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Effect of newer insecticides in combination with Triazophos against insect pest of soybean

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ABSTRACT

Experiments were conducted to evaluate insecticides and their combinations against major insect pest of soybean under field conditions in *kharif* season 2011-2012. The results revealed that Emamectin benzoate 5 SG @ 0.002% + Triazophos 40 EC @ 0.06%, Emamectin benzoate 5 SG @ 0.002%, Fenvalrate 20 EC @ 0.01%, Triazophos 40 EC @ 0.06% and Flubendiamide 20 WG @ 0.01% + Triazophos 40 EC @ 0.06% were proved to be significantly effective in managing the major insect pests of soybean and obtained comparatively highest yield, net monetary return and ICBR. All insecticides proved safer to lady bird beetle and non-phytotoxic. Hence, it is also concluded that above combinations found beneficial for the management of soybean pest.

Key words: ICBR, Insect pest of soybean, Yield.

INTRODUCTION

Soybean (*Glycine max* L.) the miracle golden bean of 20th century. It is fascinating crop with innumerable possibilities of not only improving agriculture but also supporting industries. Soybean is major source of edible oil (20%) and high quality protein (40%). It is rich source of amino acids, vitamins and minerals. Soybean oil is used as raw material in manufacturing antibiotic, paints, varnishes, adhesive, lubricants etc. Soybean meal is used as supplement to human diet and cattle feed (Anonymous, 2008).

In India 20 insect pest species have been recorded on soybean crop. Leaf miner caused 30 to 50 per cent reduction in grain yield and 100 per cent damage to plant leaflets (Singh and Singh, 1990). Shetgar and Thombre (1984) reported two larvae/plant cause the damage 2.7 to 6.1 per cent as compared to 40 and 60 per cent at 10 larvae/plant.

Leaf miner (*Aproaerema modicella* Deveter) is a serious pest of groundnut and soybean, but this gelechid prefers soybean (Gujrati *et al*., 1973). Venkatesan and Kundu (1994) reported that stem tunneling due to *Melanogromyza sojae* Zehnt was to the extent of 10 to 20 per cent causing loss in grain yield of 2.75to 3.81 per cent.

To overcome losses caused by insect pests, chemical insecticides are the best giving quick and effective results. Some insecticides are effective against sucking pest, some are against defoliators or stem borer. In order to control pest complex of both types, two kind of chemical need to be sprayed. There is a common practice among farmers to mix two or three chemicals at a time without knowing compatibility to save labour, time and economy. Hence, to find out effective combination, different newer insecticides combined with Triazophos 40 EC were evaluated.

MATERIALS AND METHODS

Experiment was carried out in randomized block design with twelve treatments replicated thrice at the Department of Agriculture Entomology, Post-Graduate institute Dr.PDKV, Akola Maharashtra. The observations were recorded to see the combine and sole effect of insecticides on the incidence of major pests of soybean. Average populations of sucking pests/three leaves/plant were recorded on top, middle and bottom leaf, larval population of defoliators/plant, per cent infestation of stem fly, girdle beetle and leaf miner per meter row length at 5 spots in the plot were worked out on the basis of post treatment observation at 3rd, 7th and 14th day after 1st, 2nd and 3rd spraying. The cumulative population of sucking pest and defoliators were calculated on the basis of average of 3 spraying. Yield data was recorded and lastly economics and ICBR were calculated for each treatment.

RESULTS AND DISCUSSION

The data on efficacy of different insecticide considering significant results only are presented in Table 1

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and Table 2. Data is expressed in terms of insect number/leaf in case of sucking pest, number of larvae/meter row length in case of defoliators and in percentage in case of other pests.

The data were found statistically significant and recorded on the basis of average pest population at 3rd, 7th and 14th day of each spray. Spinosad 45 SC @0.018% (0.00/ leaf) and Emamectin benzoate 5 SG @0.002% (0.00/leaf) followed by Flubendiamide 20 WG @0.01 % + Triazophos 40 EC @0.06% (0.07/leaf) were found to be significantly most effective minimizing the average population of leaf hopper at 14 days after 1st spray.

Flubendiamide 20 WG @0.01% + Triazophos 40 EC @0.06% (0.07/leaf) followed by Spinosad 45 SC @0.018% + Triazophos 40 EC @0.06% (0.20 /leaf) were found to be significantly effective in minimizing the average population of leaf hopper at 14 days after 2nd spray.

