

Field evaluation of pre-mixture insecticide sulfoxaflor and chlorpyrifos for the control of rice leaffolder, *Cnaphalocrocis medinalis* (Guenee) and its effect on coccinellids.

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ABSTRACT

Field trials were conducted during 2012 and 2013 at Agricultural College and Research Institute, Madurai and in a farmer's holding at Kallandhiri village, Melur Block of Madurai District respectively to evaluate the efficacy of a pre mixture insecticide sulfoxaflor 3.75 + chlorpyrifos 37.5 SE against rice leaf folder and natural enemy (Coccinellids) revealed that the test compound at 516 and 619 g a.i./ha was highly effective in reducing leaf folder incidence (71.2 to 80.2 per cent reduction over control during the period of study) and in case of coccinellids, negligible population reduction were noticed at 516 and 619 g a.i./ha (4.3 to 4.7/hill) when compared to untreated check (5.7 to 6.3/hill). The check insecticides like sulfoxaflor, buprofezin, chlorantraniliprole and chlorpyrifos were observed to be less effective than the test compounds.

Key words: Efficacy, field evaluation, pre mixture insecticide, rice leaf folder, coccinellids

The rice leaffolder, *Cnaphalocrocis medinalis* (Guenee) is considered a major pest of rice. This insect retains the potential to cause substantial damage during the vegetative growth. It leads to leaf damage of 60 to 70 % inflicting significant yield losses up to 80 % (Prabal and Saikiya 2000). In the past a number of conventional insecticides have been tested however, satisfactory control has not yet been encountered. Therefore, combination products are gaining importance. Keeping in view, an attempt was made to evaluate the efficacy of new pre-mixture insecticide, sulfoxaflor 3.75 + chlorpyrifos 37.5 % SE against rice leaffolder and this premixture insecticide, sulfoxaflor 3.75 + chlorpyrifos 37.5 SE belongs to a new class of combination of sulfoximines and phosphorothioate insecticides. Studies have demonstrated that sulfoxaflor 24 SC has a unique interaction with the nicotinic acetylcholine receptor (nAChR) (Watson *et al.* 2011).

Twenty five day old rice seedlings of a variety

Seeraga Samba were transplanted in season I and II of 2012 and 2013, respectively with all recommended agronomic practices in a plot size of (5X5) m² with a spacing of (20X10) cm with three replications arranged in a randomized block design. The test molecule sulfoxaflor 3.75 + chlorpyrifos 37.5 SE was applied at 413, 516 and 619 g a.i./ha along with four check insecticides *viz.*, sulfoxaflor 24 SC (75 g a.i./ha), chlorantraniliprole 20 SE (30 g a.i./ha), buprofezin 25 EC (200 g a.i./ha), chlorpyrifos 20 EC (375 g a.i./ha) and untreated check. The treatments were imposed at 45 days after transplanting and repeated three times at 15 days interval using high volume knapsack sprayer with the spray volume of 500 l/ha to a level of run off. Observation on leaffolder incidence (per cent leaf damage) and population of nymphs and adults of coccinellids were recorded at 1 day before first spray and at 7, 10 and 15 days after treatment (DAT) of each spray from 10 randomly selected hills/plot/replication

during both the years. Plot wise grain yield was computed and expressed as q/ha after necessary conversion. All the data were subjected to statistical analysis as per RBD procedure. The data from various field experiments were scrutinized by RBD analysis of variance (ANOVA) after getting transformed into $x+0.5$, logarithmic and arcsine percentage values where appropriate (Gomez and Gomez 1984). Critical difference values were calculated at five per cent probability level and treatment mean values were compared using Duncan's Multiple Range Test (DMRT) (Duncan 1951).

