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Field evaluation for bio-efficacy of fenpyroximate 5 EC against leaf hopper and spider mite infesting cotton and their safety to natural enemies

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ABSTRACT : Fenpyroximate 5 EC at two different doses *viz.*, 25 and 37.5 g a.i. /ha along with imidacloprid 17.8 SL (20 g a.i. / ha) and dicofol 18.5 EC (500 g a.i. /ha) as standard checks for leaf hoppers and spider mites, respectively, were evaluated for bio-efficacy under field condition during *Kharif* 2012-13 and 2013-14. After three rounds of spraying initiating at ETL of leaf hopper (> 6 / 3 leaves) at 15 days interval, fenpyroximate 5 EC at both the doses @ 25 g a.i. /ha and 37.5 g a.i. / ha were found as effective as standard check imidacloprid 17.8 SL in leaf hopper control. For spider mites, fenpyroximate @ 37.5 g a.i. / ha was found as effective as standard check dicofol 18.5 EC sprayed twice at 15 days interval when mite populations was moderate (>10 mites/ leaf) during later stage of the crop. Between the two doses of fenpyroximate, lower dose (25 g a.i. / ha) was better for predator populations. Maximum seed cotton yield was obtained in fenpyroximate 5 EC @ 25 g a.i. / ha. No phytotoxicity symptoms were formed at higher dose *viz.*, 37.5, 75 and 150 g a.i. /ha.

Key **W**ords : Cotton, Fenpyroximate, Imidacloprid, Dicofol, Leafhoppers, Spider mites, Predators

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Cotton is one of the most important commercial crops in India. Among the cotton growing states, sucking pests have become quite serious; their heavy infestation at times reduces the crop yield to a great extent. The estimated loss due to sucking pests is up to 21.20 per cent (Dhawan *et al.*, 2002). Among the such pests aphids *Aphis gossypii* (Glover), leafhoppers *Amrasca biguttula biguttula* (Ishida), thrips *Thrips tabaci* (Linn) and whitefly *Bemisia tabaci* causes significant loss. Sometimes, the non insect pest mites also occur on Bt cotton after rainy season. Many conventional and neonicotinoids insecticides are available to reduce sucking pests menace in the cotton but the development of resistance to these insecticides in sucking pests necessitated the search for alternative insecticides that can be used in insecticide resistance management or pest management programme. Fenpyroximate a substituted phenoxy pyrazole is unique contact insecticide/acaricide worked as GABA-gated chloride channel antagonists claimed to be useful against sucking insects and phytophagous mite pests. Pandey *et al.* (2014) recorded the effectiveness of fenpyroximate against European red mite of apple. Muhammad *et al.* (2012) reported that chlorfenapyr 36 SC, pyridaben 15 EC and fenpyroximate 5 EC were the best miticides for controlling two spotted spider mite infesting cotton in the Pakistan. Further they reported that fenpyroximate 5 EC showed the lowest LC 50 against spider mite 48 hours after exposure and found best. Ahmad *et al.* (2011) reported fenpyroximate that under laboratory conditions was least compatible with the release of predatory mite *Phytoseius persimilis* against *Tetranychus uricae* Koch infesting vegetable crops. An attempt was made to evaluate the bioefficacy of fenpyroximate 5 EC against leaf hoppers and spider mites along with its safety to natural enemies in Bt cotton.

