



Original Research Article

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## Bioefficacy of Acaricides against Red Spider Mite, *Tetranychus macfarlanei* Baker and Pritchard. Infesting Soybean

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### ABSTRACT

A study on the Bioefficacy of acaricides against red spider mite, *Tetranychus macfarlanei* infesting soybean was conducted. Six new acaricides viz., propargite, fenazaquin, spiromecifen, diafenthiuron, fenpyroximate and chlorfenapyr along with a standard check dicofol were evaluated. Among them Propargite 57 EC @ 427.50 a.i./ha proved to be highly effective in reducing the mite population with highest yield of 21.74 q/ha and also had highest C: B ratio of 1: 3.91 followed by spiromecifen 22.9 SC @ 91.60 a.i./ha which registered yield of 18.66 q/ha and C: B ratio of 1: 3.28.

### Introduction

Soybean [*Glycine max* (L.) Merrill] is one of the most important oilseed cash crops of India, particularly in the central part of country. The luxuriant crop growth, soft and succulent foliage attracts many insects and provides unlimited source of food, space and shelter. In 1997 the number of insect and non insect pests attacking soybean crop had swelled to an alarming figure of 270, including 1 mite, 2 millipedes, 10 vertebrates and 1 snail

(Singh, 1999). Among the non-insect pests, red spider mites are the notably notorious pests and gaining tremendous importance in recent years owing to their devastating nature and damage potential.

Red spider mite, *Tetranychus macfarlanei* Baker and Pritchard is a well known species, recorded in serious proportions on cotton, soybean, brinjal, okra, cucurbits, field crops, etc. (Jose and Shah, 1989 and Sejal et al., 1993). For effective

management of these tiny but most notorious pests, knowledge on effective acaricides is a prime requisite. Keeping these points in view, the present investigation was undertaken to evaluate the efficacy of newer acaricides against red spider mite, *Tetranychus macfarlanei*.

## Materials and methods

The experiment was laid out in a randomized block design at AHRS, Bavikere. The soybean variety JS 335 was sown in plots of size of 3.6m X 2.5 m and spacing of 30cm X 10 cm with eight treatments including untreated control which were replicated thrice. Observations on mites were recorded from five tagged plants in each plot. First spray was given in fourth week of November and the second spray was given in second week of December. Mite counts were recorded from three leaves (upper, middle and bottom portion of the plant) from 2 cm<sup>2</sup> leaf area. The observations on mites population was recorded one day before spraying and 3<sup>rd</sup>, 7<sup>th</sup> and 10<sup>th</sup> day after spraying of acaricides. The data was subjected to statistical analysis using ANOVA after suitable transformation.

## Results and discussion

After first spray, at three days after spraying, all the treatments were significantly superior over untreated control. Propargite was recorded least number of mites (0.76 per 2 cm<sup>2</sup> leaf area) which was on par with fenazaquin, spiromecifen and fenpyroximate which recorded 0.91, 1.09 and 1.26 mites per 2cm<sup>2</sup> leaf area. The remaining two diafenthiuron and chlorfenapyr were on par with standard check dicofol (1.9 mites per 2 cm<sup>2</sup> leaf area) (Table 1).

At seven days after spraying, all the treatments were statistically superior to untreated control. The lowest number of 0.69 mites per 2 cm<sup>2</sup> leaf area was recorded in propargite and was on par with fenazaquin, spiromecifen and fenpyroximate. The other three acaricides diafenthiuron, chlorfenapyr and dicofol recorded 1.63, 1.51 and 1.66 mites per 2 cm<sup>2</sup> leaf area, respectively. At ten days after

spraying, propargite, fenazaquin, spiromecifen, fenpyroximate and chlorfenapyr recorded 1.07, 1.27, 1.43, 1.50 and 2.05 mites per 2 cm<sup>2</sup> leaf area respectively. Whereas diafenthiuron and dicofol were on par with each other, which recorded 2.24 and 2.29 mites per 2 cm<sup>2</sup> leaf area respectively. All the treatments were significantly superior over untreated control.