Spinosad 45 SC @0.018% (0.07/leaf) and Fenvelerate 20 EC@ 0.01% + Triazophos 40 EC @0.06% (0.07 /leaf) followed by Deltamethrin 2.8 EC 0.0028% (0.10/ leaf) at 3rd day after 3rd spray and treatment Deltamethrin 2.8 EC 0.0028% + Triazophos 40 EC @0.06% (0.03/leaf) followed by Fenvelerate 20 EC@ 0.01% (0.07/leaf) at 14 days after 3rd spray were found significantly most effective in minimizing the average population of leaf hopper.

Spinosad 45 SC @0.018% (0.00/leaf) followed by Deltamethrin 2.8 EC 0.0028% (0.03/leaf), Triazophos 40 EC @0.06% (0.03 /leaf) and Spinosad 45 SC @0.018% + Triazophos 40 EC @0.06% (0.03 /leaf) were found to be significantly effective in minimizing the average population of whitefly at 3 days after 1st spray.

Triazophos 40 EC @0.06% (0.27 /leaf) followed by Spinosad 45 SC @0.018% (0.27/leaf) were found to be significantly most effective in minimizing the average population of whitefly at 14 days after 2nd spray.

Deltamethrin 2.8 EC 0.0028% (0.17/leaf) followed by Deltamethrin 2.8 EC 0.0028% + Triazophos 40 EC @0.06% (0.20/leaf) at 3 days after 3rd spray and Emamectin benzoate 5 SG @0.002% + Triazophos 40 EC @0.06% (0.17/ leaf) followed by Flubendiamide 20 WG @0.01% (0.23/leaf) at 7 days after 3rd spray were found to be significantly most effective in minimizing the average population of whitefly.

Emamectin benzoate 5 SG @0.002% (0.13 larvae/ MRL), Deltamethrin 2.8 EC 0.0028% + Triazophos 40 EC @0.06% (0.13 larvae/MRL) and Fenvelerate 20 EC@ 0.01% + Triazophos 40 EC @0.06% (0.13 larvae/MRL) were found

TABLE 1: Average effect of newer insecticides in combination with Triazophos against insect pests of soybean

