.16) ^{bcd}	0.26 (0.87) ^{ab}	0.09 (0.77) ^{ab}	0.73	84.60
T10- Etoxazole 10 SC	40	2.31 ^a	1.83 (1.53) ^{bc}	0.86 (1.17) ^{bcd}	0.29 (0.88) ^{ab}	0.12 (0.78) ^{ab}	0.77	83.75
T11- Dicofol 18.50 EC	85	2.53 ^a	1.87 (1.54) ^{bc}	0.90 (1.18) ^{cd}	0.32 (0.90) ^b	0.16 (0.80) ^{ab}	0.81	82.91
T12- Untreated control		3.62 ^a	4.28 (2.19) ^d	4.55 (2.25) ^e	4.89 (2.32) ^c	5.24 (2.40) ^c	4.74	
S.Em.±	--	--	0.094	0.085	0.035	0.044		
C.D. at 5%	--	--	0.277	0.250	0.104	0.129		
C.V. (%)		NS	10.606	12.514	6.464	8.482		

Table 4: Efficacy of newer acaricides against active stages of yellow mite in *Bt* cotton during *kharif* 2018 (pooled)

Treatment	Dosage (g.a.i/ha)	No. of active stages per leaf					Mean	Percent reduction over control
		1 DBS	1 DAS	3 DAS	7 DAS	10 DAS		
T1- Diafenthiuron 50 WP	400	2.63 ^a	1.46 (1.40) ^{abc}	0.63 (1.06) ^{abc}	0.00 (0.71) ^a	0.00 (0.71) ^a	0.52	89.28
T2- Propargite 57 EC	570	2.39 ^a	1.23 (1.31) ^a	0.00 (0.71) ^a	0.00 (0.71) ^a	0.00 (0.71) ^a	0.31	93.61
T3- Fenazaquin 10 EC	125	2.86 ^a	1.50 (1.41) ^{abc}	0.67 (1.08) ^{abc}	0.00 (0.71) ^a	0.00 (0.71) ^a	0.54	88.86
T4- Chlorfenapyr 10 SC	100	2.43 ^a	1.55 (1.43) ^{abc}	0.72 (1.10) ^{bcd}	0.17 (0.81) ^{ab}	0.00 (0.71) ^a	0.61	87.42
T5- Fenpyroximate 5 EC	30	2.48 ^a	1.63 (1.46) ^{abc}	0.79 (1.13) ^{bcd}	0.23 (0.85) ^{ab}	0.00 (0.71) ^a	0.66	86.39
T6- Buprofezin 25 SC	150	3.07 ^a	2.08 (1.61) ^{bc}	0.97 (1.21) ^{cd}	0.38 (0.94) ^b	0.24 (0.86) ^b	0.89	81.65
T7- Bifenthrin 10 EC	80	2.90 ^a	1.99 (1.50) ^c	1.01 (1.23) ^{cd}	0.39 (0.94) ^b	0.27 (0.87) ^b	0.92	81.03
T8- Spiromesifen 240 SC	100	2.28 ^a	1.37 (1.37) ^{ab}	0.00 (0.71) ^a	0.00 (0.71) ^a	0.00 (0.71) ^a	0.35	92.78
T9- Hexythiazox 5.45 EC	25	2.52 ^a	1.73 (1.49) ^{abc}	0.84 (1.16) ^{bcd}	0.26 (0.87) ^{ab}	0.09 (0.77) ^{ab}	0.73	84.95
T10- Etoxazole 10 SC	40	2.57 ^a	1.85 (1.53) ^{bc}	0.88 (0.18) ^{bcd}	0.30 (0.89) ^{ab}	0.13 (0.78) ^{ab}	0.80	83.50
T11- Dicofol 18.50 EC	85	2.70 ^a	1.94 (1.56) ^{bc}	0.95 (1.20) ^{cd}	0.35 (0.92) ^b	0.18 (0.82) ^{ab}	0.86	82.27
T12- Untreated control		3.63 ^a	4.14 (2.15) ^d	4.42 (2.22) ^e	4.85 (2.31) ^c	5.98 (2.55) ^c	4.85	
S.Em.±	--	--	0.082	0.072	0.024	0.041		
C.D. at 5%	--	--	0.241	0.210	0.072	0.120		
C.V. (%)		NS	9.568	11.046	6.528	7.904		