RESEARCH PROCEDURE

Field experiments were conducted at Main Cotton Research Station, Navsari Agricultural University, Surat during *Kharif* seasons of 2012-13 and 2013-14 with five treatments replicated four times in Randomized Block Design. Fenpyroximate 5 EC at two doses *viz.*, 25 and 37.5 g a.i./ha was evaluated against imidacloprid 17.8SL @20 g a.i./ha (standard check for leafhopper) and dicofol 18.5 EC @ 500 g a.i. /ha (standard check for spider mite) and untreated check. RCH-2 BG II grown at 120 × 45 cm spacing in the plots of 3.6 × 5.85 m with standard agronomic practices. Insecticides were applied as and when leaf hopper attained economic threshold level (Av. 2 leaf hopper/ leaf) and subsequent sprays against spider mite at moderate level of population (> Av. 10 spider mites/ 3 leaves) during later phase of the crop. The populations of key sucking pests *viz.*, leafhoppers and spider mite were recorded from three leaves / plant on five randomly selected plants from net plots. Observations on natural enemies *viz.*, lady bird beetle, chrysoperla and predatory mite was also recorded on five plants. Seed cotton yield at each picking was also recorded. The pooled data of sucking pests and natural enemies before and 3, 7 and 15 days after each spray were analyzed through t-test after due transformation and interpreted. Fenpyroximate 5 EC at high doses *viz.*, 750, 1500, and 3000 ml/ha was also assessed for phytotoxicity symptoms on cotton plants by adopting 0 to 10 phytotoxicity scale rating of necrosis, vein clearing, wilting epinasty, hyponasty and leaf injury in separate plots.

RESEARCH ANALYSIS AND REASONING

The data obtained on of sucking pests and natural enemies before and 3, 7 and 15 days after each spray during both the years were pooled and analyzed through t-test after due transformation and interpreted as under.

Bioefficacy of fenpyroximate against key sucking pests :

The pooled results on bioefficacy of fenpyroximate against leaf hoppers and spider mites before and 3, 7 and 15 days after spray are summarized in Table 1. The data revealed that all the insecticidal treatments were significantly superior to untreated control at 3 and 7 days after treatment. The interaction (Spray x Treatment) was found not significant indicating consistent performance of the treatments during. Three days after application, Fenpyroximate @ 37.5 g a.i. / ha (Av. 1.59 leaf hopper /3 leaves) and @ 25 (Av. 2.26 leaf hopper /3leaves) were found as effective as standard check, imidacloprid 17.8 SL @ 20 g a.i./ha (Av. 1.74 leaf hoppers/ 3leaves). After 7 days of application, more or less similar of insecticides was observed. Fifteen days after application, both the doses of fenpyroximate and Imidacloprid 17.8 SL @ 20 g a.i./ha were found equally effective in controlling leaf hopper population (Av. 3.95 to 4.65 leaf hoppers/ 3 leaves) and were significantly superior to untreated check (Av. 6 leaf hoppers/ 3 leaves).

The pooled result revealed that all the insecticidal/ acaricide treatments were significantly superior against spider mite compared to untreated check at 3, 7 and 15 days after application. The interaction (Spray x Treatment) was not

Table 1 : Efficacy of fenpyroximate 5 EC against leafhopper and spider mite on cotton and seed cotton yield at MCRS, NAU, Surat (2012-13 and 2013-14)

Tr. No.	Treatments	Formulation/ ha	Leafhopper / 3 leaves				Spider mites/ plant				Seed cotton yield (Q/ha)
			BS	3DAS	7 DAS	15 DAS	BS	3DAS	7 DAS	15 DAS	
T_1	Fenpyroximate 5 EC @ 25 g ai/ha	500	6.73	1.63 (2.17)	1.85 (2.92)	2.09 (3.85)	12.90	2.39 (5.23)	2.86 (7.65)	3.00 (8.49)	28.87
T_2	Fenpyroximate 5 EC @37.5 g ai/ha	750	6.26	1.42 (1.51)	1.56 (1.93)	1.99 (3.47)	11.40	2.16 (4.16)	2.58 (6.16)	2.67 (6.65)	25.41
T_3	Dicofol 18.5 EC @500 g ai/ha	2700	6.64	1.91 (3.16)	2.00 (3.50)	2.31 (4.82)	11.73	2.22 (4.45)	2.73 (6.96)	2.84 (7.57)	26.06
T_4	Imidacloprid 17.8 SL @20 g ai/ha	100	6.93	1.47 (1.65)	1.74 (2.52)	2.15 (4.14)	13.10	2.57 (6.09)	3.04 (8.77)	3.03 (8.65)	26.23
T_5	Control		7.34	2.61 (6.29)	2.50 (5.75)	2.46 (5.55)	13.58	3.75 (13.75)	3.94 (15.06)	3.46 (11.50)	22.73
	GM		6.78	1.81	1.93	2.20	12.54	2.62	3.03	3.00	25.86
	S.E. ± (T)		0.27	0.07	0.07	0.06	0.98	0.09	0.12	0.09	1.53
	C.D. (P=0.05) (T)		NS	0.19	0.21	0.18	NS	0.26	0.35	0.26	NS
	S.E. ± (YxT)		0.73	0.17	0.18	0.17	0.74	0.12	0.16	0.13	1.28
	C.D. (P=0.05) (YxT)		NS	NS	NS	NS	2.17	NS	NS	NS	3.75
	C.V. (%)		21.67	18.28	18.74	15.10	11.88	9.23	10.42	8.91	9.94