During season I (2012), the per cent leaf damage due to leaffolder varied from 28.0 to 30.0 per cent before imposing treatments (Table 1). After first spray at 7 DAT, there was significant reduction in the per cent leaf damage. The lowest leaf damage was recorded on plots sprayed with sulfoxaflor 3.75 + chlorpyrifos 37.5 SE 619 g a.i./ha and 516 g a.i./ha (11.5 and 13.7%) respectively. While check insecticides registered 17.3 to 23.6 per cent leaf damage, among the check insecticide sulfoxaflor 24 SC 75 g a.i./ha (17.3 %) followed by chlorantraniliprole 20 SC 30 g a.i./ha (17.5%) as against 35.6 per cent leaf damage in untreated control. There was further reduction in the leaf damage due to sulfoxaflor 3.75 + chlorpyrifos 37.5 SE 619 g a.i./ha (7.7 and 4.7%) and 516 g a.i./ha

(9.4 and 6.3%) at 10 and 15 DAT, respectively. More or less same trend of per cent leaf damage was observed after the second and third sprays. The new pre-mixture insecticides caused 80.2 to 62.9 per cent reduction in leaffolder incidence as compared to check insecticides.

Population of nymphs and adults of coccinellids like *Harmonia* sp., *Coccinella transversalis* (Fabricius) and *Chilomenus sexmaculata* (Fabricius) were recorded and given in Table 3. There was negligible reduction on coccinellids population due to sulfoxaflor 3.75 + chlorpyrifos 37.5 SE 619 g a.i./ha which ranged from 3.6 to 3.7/hill; 3.7 to 4.4/hill and 4.1 to 4.8/hill from 7 to 15 DAT after first, second and third sprays, respectively. This was followed by sulfoxaflor 3.75 + chlorpyrifos 37.5 SE 516 g a.i./ha which resulted in coccinellids population of 3.6 to 3.9 per hill, 4.2 to 4.5 per hill and 4.1 to 5.0 per hill from 7 to 15 DAT after first, second and third sprays respectively when compared to other treatments.

During season II (2013), the leaf damage due to leaffolder ranged from 22.1 to 23.4 per cent before imposing first spray (Table 2). There was significant reduction on leaf damage at 7,10 and 15 DAT after first spray due to sulfoxaflor 3.75 + chlorpyrifos 37.5 SE at 619 g a.i./ha (10.1, 7.8 and 6.7 % respectively)

Table 1. Effect of sulfoxaflor 3.75 + chlorpyrifos 37.5 SE against *Cnaphalocrocis medinalis* on rice - I season (2012)

Treatments (a.i./ha)	Per cent leaf damage on DAT									Mean	Per cent reduction over control	
	Pre count	1st spray			2nd spray			3rd spray				
		7	10	15	7	10	15	7	10			15
Sulfoxaflor 3.75 + chl- orpyrifos 37.5 SE 413 g	28.2	18.4 ^d	15.3 ^e	11.3 ^e	12.3 ^e	9.5 ^e	8.6 ^e	8.4 ^d	6.3 ^c	4.5 ^c	10.5 ^e	62.9
Sulfoxaflor 3.75 + chl- pyrifos 37.5 SE 516 g	28.0	13.7 ^b	9.4 ^b	6.3 ^b	8.5 ^b	5.4 ^b	4.4 ^b	7.3 ^b	5.5 ^b	3.4 ^b	7.1 ^b	74.9
Sulfoxaflor 3.75 + chl- pyrifos 37.5 SE 619 g	28.6	11.5 ^a	7.7 ^a	4.7 ^a	7.3 ^a	4.5 ^a	3.4 ^a	5.7 ^a	3.6 ^a	2.1 ^a	5.6 ^a	80.2
Sulfoxaflor 24 SC 75 g	29.9	17.3 ^c	11.4 ^c	8.5 ^c	10.1 ^c	8.1 ^c	7.1 ^c	8.0 ^c	6.1 ^c	5.1 ^d	9.1 ^c	67.8
Chlorpyrifos- 20 EC 375 g	28.4	23.6 ^f	18.5 ^g	15.1 ^g	14.7 ^f	11.9 ^g	10.8 ^g	7.6 ^b	5.7 ^b	3.6 ^b	12.4 ^f	56.2
Chlorantraniliprole- 20 SC 30 g	29.7	17.5 ^c	14.4 ^d	10.8 ^d	10.8 ^d	8.7 ^d	7.8 ^b	9.3 ^e	7.5 ^d	5.3 ^d	10.2 ^d	64.0
Buprofezin 25 SC 200 g	28.1	21.7 ^e	16.3 ^f	14.8 ^f	12.8 ^e	10.9 ^f	10.0 ^f	10.1 ^f	8.5 ^e	7.3 ^e	12.5 ^f	55.8
Untreated control	30.0	35.6 ^g	39.8 ^h	46.1 ^h	22.7 ^g	24.8 ^h	30.4 ^h	16.7 ^g	18.7 ^f	24.8 ^f	28.3 ^g	-
CD (0.05)	-	0.38	0.39	0.37	0.49	0.60	0.52	0.40	0.47	0.39	0.12	-
SEd	-	0.18	0.18	0.17	0.22	0.28	0.24	0.19	0.22	0.18	0.06	-