Treatments	1st Spraying at			2nd Spraying at				3rd Spraying at			
	LH	WF	SF	LH	WF	Sl	Sp	LH		WF	
	14DAT (**)	3DAT (*)	7DAT (**)	14DAT (**)	14DAT (**)	14DAT (**)	14DAT (**)	3DAT (**)	14DAT (**)	3DAT (**)	7DAT (*)
Spinosad 45SC @0.018%	0.00	0.00	0.51	0.17	0.27	0.27	0.27	0.07	0.10	0.23	0.43
	(0.71)	(0.71)	(0.95)	(0.82)	(0.50)	(0.87)	(0.87)	(0.75)	(0.77)	(0.86)	(0.65)
Flubendiamide 20WG @0.01%	0.13	0.10	1.17	0.23	0.33	0.27	0.40	0.23	0.23	0.23	0.23
	(0.79)	(0.77)	(1.23)	(0.86)	(0.57)	(0.87)	(0.95)	(0.85)	(0.85)	(0.85)	(0.84)
Deltamethrin 2.8EC 0.0028%	0.10	0.03	1.27	0.10	0.37	0.33	0.40	0.10	0.17	0.17	0.27
	(0.77)	(0.73)	(1.26)	(0.77)	(0.53)	(0.91)	(0.95)	(0.77)	(0.81)	(0.82)	(0.51)
Fenvelerate 20EC@ 0.01%	0.03	0.10	0.00	0.10	0.43	0.27	0.20	0.23	0.07	0.30	0.33
	(0.73)	(0.77)	(0.71)	(0.77)	(0.65)	(0.83)	(0.83)	(0.86)	(0.75)	(0.89)	(0.57)
Emamectin benzoate 5SG @0.002%	0.00	0.07	1.44	0.10	0.30	0.13	0.40	0.17	0.17	0.23	0.40
	(0.71)	(0.75)	(1.57)	(0.77)	(0.54)	(0.79)	(0.95)	(0.81)	(0.81)	(0.86)	(0.60)
TTriazophos 40EC @0.06%	0.23	0.03	0.00	0.23	0.27	0.33	0.47	0.13	0.10	0.20	0.23
	(0.86)	(0.73)	(0.71)	(0.86)	(0.87)	(0.91)	(0.98)	(0.79)	(0.77)	(0.84)	(0.84)
Spinosad 45SC @0.018% +	0.10	0.03	0.00	0.20	0.47	0.33	0.20	0.10	0.13	0.27	0.30
Triazophos 40EC @0.06%	(0.77)	(0.73)	(0.71)	(0.84)	(0.68)	(0.91)	(0.83)	(0.77)	(0.79)	(0.87)	(0.54)
Flubendiamide 20WG @0.01% +	0.07	0.10	0.00	0.07	0.27	0.33	0.33	0.10	0.27	0.23	0.37
Triazophos 40EC @0.06%	(0.75)	(0.77)	(0.71)	(0.75)	(0.87)	(0.90)	(0.90)	(0.77)	(0.87)	(0.86)	(0.60)
Deltamethrin 2.8EC 0.0028% +	0.10	0.07	0.00	0.40	0.30	0.13	0.60	0.23	0.03	0.20	0.43
Triazophos 40EC @0.06%	(0.77)	(0.75)	(0.71)	(0.95)	(0.54)	(0.80)	(1.05)	(0.86)	(0.73)	(0.83)	(0.58)
Fenvelerate 20EC@ 0.01% +	0.07	0.17	0.81	0.20	0.30	0.13	0.40	0.07	0.10	0.27	0.23
Triazophos 40EC @0.06%	(0.75)	(0.82)	(1.11)	(0.83)	(0.54)	(0.79)	(0.95)	(0.75)	(0.77)	(0.87)	(0.84)
Emamectin benzoate 5SG @0.002%	0.03	0.17	0.00	0.30	0.53	0.27	0.40	0.17	0.20	0.27	0.17
+ Triazophos 40EC @0.06%	(0.73)	(0.81)	(0.71)	(0.89)	(0.72)	(0.87)	(0.93)	(0.82)	(0.83)	(0.87)	(0.41)
Untreated	0.37	0.40	0.39	0.63	1.33	1.20	1.40	0.53	0.57	0.97	0.73
	(0.93)	(0.94)	(0.90)	(1.06)	(1.15)	(1.23)	(1.37)	(1.01)	(1.02)	(1.13)	(0.83)
'F' Test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SE (m)±	0.04	0.03	0.16	0.04	0.09	0.06	0.07	0.03	0.04	0.04	0.07
CD (p=0.05)	0.11	0.09	0.47	0.11	0.26	0.17	0.20	0.09	0.12	0.12	0.20
CV %	8.54	6.78	29.57	7.49	24.84	11.27	12.47	6.95	8.91	8.08	21.58

Figures in the parentheses (* indicates √X values values) and (** indicates √X +0.5 values)
LH-Leaf Hopper, WF-Whitefly, SF-Stem fly, SI-Semi looper, SP-Spodoptera litura

TABLE 2: Cumulative effect of newer insecticides in combination with Triazophos against insect pests of soybean