Table 5: Impact of newer acaricides on predatory mite *Amblyseius ovalis* (Evans) population in *Bt* cotton during *kharif* 2017 (pooled)

Treatment	Dosage (g.a.i/ha)	No. of predatory mite per leaf					Mean	Percent reduction over control
		1 DBS	1 DAS	3 DAS	7 DAS	10 DAS		
T1- Diafenthiuron 50 WP	400	0.73 ^a	0.32 (0.90) ^{de}	0.12 (0.79) ^{de}	0.00 (0.71) ^d	0.00 (0.71) ^d	0.11	87.91
T2- Propargite 57 EC	570	0.74 ^a	0.26 (0.87) ^e	0.00 (0.71) ^e	0.00 (0.71) ^d	0.00 (0.71) ^d	0.07	92.31
T3- Fenazaquin 10 EC	125	0.67 ^a	0.36 (0.92) ^d	0.17 (0.81) ^{de}	0.00 (0.71) ^d	0.00 (0.71) ^d	0.13	85.71
T4- Chlorfenapyr 10 SC	100	0.92 ^a	0.39 (0.93) ^{cd}	0.19 (0.82) ^d	0.00 (0.71) ^d	0.00 (0.71) ^d	0.15	83.52
T5- Fenpyroximate 5 EC	30	0.74 ^a	0.40 (0.93) ^{cd}	0.23 (0.85) ^d	0.06 (0.75) ^{bcd}	0.00 (0.71) ^d	0.17	81.32
T6- Buprofezin 25 SC	150	0.82 ^a	0.56 (1.03) ^{bc}	0.35 (0.92) ^{bc}	0.20 (0.84) ^b	0.13 (0.79) ^{bc}	0.31	65.93
T7- Bifenthrin 10 EC	80	0.79 ^a	0.58 (1.04) ^{bc}	0.39 (0.93) ^b	0.23 (0.85) ^b	0.15 (0.80) ^b	0.34	62.64
T8- Spiromesifen 240 SC	100	0.79 ^a	0.30 (0.89) ^{de}	0.03 (0.72) ^e	0.00 (0.71) ^d	0.00 (0.71) ^d	0.09	90.11
T9- Hexythiazox 5.45 EC	25	0.80 ^a	0.48 (0.99) ^{bcd}	0.26 (0.87) ^{cd}	0.14 (0.79) ^{bc}	0.05 (0.73) ^{bcd}	0.24	73.63
T10- Etoxazole 10 SC	40	0.88 ^a	0.51 (1.00) ^{bcd}	0.28 (0.88) ^{cd}	0.16 (0.80) ^{bc}	0.07 (0.74) ^{bcd}	0.26	71.43
T11- Dicofof 18.50 EC	85	0.86 ^a	0.53 (1.01) ^{bc}	0.31 (0.90) ^c	0.18 (0.81) ^{bc}	0.12 (0.78) ^{bc}	0.29	68.13
T12- Untreated control		0.88 ^a	0.89 (1.18) ^a	0.91 (1.19) ^a	0.91 (1.19) ^a	0.92 (1.20) ^a	0.91	
S.Em.±	--		0.064	0.027	0.012	0.031		
C.D. at 5%	--		0.189	0.079	0.035	0.091		
C.V. (%)	NS		7.538	6.480	6.321	6.227		

Table 6: Impact of newer acaricides on predatory mite *Amblyseius ovalis* (Evans) population in *Bt* cotton during *kharif* 2018 (pooled)

