Evaluation of different Insecticides against Sucking Pests Infesting Brinjal

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Abstract— *A field experiment was conducted at Agricultural Research Station, S. D. Agricultural University, Ladol during 2019-20, 2020-21, 2021-22 and 2022-23 for evaluation of different insecticides against sucking pests infesting brinjal. The eleven different treatments were evaluated. There was no any sucking pest infestation in kharif 2019-20. Based on pooled data of three years, Sulfoxaflor 21.8 SC 0.03 per cent @ 12.5 ml/10 liter of water recorded minimum white fly and jassid population (2.79/leaf and 1.21/leaf), no effect on predator and highest yield (286.61 q/ha) followed by Sulfoxaflor 21.8 SC 0.024 per cent @ 10 ml/10 liter of water and Cyantraniliprole 10.26 OD 0.0072 per cent @ 7.02 ml/10 liter of water.*

Keywords— Brinjal, Jassids, Whiteflies, LLB, Predator, Insecticides.

I. INTRODUCTION

Brinjal, solanum melongena L. also known as eggplant belong to family solanaceae is cultivated in almost all the seasons across India. Brinjal is often described as the 'King of vegetables 'due to its versatility use in Indian food (Choudhary and Gaur, 2009). India is one of the largest producers of brinjal in the world. Due to its nutritive value, consisting of minerals like iron, phosphorous, calcium and vitamins like A, B and C, unripe fruits are used primarily as vegetable in the country. Brinjal is subjected to attack by number of insect pests right from nursery stage till harvesting (Regupathy et al., 1997). Among them, shoot and fruit borer, *Leucinodes orbonalis* (Guen.), whitefly, *Bemicia tabaci* (Genn.), leafhopper, *Amrasca biguttula biguttula* (Ishida) and red spider mite, *Tetranychus macfurlanei* (Baker and Pritchard). Of these, sucking pests is considered as one of the main constraints as it damages the crop throughout the year. The extensive and indiscriminate use of pesticides for controlling brinjal pests has led to several problems like resurgence of secondary pests, health hazards and pesticide residues in edible fruits (Kabir et al., 1996). The objective of the present investigation is to test the efficacy of newer insecticides for the management of sucking pests of brinjal.

II. MATERIALS AND METHODOLOGY

Brinjal (*var*. Guj. Anand oblong brinjal-2) was raised following standard agronomical practices adopting flood irrigation method on Agricultural Research Station, S. D. Agricultural University, Ladol. The experiment was laid out in a randomized block design with elevan treatments including untreated control with three replications. The planting was done at spacing of 90 x 60 cm. The recommended dosage of fertilizers 100 kg N, 50 kg P and 50 kg K per hectare was applied. The observations on population of sucking pests *viz*. aphid, jassid and white fly was recorded from five randomly selected plants per treatments. On each plant, three leaves (one each from bottom, middle and top portion of the plant) was observed for the pest count. Observation

on sucking pests was recorded before spray and 1, 3, 5, 7 and 14 days after spray. Two foliar sprays were undertaken. 1st spray at ETL, 5 Insect population/leaf per plant and subsequent foliar spray made 15 days after first spray.

TREATMENT DETAILS:

Tr. No.	Treatments	Conc. (%)	Dose g.a.i./ha	Dose /10 lit water
1.	Thiamethoxam 25 WG	0.0084	42	3.36 g
2.	Cyantraniliprole 10.26 OD	0.0054	27	5.26 ml
3.	Cyantraniliprole 10.26 OD	0.0072	36	7.02 ml
4.	Cyantraniliprole 10.26 OD	0.0090	45	8.78 ml
5.	Sulfoxaflor 21.8 SC	0.0180	82	7.5 ml
6.	Sulfoxaflor 21.8 SC	0.0240	109	10 ml
7.	Sulfoxaflor 21.8 SC	0.0300	136	12.5 ml
8.	Flupyradifuron 17.9 EC	0.0067	32	3.75 ml
9	Flupyradifuron 17.9 EC	0.0089	43	5.0 ml
10.	Flupyradifuron 17.9 EC	0.0112	53	6.25 ml
11.	Untreated Control	--	--	--

III. RESULTS AND DISCUSSION

The results presented in table 1 to 6 showed effect of different insecticides on populations of sucking pests in brinjal. During entire period aphid populations is below ETL or less. There are no any sucking pests infestation during *kharif* 2019-20 in brinjal.