After first spray, the minimum no. of mites were recorded in plots treated with propargite 57 EC with 0.84 mites per 2 cm<sup>2</sup> leaf area against the initial count of 3.87 mites per 2 cm<sup>2</sup> leaf area followed by fenazaquin 10 EC and spiromecifen 22.9 SC with 1.03 and 1.19 mites per 2 cm<sup>2</sup> leaf area against the initial count of 3.68 and 3.74 mites per 2 cm<sup>2</sup> leaf area, respectively. Chlorfenapyr 10 SC and diafenthiuron 50 WP recorded 1.72 and 1.86 mites per 2 cm<sup>2</sup> leaf area compared to the initial count of 3.48 and 3.20 mites per 2 cm<sup>2</sup> leaf area, respectively which were lower than standard check dicofol 18.5 EC (1.95 mites per 2 cm<sup>2</sup> leaf area against the initial count of 3.64 mites per 2 cm<sup>2</sup> leaf area). However, all the treatments were statistically superior to untreated control in reducing the mite population (Table 2).

After second spray, at three days after spraying, propargite and fenazaquin recorded least number of mites per 2 cm<sup>2</sup> leaf area i.e. 0.36 and 0.63 respectively. Spiromecifen, fenpyroximate, chlorfenapyr, diafenthiuron and dicofol were also proved effective with 0.75, 0.96, 1.16, 1.47 and 1.79 mites per 2 cm<sup>2</sup> leaf area respectively. At seven days after spraying, the same trend was followed with highest reduction in propargite (0.29 mites per 2 cm<sup>2</sup> leaf area). All the treatments were superior to untreated control. At ten days after spraying, propargite and fenazaquin retained their superiority in reduction of mite population with 0.39 and 0.58 mites per 2 cm<sup>2</sup> leaf area respectively. However these treatments were on par with spiromecifen, fenpyroximate and chlorfenapyr with 0.71, 0.89 and 1.12 mites per 2 cm<sup>2</sup> leaf area. However diafenthiuron (1.49 mites per 2 cm<sup>2</sup> leaf area) was on par with standard check dicofol (1.71 mites per 2 cm<sup>2</sup> leaf area).

**Table 1.** Evaluation of newer acaricides against *Tetranychus macfarlanei* on soybean during Rabi 2017-18.

Sl. No.	Treatment	Dose (g or ml/l)	Mean no. of mites/2 cm <sup>2</sup> leaf area After First Spray				Overall mean no. of mites/ 2 cm <sup>2</sup> leaf area	Percent reduction over control
			1 DBS	3 DAS	7 DAS	10 DAS		
1	Diafenthiuron 50WP	1.5g	3.20 (1.92)	1.71 (1.48) <sup>bc</sup>	1.63 (1.46) <sup>b</sup>	2.24 (1.65) <sup>bc</sup>	1.86	54.59
2	Chlorfenapyr 10 SC	1.5ml	3.48 (1.99)	1.59 (1.44) <sup>bcd</sup>	1.51 (1.41) <sup>bc</sup>	2.05 (1.59) <sup>bcd</sup>	1.72	58.06
3	Propargite 57 EC	1.5ml	3.87 (2.09)	0.76 (1.12) <sup>e</sup>	0.69 (1.09) <sup>d</sup>	1.07 (1.25) <sup>e</sup>	0.84	79.42
4	Fenazaquin 10 EC	2.5ml	3.68 (2.04)	0.91 (1.18) <sup>de</sup>	0.91 (1.19) <sup>d</sup>	1.27 (1.32) <sup>e</sup>	1.03	74.86
5	Fenpyroximate 5 EC	1.2ml	3.57 (2.02)	1.26 (1.32) <sup>cde</sup>	1.19 (1.29) <sup>bcd</sup>	1.50 (1.41) <sup>cde</sup>	1.32	67.86
6	Spiromecifen 22.9 EC	0.8ml	3.74 (2.06)	1.09 (1.26) <sup>de</sup>	1.04 (1.24) <sup>cd</sup>	1.43 (1.38) <sup>de</sup>	1.19	71.01
7	Dicofol 18.5EC	2.5 ml	3.64 (1.99)	1.90 (1.55) <sup>b</sup>	1.66 (1.47) <sup>b</sup>	2.29 (1.66) <sup>bc</sup>	1.95	52.31
8	Untreated Control	-	3.37 (1.97)	3.91 (2.1) <sup>a</sup>	4.04 (2.13) <sup>a</sup>	4.32 (2.2) <sup>a</sup>	4.09	-
	<b>SEM ±</b>		0.10	0.07	0.07	0.08		
	<b>CD (p = 0.05)</b>		0.32	0.20	0.20	0.25		
	<b>CV%</b>		9.12	8.10	8.18	9.21		