Data are mean values of three replications, DAT - Days After Treatment

Values were transformed by arc sine transformation and the original values are given

Means with columns lacking common bold upper case superscript are significantly different (P<0.05)

Table 2. Effect of sulfoxaflor 3.75 + chlorpyrifos 37.5 SE against *Cnaphalocrocis medinalis* on rice- II season (2013)

Treatments (a.i./ha)	Per cent leaf damage on DAT										Mean	Per cent reduction over control
	Pre count	1st spray			2nd spray			3rd spray				
		7	10	15	7	10	15	7	10	15		
Sulfoxaflor 3.75 + chlorpyrifos 37.5 SE 413 g	22.1	14.8 ^c	11.3 ^d	9.4 ^c	9.4 ^c	7.8 ^c	5.5 ^c	7.4 ^b	5.7 ^c	3.5 ^c	8.3 ^c	64.4
Sulfoxaflor 3.75 + chlorpyrifos 37.5 SE 516 g	22.4	12.5 ^b	8.6 ^b	6.9 ^b	8.2 ^b	6.1 ^b	4.1 ^a	6.4 ^a	4.4 ^b	2.9 ^b	6.7 ^b	71.2
Sulfoxaflor 3.75 + chlorpyrifos 37.5 SE 619 g	22.0	10.1 ^a	7.8 ^a	6.7 ^a	7.3 ^a	5.4 ^a	3.3 ^a	6.3 ^a	3.2 ^a	2.3 ^a	5.8 ^a	75.1
Sulfoxaflor 24 SC 75 g	23.1	14.6 ^d	10.8 ^c	8.2 ^e	11.3 ^e	9.7 ^d	8.5 ^b	9.3 ^{cd}	7.4 ^d	5.2 ^e	9.4 ^e	59.6
Chlorpyrifos-20 EC 375 g	22.6	17.3 ^f	14.5 ^f	3.6 ^e	11.4 ^e	9.3 ^d	8.2 ^e	10.0 ^d	6.1 ^d	4.3 ^d	10.6 ^f	54.5
Chlorantraniliprole-20 SC 30 g	23.4	15.6 ^e	12.4 ^e	8.3 ^d	10.4 ^d	7.3 ^c	6.4 ^b	7.9 ^d	5.1 ^c	3.9 ^{cd}	8.6 ^d	63.1
Buprofezin 25 SC 200 g	22.9	20.3 ^g	14.7 ^f	11.5 ^e	11.8 ^e	9.6 ^d	8.8 ^d	9.1 ^c	7.4 ^d	6.3 ^f	11.0 ^g	52.8
Untreated control	23.0	27.2 ^h	32.6 ^g	38.4 ^f	17.6 ^f	20.4 ^e	25.6 ^f	13.3 ^e	15.5 ^e	18.7 ^g	23.3 ^h	-
CD (0.05)	-	0.51	0.49	0.69	0.45	0.58	0.43	0.74	0.71	0.63	0.22	-
SEd	-	0.23	0.22	0.32	0.21	0.27	0.20	0.34	0.33	0.29	0.10	-

Data are mean values of three replications

Values were transformed by arc sine transformation and the original values are given

Means with columns lacking common bold upper case superscript are significantly different (P<0.05)

Table 3. Effect of sulfoxaflor 3.75 + chlorpyrifos 37.5 SE against coccinellids on rice- I season (2012)

