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Evaluation of new combi-molecules against insect pests of cotton

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Abstract

The field experiments were conducted to evaluate the efficacy of new molecules in combination and alone against insect pests of cotton (sucking and bollworms) at Agricultural Research Station-Banswara (Rajasthan) during *khariif* -2016 and 2017. The trial was laid out in a randomized block design (RBD) with eleven treatments including untreated check, each replicated thrice. The results revealed that both the doses of sulfoxaflor 30% WG i.e. 437.5 and 375 ml ha⁻¹ were found very effective against jassids with highest percent control. Whereas, pyriproxyfen 5% EC @750 ml ha⁻¹ and pyriproxyfen 5% EC + fenpropathrin 15% EC @ 750 ml ha⁻¹ were found more effective against whiteflies and also gave highest seed cotton yield.

Keywords: Efficacy, combi products, spinetoram 10% w/w + sulfoxaflor 30% w/w WG, pyriproxyfen 5% EC + fenpropathrin 15% EC cotton and insect pests

Introduction

Cotton, which is often referred to as “King of fibres” or “White gold”, is grown commercially in many countries and India has a unique place among cotton growing nations of the world. In India, all the four cultivated species of cotton are grown under diverse agro-climatic conditions and contribute more than 65 percent of total raw material to the textile industry. Cotton plays major role in Indian economy, in terms of providing employment, directly or indirectly, to millions of people. In India, it is cultivated in 123.50 lakh ha area but its productivity is quite low as 469 kg lint per hectare ^[1].

After the introduction of Bt cotton hybrids, bollworm problem has been solved to some extent and a significant change in cropping pattern in the cotton growing areas has been observed ^[2, 3]. The major constraint in achievement of desired productivity levels in Bt cotton production is the sucking pests. More than 90 percent area in the country is under Bt cotton and Bt cotton is susceptible to sucking pests ^[4]. Among sucking pests, jassids, *Amrasca biguttula biguttula* (Ishida); whiteflies, *Bemisia tabaci* (Genn.); thrips, *Thrips tabaci* (Linn.) and aphids, *Aphis gossypii* (Glover) occupy major pest status and cause considerable damage in cotton. A yield loss of up to 21.2 percent is estimated in cotton due to sucking pests ^[5]. A reduction of 22.85 percent seed cotton yield due to sucking pests has also been reported ^[6]. Jassid, *Amrasca biguttula biguttula* (Ishida) is the most destructive insect pest of cotton, which causes 11.60-18.78 percent reduction in seed cotton yield ^[7, 8]. Similarly, whitefly harms indirectly to cotton by secreting honeydew and transmitting CLCuV diseases ^[9]. Number of insecticides of different groups have been tested and considered under general recommendation for the management of these insects. The repetitive use of synthetic insecticides as crop protectants against insect pests has posed serious threats to environment, humans, resistance in pests to insecticides and natural enemies. Therefore, attempts have been made to find out new chemistry molecules along with other alternatives for controlling devastating pests in crops.

Material and Methods

The field experiments were carried out at Agricultural Research Station-Banswara (Rajasthan) during *khariif*-2016 and 2017 to evaluate the efficacy of new molecules in combination and alone against insect pests of cotton (sucking and bollworms). The trial was laid out in a randomized block design (RBD) with eleven treatments including control; each replicated thrice (Table 1).

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Cotton variety, Suraj was dibbled at 90×45 cm spacing. The plot size was kept 6.0×5.4 m. All recommended package and practices were followed to raise the crop as per package and practice booklet of zone IV b, except plant protection measures. Observations on pest incidence were recorded from five fixed plants/plot which were tagged after selecting randomly for this purpose. The number of sucking pests namely, jassids (*Amrasca biguttula biguttula*) and whiteflies (*Bemisia tabaci*) were recorded from 3 leaves per plant before spray and 7 days after spray. Whereas, percent boll and locule damage due to bollworms were recorded at harvest. The seed cotton yield was recorded plot wise at harvest and it was converted into kg ha^{-1} for analysis and comparison.

Results and Discussion

The efficacy of different doses of new molecules in combination and alone were evaluated against insect pests of cotton under field conditions at Agricultural Research Station-Borwat Farm, Banswara during the year 2016 and 2017, the results of which are summarized in Table 2-4.

Efficacy against jassids (*Amrasca biguttula biguttula*)

The pre-treatment population of jassids was uniform and no significant difference was observed among the treatments/plots with respect to number of 14.33 to 15.67 & 16.33 to 17.67 during 2016 and 2017 per three leaves before spray, respectively. The minimum number of jassids (4.67 & 5.67/3 leaves during 2016 and 2017, respectively) was observed in sulfoxaflor 30% @ 437.5 ml ha^{-1} and significantly superior over rest of the treatments with maximum percent control (68.88 and 71.65% during both the years 7th days after of spray). The next best treatment was sulfoxaflor 30% @ 375 ml ha^{-1} and was statistically at par with spinetoram 10% w/w + sulfoxaflor 30% w/w WG @ 350 ml ha^{-1} , spinetoram 10% w/w + sulfoxaflor 30% w/w WG @ 300 ml ha^{-1} , pyriproxyfen 5% EC + fenprothrin 15% EC @ 750 ml ha^{-1} , and pyriproxyfen 5% EC @ 750 ml ha^{-1} . Whereas, maximum population of jassids (16.0 and 20.33/3leaves) was recorded in untreated check (Table 2).