Treatments	Leaf hopper/plant		Whitefly/plant		Girdle beetle/mrl		Leaf miner/mrl
	3DAT	7DAT	3DAT	7DAT	7DAT	14DAT	14DAT
Spinosad 45SC @0.018%	0.05	0.14	0.11	0.21	0.47	0.64	0.71
	(0.71)	(0.80)	(0.78)	(0.83)	(0.98)	(1.03)	(1.07)
Flubendiamide 20WG @0.01%	0.11	0.15	0.14	0.20	1.18	0.80	0.86
	(0.78)	(0.80)	(0.80)	(0.83)	(1.29)	(1.11)	(1.12)
Deltamethrin 2.8EC 0.0028%	0.04	0.09	0.11	0.21	3.64	2.97	0.99
	(0.74)	(0.77)	(0.78)	(0.84)	(1.99)	(1.72)	(1.17)
Fenvelerate 20EC@ 0.01%	0.14	0.03	0.18	0.27	1.49	1.65	0.67
	(0.80)	(0.73)	(0.82)	(0.88)	(1.41)	(1.38)	(1.05)
Emamectin benzoate 5SG @0.002%	0.09	0.06	0.17	0.18	1.26	0.98	0.92
	(0.77)	(0.75)	(0.81)	(0.82)	(1.31)	(1.21)	(1.15)
TTriazophos 40EC @0.06%	0.08	0.13	0.10	0.14	0.94	0.94	0.85
	(0.76)	(0.79)	(0.77)	(0.80)	(1.20)	(1.16)	(1.12)
Spinosad 45SC @0.018% +	0.03	0.10	0.12	0.23	0.54	1.65	0.90
Triazophos 40EC @0.06%	(0.73)	(0.77)	(0.79)	(0.85)	(1.00)	(1.36)	(1.14)
Flubendiamide 20WG @0.01% +	0.07	0.13	0.18	0.24	2.29	1.53	1.05
Triazophos 40EC @0.06%	(0.75)	(0.79)	(0.82)	(0.86)	(1.67)	(1.35)	(1.20)
Deltamethrin 2.8EC 0.0028% +	0.08	0.02	0.11	0.28	0.00	0.00	0.96
Triazophos 40EC @0.06%	(0.76)	(0.72)	(0.78)	(0.88)	(0.71)	(0.71)	(1.16)
Fenvelerate 20EC@ 0.01% +	0.05	0.04	0.18	0.21	1.82	1.46	0.92
Triazophos 40EC @0.06%	(0.74)	(0.74)	(0.82)	(0.84)	(1.48)	(1.33)	(1.15)
Emamectin benzoate 5SG @0.002%	0.07	0.14	0.18	0.25	2.32	1.68	0.79
+ Triazophos 40EC @0.06%	(0.75)	(0.80)	(0.82)	(0.86)	(1.65)	(1.39)	(1.10)
Untreated	0.29	0.39	0.56	0.53	1.57	1.54	1.06
	(0.88)	(0.93)	(1.02)	(1.01)	(1.43)	(1.35)	(1.21)
'F' Test	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SE (m)±	0.02	0.03	0.02	0.03	0.01	0.15	0.03
CD (p=0.05)	0.06	0.09	0.07	0.10	0.29	0.44	0.08
CV %	4.49	6.71	5.46	6.99	12.59	20.48	4.08

N.B: Figures in the parentheses indicates $\sqrt{X}$ +0.5 values

to be significantly effective in minimizing the average larval population of semilooper at 14 days after 2nd spray.

Fenvelerate 20 EC@ 0.01% (0.20 larvae/MRL), Spinosad 45 SC @0.018% + Triazophos 40 EC @0.06% (0.20 larvae/MRL) followed by Spinosad 45 SC @0.018% (0.27 larvae/MRL) were found to be significantly most effective in minimizing the average larval population of *Spodoptera* at 14 days after 2nd spray.

Fenvelerate 20 EC@ 0.01% (0.00%), Triazophos 40 EC @0.06% (0.00), Spinosad 45 SC @0.018% + Triazophos 40 EC @0.06% (0.00%), Flubendiamide 20 WG @0.01% + Triazophos 40 EC @0.06% (0.00%), Deltamethrin 2.8 EC 0.0028% + Triazophos 40 EC @0.06% (0.00%) and Emamectin benzoate 5 SG @0.002% + Triazophos 40 EC @0.06% (0.00%) were found to be significantly most effective in minimizing the per cent infestation of stem fly at 7 days after 1st spray.

The data presented in the Table 2 were found to be statistically significant and recorded on the basis of cumulative average of pest population of 3 sprayings. Deltamethrin 2.8 EC 0.0028% + Triazophos 40 EC @0.06% (0.02/leaf) followed by Spinosad 45 SC @0.018% + Triazophos 40 EC @0.06% (0.03/leaf), Fenvelerate 20 EC@ 0.01% (0.03%), Fenvelerate 20 EC@ 0.01% + Triazophos 40 EC @0.06% (0.04/leaf) were found to be significantly most effective in minimizing the cumulative average population of leaf hopper at 3 and 7 days after spray.

Triazophos 40 EC @0.06% (0.10/leaf and 0.14/leaf) followed by Spinosad 45 SC @0.018% (0.11/leaf and 0.21/leaf) and Deltamethrin 2.8 EC 0.0028% (0.11/leaf and 0.21/leaf) at 3 and 7 days after spray were found to be significantly most effective in minimizing the cumulative average population of whitefly.

Deltamethrin 2.8 EC 0.0028% + Triazophos 40 EC @0.06% (0.00%) followed by Spinosad 45 SC @0.018% (0.47% and 0.64%) at7 and 14 days after spray were found to be significantly most effective in minimizing the cumulative average per cent infestation of girdle beetle.