Treatments (a.i./ha)	Number of grubs and adults/hill on DAT										Mean population of grubs and adults/hill	Grain Yield q/ha
	Pre count	1st spray			2nd spray			3rd spray				
		7	10	15	7	10	15	7	10	15		
Sulfoxaflor 3.75 + chlorpyrifos 37.5 SE 413 g	4.2	3.9 ^b	4.0 ^b	3.8 ^b	4.5 ^b	4.4 ^{bcd}	5.0 ^{ab}	4.9 ^b	5.3 ^b	5.5 ^b	4.4 ^b	32.9 ^c
Sulfoxaflor 3.75 + chlorpyrifos 37.5 SE 516 g	4.0	3.9 ^b	3.6 ^b	3.7 ^b	4.5 ^b	4.2 ^{bc}	4.4 ^b	4.1 ^c	4.8 ^c	5.0 ^{bc}	4.3 ^c	34.6 ^b
Sulfoxaflor 3.75 + chlorpyrifos 37.5 SE 619 g	3.8	3.6 ^b	3.9 ^b	3.7 ^b	3.7 ^c	4.3 ^{bc}	4.4 ^b	4.2 ^{bc}	4.1 ^d	4.8 ^c	4.0 ^d	36.7 ^a
Sulfoxaflor 24 SC 75 g	3.6	3.7 ^b	3.8 ^b	3.9 ^b	4.5 ^b	4.5 ^b	4.5 ^b	4.3 ^c	5.0 ^{bc}	5.2 ^{bc}	4.4 ^{bc}	34.2 ^b
Chlorpyrifos 20 EC 375 g	4.3	2.1 ^d	2.2 ^d	2.3 ^d	3.0 ^d	3.2 ^e	3.0 ^c	3.0 ^e	3.0 ^f	3.2 ^e	2.7 ^f	30.4 ^d
Chlorantraniliprole 20 SC 30 g	3.5	2.9 ^c	3.0 ^c	3.0 ^c	3.4 ^c	3.5 ^{cde}	3.3 ^c	3.8 ^d	4.1 ^d	4.0 ^d	3.4 ^e	32.5 ^c
Buprofezin 25 SC 200 g	4.7	2.8 ^c	2.8 ^c	2.9 ^c	3.5 ^c	3.3 ^{be}	3.4 ^c	3.5 ^d	3.7 ^e	3.9 ^d	3.4 ^e	32.8 ^c
Untreated control	4.4	4.7 ^a	4.8 ^a	5.1 ^a	5.8 ^a	5.8 ^a	5.7 ^a	6.3 ^a	6.4 ^a	6.2 ^a	5.7 ^a	26.1 ^e
CD (0.05)	-	0.14	0.15	0.14	0.11	0.21	0.16	0.13	0.08	0.10	0.04	0.01
SEd	-	0.07	0.07	0.07	0.05	0.1	0.08	0.06	0.04	0.05	0.02	0.004

Data are mean values of three replications

Values were transformed by arc sine transformation and the original values are given

Means with columns lacking common bold upper case superscript are significantly different (P<0.05)

and sulfoxaflor 3.75 + chlorpyrifos 37.5 SE at 516 g a.i./ha (12.5, 8.6 and 6.9 % respectively) when compared to other treatments. The per cent reduction in leaf folder incidence was higher in sulfoxaflor 3.75 + chlorpyrifos 37.5 SE 619 g a.i./ha (75.1 %) followed by sulfoxaflor 3.75 + chlorpyrifos 37.5 SE 516 g a.i./ha (71.2 %).

Population of grubs and adults of coccinellids

on insecticide treated and control plots are given in the Table 4. Initial population of coccinellids ranged from 3.2 to 4.8 per hill before imposing first spray. Mean coccinellids population were higher in sulfoxaflor 3.75 + chlorpyrifos 37.5 SE 413, 516 and 619 g a.i./ha (ranged from 4.0 to 4.4/hill) followed by sulfoxaflor 24 SC 75 g a.i./ha (4.4/hill). Lowest coccinellids population was recorded in chlorpyrifos 20 EC 375 g a.i./ha (2.7/

Table 4. Effect of sulfoxaflor 3.75 + chlorpyriphos 37.5 SE against coccinellids on rice - II season (2013)