BS- Before Spray; DAS- Days of spraying; Figure in parentheses are (retransformed value) and transformed are square root + 0.5; Leafhopper, pooled data of three sprays in each year; Spider mites, pooled data of one spray in each year; NS = Non–significant

significant indicating consistent performance of the treatments. Fenpyroximate at both the doses was found as effective as standard check dicofol @ 500 g a.i./ha at 3, 7 and 15 days after application.

From the above results, fenpyroximate 5 EC at the lower dose *i.e.*, 25 g a.i./ha can be taken advantage of the management of leaf hopper as well as spider mite infestation on cotton. It remained effective up to 15 days of application in controlling both the pests. Similar findings were reported by the Muhammad *et al.*, (2012) on spider mite infesting cotton, Singh and Singh (2005) on *T. urticae* infesting okra and Naik *et al.* (2009) on Tetranychus infesting brinjal. Murugesan and Kavitha (2009) reported effectiveness of imidacloprid against leaf hopper infesting cotton.

Safety of fenpyroximate on natural enemies :

Pooled results on population of predators' *viz.*, lady bird beetle, chrysoperla, and predatory mite before spray and 3, 7 and 15 days after spray are presented in Table 2. The data revealed that untreated control had significantly higher population of lady bird beetle and chrysoperla than all insecticide/acaricide treatments. The interaction (spray × treatment) was found not significant indicating consistent performance of the treatments. All insecticide/acaricide including fenpyroximate equally affect lady bird beetle populations during 3, 7 and 15 days after application and were inferior to untreated control.

As far as the population of chrysoperla is concerned, fenpyroximate at lower dose (25 g a.i./ha) recorded higher population and was found stastically at par to standard checks (Imidacloprid 17.8 SL and Dicofol 18.5 EC). Fenpyroximate at higher dose (37.5 g a.i./ ha) recorded lowest population at 3 and 7 days after application which was significant that in fenpyroximate 25 g a.i./ ha.

Fenpyroximate @ 25 g a.i./ha and imidacloprid were found as safe as untreated control against predatory mite population at 3 days after applications. Even fenpyroximate @ 37.5 g a.i./ha was found moderately safe as it was one side at par with the lower dose of fenpyroximate and on the other side with imidacloprid. Similarly, at 15 days after application, fenpyroximate 5 EC @ 25 g a.i. /ha and imidacloprid 17.8 SL were found as safe as untreated control as the difference in population was not significant. Lowest population of predatory mite was recorded in dicofol which was significant than fenpyroximate 25g a.i./ ha and imidacloprid. Thus, fenpyroximate 25g a.i./ ha was most safe pesticide and comparable to existing life of imidacloprid.