Figures in parentheses are  $\sqrt{X+0.5}$  transformed values; Means followed by same letters do not differ significantly by DMRT ( $p = 0.05$ ); DBS- Day Before Spray; DAS – Days After Spray.

**Table 2.** Evaluation of newer acaricides against *Tetranychus macfarlanei* on soybean during Rabi 2017-18.

Sl. no.	Treatment	Dose (g or ml/l)	Mean no. of mites/2 cm <sup>2</sup> leaf area After First Spray				Overall mean no. of mites/2 cm <sup>2</sup> leaf area	Percent reduction over control
			1 DBS	3 DAS	7 DAS	10 DAS		
1	Diafenthiuron 50 WP	1.5g	2.58 (1.75)	1.47 (1.4) <sup>bc</sup>	1.31 (1.34) <sup>bcd</sup>	1.49 (1.41) <sup>bc</sup>	1.42	71.85
2	Chlorfenapyr 10 SC	1.5ml	2.45 (1.72)	1.16 (1.29) <sup>cd</sup>	1.09 (1.26) <sup>cde</sup>	1.12 (1.27) <sup>cd</sup>	1.12	77.78
3	Propargite 57 EC	1.5ml	1.49 (1.41)	0.36 (0.93) <sup>f</sup>	0.29 (0.89) <sup>f</sup>	0.39 (0.94) <sup>f</sup>	0.35	93.12
4	Fenazaquin 10 EC	2.5ml	1.63 (1.45)	0.63 (1.06) <sup>ef</sup>	0.49 (0.99) <sup>e</sup>	0.58 (1.03) <sup>ef</sup>	0.56	88.84
5	Fenpyroximate 5 EC	1.2ml	2.14 (1.61)	0.96 (1.21) <sup>de</sup>	0.81 (1.14) <sup>def</sup>	0.89 (1.18) <sup>de</sup>	0.89	82.44
6	Spiromecifen 22.9 EC	0.8ml	2.12 (1.6)	0.75 (1.12) <sup>def</sup>	0.63 (1.06) <sup>ef</sup>	0.71 (1.1) <sup>def</sup>	0.70	86.22
7	Dicofol 18.5 EC	2.5 ml	2.89 (1.84)	1.79 (1.51) <sup>b</sup>	1.64 (1.46) <sup>b</sup>	1.71 (1.48) <sup>b</sup>	1.71	66.13
8	Untreated Control	-	4.51 (2.24)	4.82 (2.3) <sup>a</sup>	5.04 (2.35) <sup>a</sup>	5.31 (2.41) <sup>a</sup>	5.06	
	<b>SEM ±</b>		0.11	0.06	0.06	0.06		
	<b>CD (p = 0.05)</b>		0.32	0.19	0.19	0.18		
	<b>CV%</b>		10.73	8.07	8.37	7.47		

Figures in parentheses are  $\sqrt{X+0.5}$  transformed values; Means followed by same letters do not differ significantly by DMRT ( $p = 0.05$ ); DBS- Day Before Spray; DAS – Days After Spray.