Treatment	Dosage (g.a.i/ha)	No. of predatory mite per leaf					Mean	Percent reduction over control
		1 DBS	1 DAS	3 DAS	7 DAS	10 DAS		
T1- Diafenthiuron 50 WP	400	0.75 ^a	0.33 (0.91) ^{de}	0.15 (0.80) ^{de}	0.00 (0.71) ^d	0.00 (0.71) ^d	0.12	86.81
T2- Propargite 57 EC	570	0.75 ^a	0.29 (0.89) ^e	0.04 (0.73) ^e	0.00 (0.71) ^d	0.00 (0.71) ^d	0.08	91.21
T3- Fenazaquin 10 EC	125	0.86 ^a	0.38 (0.93) ^d	0.18 (0.82) ^{de}	0.00 (0.71) ^d	0.00 (0.71) ^d	0.14	84.61
T4- Chlorfenapyr 10 SC	100	0.76 ^a	0.42 (0.96) ^{cd}	0.22 (0.85) ^d	0.05 (0.73) ^{bcd}	0.00 (0.71) ^d	0.17	81.32
T5- Fenpyroximate 5 EC	30	0.88 ^a	0.43 (0.96) ^{cd}	0.24 (0.86) ^d	0.07 (0.75) ^{bcd}	0.00 (0.71) ^d	0.19	79.12
T6- Buprofezin 25 SC	150	0.84 ^a	0.58 (1.04) ^{bc}	0.36 (0.93) ^{bc}	0.23 (0.85) ^b	0.15 (0.80) ^{bc}	0.33	63.74
T7- Bifenthrin 10 EC	80	0.80 ^a	0.60 (1.05) ^{bc}	0.41 (0.96) ^b	0.24 (0.86) ^b	0.17 (0.81) ^{bc}	0.36	60.44
T8- Spiromesifen 240 SC	100	0.74 ^a	0.33 (0.91) ^{de}	0.05 (0.73) ^e	0.00 (0.71) ^d	0.00 (0.71) ^d	0.10	89.01
T9- Hexythiazox 5.45 EC	25	0.75 ^a	0.49 (0.99) ^{bcd}	0.28 (0.89) ^{cd}	0.15 (0.81) ^{bc}	0.05 (0.73) ^{cd}	0.24	73.63
T10- Etoxazole 10 SC	40	0.85 ^a	0.53 (1.02) ^{bcd}	0.31 (0.90) ^{cd}	0.19 (0.82) ^{bc}	0.13 (0.79) ^{bc}	0.29	68.13
T11- Dicofof 18.50 EC	85	0.84 ^a	0.55 (1.03) ^{bc}	0.31 (0.90) ^{cd}	0.20 (0.82) ^{bc}	0.15 (0.80) ^{bc}	0.31	65.93
T12- Untreated control		0.87 ^a	0.88 (1.16) ^a	0.90 (1.18) ^a	0.94 (1.20) ^a	0.90 (1.18) ^a	0.91	
S.Em.	--		0.024	0.031	0.040	0.009		
C.D. at 5%	--		0.072	0.092	0.119	0.026		
C.V. (%)	NS		6.379	5.895	8.203	6.860		

Table 7: Economics of different acaricides against yellow mite, *P. latus* on *Bt* cotton during *kharif* 2017, 2018 and pooled

Treatments	Dosage (g.a.i / ha)	Treatment cost (Rs. / ha)			Average yield (q / ha)			Average gross returns (Rs. / ha)			Net returns (Rs. / ha)		
		2017	2018	Pooled	2017	2018	Pooled	2017	2018	pooled	2017	2018	Pooled
T1-Diafenthiuron 50 WP	400	1400	1400	1400	24.73	25.69	25.21	128596	133588	131092	98196	103188	100692
T2-Propargite 57 EC	570	1000	1000	1000	26.45	27.52	26.99	137540	143104	140348	107540	113104	110348
T3-Fenazaquin 10 EC	125	900	900	900	23.89	24.55	24.22	124228	127660	125944	94328	97760	96044
T4-Chlorfenapyr 10 SC	100	1000	1000	1000	23.23	23.86	23.55	120796	124072	122460	90796	94072	92460
T5-Fenpyroximate 5 EC	30	1100	1100	1100	22.76	23.27	23.02	118352	121004	119704	88252	90904	89604
T6-Buprofezin 25 SC	150	750	750	750	20.94	21.17	21.06	108888	110084	109512	79138	80334	79762
T7-Bifenthrin 10 EC	80	900	900	900	20.66	20.94	20.80	107432	108888	108160	77532	78988	78260
T8-Spiromesifen 240 SC	100	1100	1100	1100	25.77	26.82	26.30	134004	139464	136760	103904	109364	106660
T9-Hexythiazox 5.45 EC	25	1000	1000	1000	22.17	22.80	22.49	115284	118560	116948	85284	88560	86948
T10-Etoxazole 10 SC	40	1300	1300	1300	21.58	22.23	21.91	112216	115596	113932	81916	85296	83632
T11-Dicofof 18.50 EC	85	900	900	900	21.25	21.78	21.52	110500	113256	111904	80600	83356	82004
T12-Untreated control					17.24	18.13	17.69	89648	94276	91988	60648	65276	62988

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