The present findings on safety of fenpyroximate @ 25 g a.i./ha against predatory mite especially *Amblyseius* sp. on cotton indicated possibility of its use in IPM programme against spider mite. However, in contrast, Ahmad *et al.* (2011) reported that fenpyroximate at three concentrations *viz.*, 0.12, 0.25 and 0.5 ml/l was found least compatible with the release of predatory mite, *Phytoseius persimilis* against *Tetranychus uricae* Koch

Table 2 : Safety of fenpyroximate (Neon 5 EC) against LBB, Chyrsoperla, Predatory mite on cotton at MCRS, NAU, Surat (2012-13 and 2013-14)

Tr. No	Treatments and dose g ai/ha	Formulation/ha	LBB/ plant*				Chyrsoperla / plant*				Predatory mites / plant*			
			BS	3DAS	7DAS	15 DAS	BS	3DAS	7 DAS	15 DAS	BS	3DAS	7 DAS	15 DAS
T_1	Fenpyroximate 5 EC @ 25 g ai/ha	500	1.38	1.18 (0.90)	1.27 (1.10)	1.29 (1.17)	1.63	1.27 (1.12)	1.38 (1.41)	1.35 (1.33)	2.38	1.38 (1.41)	1.39 (1.44)	1.48 (1.70)
T_2	Fenpyroximate 5 EC @37.5 g ai/ha	750	1.25	1.03 (0.56)	1.14 (0.80)	1.12 (0.75)	1.63	0.84 (0.20)	0.97 (0.43)	1.21 (0.96)	2.25	1.33 (1.27)	1.38 (1.41)	1.38 (1.41)
T_3	Dicofol 18.5 EC @500 g ai/ha	2700	1.50	1.20 (0.95)	1.29 (1.17)	1.25 (1.06)	1.50	1.14 (0.80)	1.12 (0.75)	1.34 (1.29)	1.38	1.03 (0.56)	1.08 (0.66)	1.20 (0.94)
T_4	Imidacloprid 17.8 SL @20 g ai/ha	100	1.38	1.14 (0.80)	1.22 (0.99)	1.25 (1.06)	1.75	1.08 (0.66)	1.20 (0.95)	1.35 (1.32)	2.38	1.42 (1.51)	1.48 (1.70)	1.53 (1.84)
T_5	Control		1.75	1.64 (2.19)	1.65 (2.21)	1.73 (2.48)	2.13	1.68 (2.33)	1.75 (2.57)	1.93 (3.24)	2.38	1.68 (2.34)	1.66 (2.27)	1.67 (2.29)
	GM		1.45	1.24	1.31	1.33	1.73	1.20	1.29	1.44	2.15	1.37	1.40	1.45
	S.E. ± (T)		0.22	0.08	0.08	0.10	0.25	0.11	0.11	0.12	0.27	0.11	0.11	0.08
	C.D. (P=0.05) (T)		NS	0.24	0.24	0.29	NS	0.32	0.33	0.36	NS	0.32	0.32	0.24
	S.E. ± (YxT)		0.32	0.12	0.11	0.15	0.36	0.17	0.17	0.18	0.37	0.15	0.16	0.11
	C.D. (P=0.05) (YxT)		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	C.V. (%)		44.74	19.90	17.45	22.53	41.33	27.57	26.22	25.41	34.62	21.82	22.15	15.40

BS- Before spray; DAS- Days of spraying. Figure in parentheses are (retransformed value) and transformed are square root + 0.5. -LBB, Chyrsoperla, Predatory mites are pooled data of one spray in each year. NS = Non–significant

infesting vegetable crops especially under in green houses condition.

Phytotoxicity study revealed no adverse effect of Fenpyroximate 5 EC @ 37.5, 75 and 150 g a.i./ha in comparison to untreated control. Overall, it can be concluded that fenpyroximate 5 EC @ 25 g a.i./ha found effective in controlling spider mite and leaf hopper in cotton up to 15 days of spray and was found moderately safe to natural enemies that permit its use in integrated pest management or insecticide resistant management programme.

Seed cotton yield:

Two years pooled data did not indicate any significant effect of pesticide through seed cotton yield. Nevertheless untreated control yielded 22.73 q/ha seed cotton yield whereas fenpyroximate @ 25 g a.i./ha yield 28.87 q/ha field proving its wortheness. Similar work related to the topic was also done by Oatman and McMurtry (1966); Leigh and Hyer (1963); Kamel and Elkassaby (1965) and Butler *et al*. (1988).

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