Efficacy against whiteflies (*Bemisia tabaci*)

In case of whiteflies, the pre-treatment population of

whiteflies did not vary significantly in all the plots. The minimum number of whiteflies (9.00 & 10.00/3 leaves during 2016 and 2017, respectively) was observed in pyriproxyfen 5% EC @ 750 ml ha^{-1} and significantly superior over rest of the treatments with maximum percent control (61.97 and 66.67% during 2016 and 2017, respectively) after 7th days of spray. The next best treatment was pyriproxyfen 5% EC + fenprothrin 15% EC @ 750 ml ha^{-1} , sulfoxaflor 30% @ 437.5 ml , sulfoxaflor 30% @ 375 ml , spinetoram 10% w/w + sulfoxaflor 30% w/w WG @ 350 ml ha^{-1} and were statistically at par to each other. Whereas, maximum population of jassids (26.67 and 30.00/3 leaves) was recorded in untreated check (Table 3). The efficacy of these molecules was not evaluated against bollworms as there was no attack in the field.

Effect on seed cotton yield

The maximum mean seed cotton yield of 1505 kg ha^{-1} was recorded in sulfoxaflor 30% @ 437.5 ml ha^{-1} . It was followed by sulfoxaflor 30% @ 375 ml ha^{-1} , Spinetoram 10% w/w + Sulfoxaflor 30% w/w WG and spinetoram 10% w/w + sulfoxaflor 30% w/w WG @ 350 and 300 ml ha^{-1} (Table 4).

In the present study, new molecules were evaluated, in combination and alone, against insect pests of cotton. Among the sucking pests, jassids and whiteflies were the major insect pests. Both the doses of sulfoxaflor 30% @ 437.5 and 375 ml ha^{-1} were found very effective against jassids. Whereas, pyriproxyfen 5% EC @ 750 ml ha^{-1} and pyriproxyfen 5% EC + fenprothrin 15% EC @ 750 ml ha^{-1} gave effective control against whiteflies and also contributed to highest seed cotton yield. Various other researches also confirm the present studies. Spinetoram 40% WG + sulfoxaflor @ 140 and $120 \text{ g a.i. ha}^{-1}$ were found superior in controlling the leaf hopper and whiteflies damage^[10, 11]. Similar findings were confirmed by^[12, 13] and reported that buperofezin and sulfoxaflor were found more effective against whiteflies at the recommended doses. Pyriproxyfen 10 EC was found better among other treatments against sucking pests of chilli, in another study^[14]. Similarly, efficacy of spinetoram+ sulfoxaflor @ 350 and 300 ml ha^{-1} has been reported in controlling the sucking pest population with special reference to leafhoppers in cotton^[15, 16].

Table 1: Detail of the treatments and their doses

S. N.	Treatments	Doses (ml or g ha^{-1})	
		(a.i. g ha^{-1})	Formulation
1	Spinetoram 10% w/w + Sulfoxaflor 30% w/w WG	120	300
2	Spinetoram 10% w/w + Sulfoxaflor 30% w/w WG	140	350
3	Spinetoram 10% w/w	30	250
4	Sulfoxaflor 30%	90	375
5	Spinetoram 10% w/w	35	291.6
6	Sulfoxaflor 30%	105	437.5
7	Pyriproxyfen 5% EC + Fenprothrin 15% EC	37.5 + 112.5	750
8	Pyriproxyfen 5% EC	37.5	750
9	Fenprothrin 15% EC	112.5	750
10	Control (Unsprayed)	-	-
11	Control (Water spray)	-	-

Table 2: Efficacy of combination insecticides against sucking pests in cotton during kharif -2016