3.1 Efficacy of insecticides against white fly:

In pooled over year data of three years (Table 1), lowest white fly population (2.79/leaf) observed in Sulfoxaflor 21.8 SC 0.03 per cent @ 12.5 ml/10 liter of water which was followed by Sulfoxaflor 21.8 SC 0.024 per cent @ 10 ml/10 liter of water and Cyantraniliprole 10.26 OD 0.0072 per cent @ 7.02 ml/10 liter of water.

3.2 Efficacy of insecticides against jassid:

In pooled over year data of three years (Table 2), lowest jassid fly population (1.21/leaf) observed in Sulfoxaflor 21.8 SC 0.03 per cent @ 12.5 ml/10 liter of water the treatment which was followed by Sulfoxaflor 21.8 SC 0.024 per cent @ 10 ml/10 liter of water and Thiamethoxam 25 WG 0.0084 per cent @ 3.36 g/10 liter of water.

3.3 Effect of insecticides predator:

During the year 2020-21, 2021-22 and 2022-23, there was no significant difference observed among the mean population of predators at before spray and at different days after both the sprays (Table 3).

TABLE 1

EFFECT OF DIFFERENT INSECTICIDES ON WHITE FLY POPULATION IN BRINJAL (POOLED)

Sr. No.	Treatments	Conc. (%)	No. of white fly /leaf				Pooled over year
			Before spray	2020-21	2021-22	2022-23	
1	Thiamethoxam 25 WG	0.0084	2.87^{a}	1.90^{b}	1.97^{bc}	1.99^{bc}	1.95^{bcd}
			-7.54	-3.18	-3.45	-3.56	-3.4
2	Cyantraniliprole 10.26 OD	0.0054	2.89^{a}	1.90^{b}	1.99^{bc}	2.03^{bc}	1.97^{bcd}
			-7.49	-3.21	-3.54	-3.69	-3.48
3	Cyantraniliprole 10.26 OD	0.0072	2.89^{a}	1.87^{b}	1.96^{bc}	2.00^{bc}	1.94^{cd}
			-7.58	-3.1	-3.44	-3.6	-3.38
4	Cyantraniliprole 10.26 OD	0.009	2.88^{a}	1.90^{b}	1.95^{bc}	1.99^{bc}	1.94^{cd}
			-7.57	-3.19	-3.4	-3.54	-3.38
5	Sulfoxaflor 21.8 SC	0.018	2.87^{a}	1.92^{b}	1.96^{bc}	2.01^{bc}	1.96^{bcd}
			-7.56	-3.27	-3.45	-3.62	-3.45
6	Sulfoxaflor 21.8 SC	0.024	2.88^{a}	1.89^{b}	1.90^{c}	1.95^{c}	1.91^{d}
			-7.49	-3.13	-3.22	-3.43	-3.26
7	Sulfoxaflor 21.8 SC	0.03	2.87^{a}	1.70^{c}	1.77^{d}	1.86^{d}	1.78^{e}
			-7.59	-2.52	-2.79	-3.06	-2.79
8	Flupyradifuron 17.9 EC	0.0067	2.86^{a}	1.94^{b}	2.03b	2.06^{b}	2.01^{b}
			-7.56	-3.38	-3.71	-3.83	-3.64
9	Flupyradifuron 17.9 EC	0.0089	2.89^{a}	1.93^{b}	2.02^{b}	2.04^{bc}	2.00^{bc}
			-7.59	-3.31	-3.68	-3.77	-3.59
10	Flupyradifuron 17.9 EC	0.0112	2.88^{a}	1.91^{b}	2.02^{b}	2.04^{bc}	1.99^{bc}
			-7.61	-3.24	-3.65	-3.75	-3.55
11	Untreated Control	--	2.90^{a}	2.69^{a}	2.73^{a}	2.77^{a}	2.73^{a}
			-7.59	-6.74	-6.99	-7.18	-6.97
S.Em.±		T	0.05	0.03	0.03	0.03	0.02
		P	-	0.02	0.02	0.02	0.01
		S	-	0.01	0.01	0.01	0.01
		Y	0.03	-	-	-	0.01
		T×P	-	0.06	0.07	0.07	0.04
		T×S	-	0.04	0.05	0.05	0.02
		P×S	-	0.03	0.03	0.03	0.02
		Y×T	0.11	-	-	-	0.03
		Y×P	-	-	-	-	0.02
		Y×S	-	-	-	-	0.01
		T×P×S	-	0.08	0.09	0.1	0.05
		Y×S×T	-	-	-	-	0.04
		Y×S×P	-	-	-	-	0.03
		Y×P×T	-	-	-	-	0.07
		Y×S×P×T	-	-	-	-	0.09
C. D. at 5%		T	NS	0.07	0.08	0.09	0.05
		Y×S×P×T	-	-	-	-	NS
C.V. (%)			6.39	7.2	7.83	8.44	7.86