Fenvelerate 20 EC@ 0.01% (0.67%) followed by Spinosad 45 SC @0.018% (0.71%) were found to be significantly most effective in minimizing the cumulative average per cent infestation of leaf miner at 14 days after spray.

TABLE 3: Effect of newer insecticides in combination with Triazophos on yield and ICBR

Treatments	Yield (q/ha)	Gross Income (Rs)	Additional income over control (Rs)	Cost of treatment + labour charges (Rs)	Net profit on control (Rs)	ICBR
Spinosad 45SC @0.018%	16.24	50994	6406	8378	-1972	1:-0.24
Flubendiamide 20WG @0.01%	21.47	67416	22828	5850	16978	1:2.92
Deltamethrin 2.8EC 0.0028%	18.48	58027	13439	1890	11549	1:6.26
Fenvelerate 20EC@ 0.01%	19.66	61732	17144	1698	15446	1:9.34
Emamectin benzoate 5SG @0.002%	28.95	90903	46315	3930	42385	1:10.91
TTriazophos 40EC @0.06%	20.41	64087	19499	2223	17276	1:7.93
Spinosad 45SC @0.018% + Triazophos 40EC @0.06%	21.58	67761	23173	9071	14102	1:1.56
Flubendiamide 20WG @0.01% + Triazophos 40EC @0.06%	25.64	80510	35922	6543	29379	1:4.52
Deltamethrin 2.8EC 0.0028% + Triazophos 40EC @0.06%	16.45	51653	7065	2583	4482	1:1.77
Fenvelerate 20EC@ 0.01% + Triazophos 40EC @0.06%	24.79	77841	33253	2391	30862	1:13.16
Emamectin benzoate 5SG @0.002% + Triazophos 40EC @0.06%	29.17	91594	47006	4623	42383	1:9.26
Untreated	14.20	44588	-	-	-	-
'F' Test	Sig	-	-	-	-	-
SE (m)±	2.56	-	-	-	-	-
CD (p=0.05)	7.69	-	-	-	-	-
CV %	14.09	-	-	-	-	-

The highest soybean yield was recorded in Emamectin benzoate 5 SG @0.002% + Triazophos 40 EC @0.06% (29.17 qtl/ha) followed by Emamectin benzoate 5 SG @0.002% (28.95 qtl/ha).

Fenvelerate 20 EC@ 0.01% + Triazophos 40 EC @0.06% was found to be most economical in order of merit with highest ICBR of 1:13.16 and NMR of Rs 30,862/ha followed by Emamectin benzoate 5 SG @0.002% with ICBR of 1:10.91 and NMR of Rs 42,385/ha. However higher NMR of Rs 42,383/ha with rank 4th and ICBR of 1:9.26 was also recorded in next most best Emamectin benzoate 5 SG @0.002% + Triazophos 40 EC @0.06%.

The present findings are supported by several workers, Singh and Singh (1994) reported that Triazophos 0.04% was found to be more toxic to semilooper and thrips on soybean. Anonymous (2000) reported that lowest per cent infestation of girdle beetle was found in Triazophos. Upadhyay and Sharma (2000) reported that Triazophos gave greatest egg mortality but did not control larvae of *Obereopsis brevis* on soybean. Arbind Kumar *et al*. (2010) reported that Triazophos proved to be most effective against girdle beetle and stem fly and maximum grain yield was also obtained.

Singh and Singh (1990) reported that Fenvelerate 20 EC was found to be more effective in controlling the stem fly. Venkateshan and Kundu (1994) recorded effective control of stem fly due to Fenvelerate 0.03%. Anonymous (2001) reported that stem tunneling due to stem fly in soybean was observed to be less in Triazophos. Anonymous (1995) recorded the minimum leaf miner damage in plots treated with Triazophos 0.05% in soybean. Mangnale (2000) reported that Triazophos 40 EC recorded lower incidence of leaf miner on soybean. Ashok Kumar *et al.* (2006) who reported that Triazophos 40 EC gave the highest soybean grain yield.

CONCLUSION

Emamectin benzoate 5 SG @ 0.002% + Triazophos 40 EC @ 0.06%, Emamectin benzoate 5 SG @ 0.002%, Fenvalrate 20 EC @ 0.01%, Triazophos 40 EC @ 0.06% and Flubendiamide 20 WG @ 0.01% + Triazophos 40 EC @ 0.06% proved significantly effective in managing the major insect pests of soybean and obtained comparatively higher yield, net monetary return and ICBR.

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