Treatments	Doses (ml or g ha)	Jassids/3leaves		% Reduction over control	Whiteflies/3leaves		% Reduction over control
		BS	7 DAS		Before spray	7 DAS	
T ₁ = Spinetoram 10% w/w + Sulfoxaflor 30% w/w WG	300	14.67(3.83)	8.33 (2.88)	43.21	23.00 (4.80)	12.00(3.46)	47.82
T ₂ = Spinetoram 10% w/w + Sulfoxaflor 30% w/w WG	350	14.33(3.79)	7.67 (2.77)	46.47	23.67 (4.86)	10.67(3.26)	54.92
T ₃ = Spinetoram 10% w/w	250	15.33(3.92)	9.33(3.05)	39.13	24.00 (4.90)	13.00(3.59)	45.83
T ₄ = Sulfoxaflor 30%	375	15.67(3.96)	7.00(2.64)	55.32	24.67(4.97)	10.33(3.21)	58.12
T ₅ = Spinetoram 10% w/w	291.6	14.33(3.79)	9.33(3.05)	34.89	24.00 (4.90)	14.00(3.74)	41.66
T ₆ = Sulfoxaflor 30%	437.5	15.00(3.87)	4.67(2.15)	68.88	24.67 (4.97)	10.00(3.15)	59.46
T ₇ = Pyriproxyfen 5% EC + Fenprothrin 15% EC	750	15.33(3.92)	8.00(2.83)	47.81	23.00 (4.80)	9.67 (3.11)	57.95
T ₈ = Pyriproxyfen 5% EC	750	14.67(3.83)	8.67(2.94)	40.69	23.67 (4.86)	9.00 (3.00)	61.97
T ₉ = Fenprothrin 15% EC	750	15.33(3.92)	10.67(3.26)	30.39	24.67 (4.97)	12.67(3.55)	48.64
T ₁₀ = Control (Unsprayed)	-	15.27(3.91)	16.33(4.04)	-	24.33(4.93)	26.67(5.16)	-
T ₁₁ = Control (Water spray)	-	14.67(3.83)	16.00(4.00)	-	24.67(4.97)	26.00(5.10)	-
F Test		NS	S		NS	S	
S. Em ±		-	0.11	-	-	0.13	-
CD at 5%		-	0.32	-	-	0.38	-
CV%		-	6.09	-	-	6.01	-

BS= Before spray, DAS= Days after spray,

Table 3: Efficacy of combination insecticides against sucking pests in cotton during kharif -2017

Treatments	Doses (ml or g ha)	Jassids/3leaves		% Reduction over control	Whiteflies/3leaves		% Reduction over control
		Before spray	7 DAS		Before spray	7 DAS	
T ₁ = Spinetoram 10% w/w + Sulfoxaflor 30% w/w WG	300	16.67(4.08)	8.67(2.94)	56.65	27.67(5.26)	13.00(3.60)	56.66
T ₂ = Spinetoram 10% w/w + Sulfoxaflor 30% w/w WG	350	17.67(4.20)	8.33(2.87)	58.35	27.67(5.26)	12.00(3.46)	60.00
T ₃ = Spinetoram 10% w/w	250	17.33(4.16)	10.33(3.21)	48.35	28.00(5.29)	15.33(3.91)	48.00
T ₄ = Sulfoxaflor 30%	375	17.67(4.20)	8.00(2.81)	60.00	27.00(5.19)	11.33(3.36)	62.33
T ₅ = Spinetoram 10% w/w	291.6	17.00(4.12)	11.00(3.31)	45.00	27.00(5.20)	14.00(3.74)	53.33
T ₆ = Sulfoxaflor 30%	437.5	16.67(4.08)	5.67(2.38)	71.65	27.33(5.23)	11.00(3.31)	63.33
T ₇ = Pyriproxyfen 5% EC + Fenprothrin 15% EC	750	17.33(4.16)	9.67(3.11)	51.65	27.33(5.23)	10.67(3.26)	64.43
T ₈ = Pyriproxyfen 5% EC	750	16.33(4.04)	9.33(3.04)	53.35	28.00(5.29)	10.00(3.15)	66.67
T ₉ = Fenprothrin 15% EC	750	17.67(4.20)	12.00(3.46)	40.00	28.00(5.29)	13.67(3.69)	54.43
T ₁₀ = Control (Unsprayed)	-	17.33(4.16)	20.00(4.47)	-	27.00(5.19)	30.00(5.48)	-
T ₁₁ = Control (Water spray)	-	17.67(4.20)	19.33(4.39)	-	27.33(5.23)	29.33(5.41)	-
F Test		NS	S		NS	S	
S. Em ±		-	0.14	-	-	0.14	-
CD at 5%		-	0.40	-	-	0.42	-
CV%		-	7.20	-	-	6.46	-

Table 4: Mean seed cotton yield (kg ha⁻¹) in different treatments

S. No.	Treatments	Dosage (ml or g ha ⁻¹)	Seed cotton yield (kg ha ⁻¹)		
			2016	2017	Mean
1.	T ₁ = Spinetoram 10% w/w + Sulfoxaflor 30% w/w WG	300	1369	1357	1. 1363
2.	T ₂ = Spinetoram 10% w/w + Sulfoxaflor 30% w/w WG	350	1406	1369	2. 1388
3.	T ₃ = Spinetoram 10% w/w	250	1209	1184	3. 1197
4.	T ₄ = Sulfoxaflor 30%	375	1443	1394	4. 1419
5.	T ₅ = Spinetoram 10% w/w	291.6	1196	1147	5. 1172
6.	T ₆ = Sulfoxaflor 30%	437.5	1566	1443	6. 1505
7.	T ₇ = Pyriproxyfen 5% EC + Fenprothrin 15% EC	750	1246	1344	7. 1295
8.	T ₈ = Pyriproxyfen 5% EC	750	1221	1320	8. 1271
9.	T ₉ = Fenprothrin 15% EC	750	1122	1036	9. 1079
10.	T ₁₀ = Control (Unsprayed)	-	829	740	10. 785
11.	T ₁₁ = Control (Water spray)	-	870	777	11. 824
	S. Em ±		240.34	223.29	-
	CD at 5%		262	244	-
	CV%		12.57	12.01	-

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