**Table 3.** Cost economics of newer acaricides against red spider mites on soybean.

Sl. No.	Treatment	Dose (g or ml/ltr)	Yield (q/ha)	Yield increment over control (%)	Cost of production (Rs/ha)	Cost of protection (Rs/ha)	Total cost of production (Rs/ha)	Gross returns (Rs/ha)	Net returns	C:B ratio
1	Diafenthiuron 50WP	1.5g	15.38	32.51	15000	4100	19100	47678	28578	1:2.49
2	Chlorfenapyr 10 SC	1.5ml	16.08	35.44	15000	3100	18100	49848	31748	1:2.75
3	Propargite 57 EC	1.5ml	21.74	52.33	15000	2225	17225	67394	50169	1:3.91
4	Fenazaquin 10 EC	2.5ml	20.10	48.35	15000	4300	19300	62310	43010	1:3.23
5	Fenpyroximate 5 EC	1.2ml	16.89	38.55	15000	1340	16340	52359	34019	1:3.20
6	Spiromecifen 22.9 EC	0.8ml	18.66	44.33	15000	2600	17600	57846	40246	1:3.28
7	Dicofol 18.5 EC	2.5 ml	14.25	27.16	15000	1312	16312	44175	25863	1:2.70
8	Untreated control	-	10.38	-	15000	-	15000	32178	17178	1:1.15

Note: Price of soybean = Rs. 3100/q

**Cost of acaricides:** 1: Diafenthiuron 50WP (25g) -Rs.110.00/-, 2: Chlorfenapyr 10 SC (300 ml)-Rs.920.00/-, 3: Propargite 57 EC (1 lit) -1900.00/-, 4: Fenazaquin 10 EC (250ml)- Rs.700.00/-, 5: Fenpyroximate 5 EC (1 lit)-Rs.900.00/-, 6: Spiromecifen 22.9 EC (100 ml)-Rs.450.00/- and 7: Dicofol 18.5 EC (1 lit) - Rs.410.00/-

Cost of labour: Rs. 200/day, Standard spray volume: 500 lit/ha

After second spray, the data revealed that, minimum no. of mites were recorded from the plots treated with propargite 57 EC with 0.35 mites per 2 cm<sup>2</sup> leaf area against the initial count of 1.49 mites per 2 cm<sup>2</sup> leaf area followed by fenazaquin 10 EC and spiromecifen 22.9 SC with 0.56 and 0.70 mites per 2 cm<sup>2</sup> leaf area against the initial count of 1.63 and 2.12 mites per 2 cm<sup>2</sup> leaf area, respectively. Fenpyroximate 5 EC, chlorfenapyr 10 SC and diafenthiuron 50 WP recorded 0.89, 1.12 and 1.42 mites per 2 cm<sup>2</sup> leaf area, respectively which were lower than the standard check dicofol 18.5 EC (1.71 mites per 2 cm<sup>2</sup> leaf area against the initial count of 2.89 mites per 2 cm<sup>2</sup> leaf area). However, all the treatments were significantly superior to untreated control (5.06 mites per 2 cm<sup>2</sup> leaf area) in containing the mite population.

### Yield and economics

Out of eight treatments, propargite 57 EC recorded highest yield of 21.74 q/ha with net returns of Rs. 50169 and cost benefit ratio (C: B) of 1: 3.91 (Table 11). The second best treatment was spiromecifen 22.9 SC which registered yield of 18.66 q/ha, net returns of Rs. 40246 and C: B ratio of 1: 3.28 followed by fenazaquin 10 EC with C: B ratio of 1: 3.23. Among the acaricides tested dicofol 18.5 EC recorded the lower C: B ratio of 1: 2.70 followed by diafenthiuron 50 WP (1: 2.49) (Table 3).

It is evident from the data recorded on efficacy of acaricides, propargite, fenazaquin and spiromecifen were highly effective against red spider mite, *Tetranychus macfarlanei*. Other acaricides fenpyroximate, chlorfenapyr and diafenthiuron were also effective, but dicofol found least effective among new molecules tested. The superiority of propargite and fenazaquin are in confirmation with the works of Roopa (2005), Jadhav et al. (2016), Sarmah et al. (2016), Reza and Ahmed (2017) and Singh et al. (2017).

### Conclusion

A total of seven acaricides were evaluated with dicofol 18.5 EC as standard check against red

spider mite, *Tetranychus macfarlanei*. Among the seven tested acaricides propargite 57 EC and fenazaquin 10 EC were highly effective against red spider mites. Spiromecifen, diafenthiuron, fenpyroximate and chlorfenapyr were moderately effective and dicofol was least effective among the evaluated acaricides.

### Conflict of interest statement

Authors declare that they have no conflict of interest.

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