Treatments (a.i./ha)	Pre count	Number of grubs and adults/hill on DAT									Mean population of grubs and adults/hill	Grain Yield (q/ha)
		1st spray			2nd spray			3rd spray				
		7	10	15	7	10	15	7	10	15		
Sulfoxaflor 3.75 + chlorpyriphos 37.5 413 g	4.8	4.6 ^{ab}	4.2 ^b	4.1 ^b	4.8 ^b	4.8 ^b	4.8 ^b	5.6 ^b	5.4 ^{bc}	5.8 ^b	4.9 ^b	29.7 ^e
Sulfoxaflor 3.75 + chlorpyriphos 37.5 516 g	4.3	4.4 ^{ab}	4.1 ^{bc}	4.0 ^b	4.6 ^b	4.6 ^b	4.6 ^b	5.2 ^{bc}	5.4 ^{bc}	5.5 ^{bc}	4.7 ^b	32.2 ^b
Sulfoxaflor 3.75 + chlorpyriphos 37.5 619 g	3.8	4.0 ^{bc}	3.5 ^{cd}	3.9 ^b	4.2 ^{bc}	4.4 ^b	4.4 ^{bc}	5.0 ^{cd}	4.8 ^c	5.0 ^c	4.3 ^c	34.0 ^c
Sulfoxaflor 24 SC 75 g	4.4	4.1 ^{bc}	4.3 ^b	4.2 ^b	4.6 ^b	4.8 ^b	4.4 ^{bc}	5.5 ^{bc}	5.8 ^{ab}	5.4 ^{bc}	4.8 ^b	31.3 ^c
Chlorpyriphos 20 EC 375 g	4.0	2.0 ^e	1.9 ^e	1.6 ^d	2.0 ^e	2.0 ^d	2.1 ^e	2.4 ^f	2.2 ^f	2.6 ^e	2.0 ^f	27.6 ^f
Chlorantraniliprole 20 SC 30 g	3.9	3.6 ^c	3.5 ^{cd}	3.4 ^c	3.8 ^d	3.7 ^c	4.0 ^{cd}	4.4 ^d	4.4 ^d	4.4 ^d	3.9 ^d	30.5 ^d
Buprofezin 25 SC 200 g	3.8	3.0 ^d	3.0 ^d	3.0 ^c	3.5 ^d	3.4 ^c	3.5 ^d	3.9 ^e	3.7 ^e	4.1 ^d	3.4 ^e	29.8 ^e
Untreated control	3.2	4.8 ^a	5.3 ^a	5.6 ^a	6.0 ^a	6.3 ^a	6.8 ^a	6.6 ^a	6.6 ^a	7.2 ^a	6.3 ^a	23.3 ^g
CD (0.05)	-	0.14	0.17	0.11	0.18	0.15	0.13	0.12	0.17	0.12	0.06	0.01
SEd	-	0.07	0.08	0.05	0.08	0.07	0.06	0.06	0.08	0.06	0.03	0.004

Data are mean values of three replications

Values were transformed by square root transformation and the original values are given

Means with columns lacking common bold upper case superscript are significantly different (P<0.05)

hill). During both the years, sulfoxaflor 3.75 + chlorpyriphos 37.5 SE 619 g a.i./ha registered highest grain yield of 36.7 and 34 q/ha which was significantly different than rest of its other dosage and the check insecticides (Table 3 & 4). The premixture insecticides at its two higher dosages were observed to be more potential than the check insecticides.

These results are in accordance with the findings of Rath and Dash (2009) who reported that Ducord 17 EC (chlorpyriphos 16 % + alpha cypermethrin 1%) at 1250 and 1000 ml/ha produced pronounced effect on leaf folder causing least leaf infestation. Seetharamu *et al.* (2005) reported that chlorpyriphos effectively reduced the larval count and reported 8.17 % leaf damage. DRR (2011) reported that chlorpyriphos was relatively better against rice pest complex and in increasing grain yield. Monilal Chatterjee and Amalendu Ghosh (2012) reported that sulfoxaflor showed excellent fit with high levels of insecticidal potency and showed lesser hazards to natural enemies. Anonymous (2012) indicated that sulfoxaflor 24 SC @ 375 g per ha recorded the maximum yield of 4.96 t per ha.

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