Figures in parentheses are retransformed values, those outside are $\sqrt{x+0.5}$ ***transformed values***

Treatment means with the letter(s) in common are not significant by DNMRT at 5% level of significance

TABLE 2
EFFECT OF DIFFERENT INSECTICIDES ON JASSID POPULATION IN BRINJAL (POOLED)

Sr. No.	Treatments	Conc. (%)	No. of jassid /leaf				Pooled over year
			Before spray	2020-21	2021-22	2022-23	
1	Thiamethoxam 25 WG	0.0084	1.80^{a}	1.36^{b}	1.44^{bc}	1.46^{b}	1.42^{de}
			-2.73	-1.36	-1.59	-1.65	-1.53
2	Cyantraniliprole 10.26 OD	0.0054	1.80^{a}	1.39^{b}	1.46^{bc}	1.50^{b}	1.45^{bcd}
			-2.75	-1.44	-1.64	-1.77	-1.62
3	Cyantraniliprole 10.26 OD	0.0072	1.80^{a}	1.37^{b}	1.45^{bc}	1.48^{b}	1.43^{cde}
			-2.76	-1.38	-1.62	-1.72	-1.57
4	Cyantraniliprole 10.26 OD	0.009	1.79^{a}	1.36^{b}	1.44^{bc}	1.48^{b}	1.43^{cde}
			-2.72	-1.37	-1.6	-1.7	-1.56
5	Sulfoxaflor 21.8 SC	0.018	1.76^{a}	1.38^{b}	1.45^{bc}	1.48^{b}	1.43^{cde}
			-2.61	-1.42	-1.6	-1.71	-1.58
6	Sulfoxaflor 21.8 SC	0.024	1.79^{a}	1.35^{b}	1.41^{c}	1.44^{b}	1.40^{e}
			-2.73	-1.35	-1.51	-1.61	-1.49
7	Sulfoxaflor 21.8 SC	0.03	1.78^{a}	1.26^{c}	1.29^{d}	1.35^{c}	1.30^{f}
			-2.7	-1.09	-1.19	-1.35	-1.21
8	Flupyradifuron 17.9 EC	0.0067	1.77^{a}	1.39^{b}	1.50^{b}	1.53^{b}	1.48^{b}
			-2.67	-1.46	-1.78	-1.87	-1.7
9	Flupyradifuron 17.9 EC	0.0089	1.76^{a}	1.39^{b}	1.48^{b}	1.51^{b}	1.46^{bc}
			-2.62	-1.46	-1.72	-1.8	-1.66
10	Flupyradifuron 17.9 EC	0.0112	1.75^{a}	1.36^{b}	1.47^{bc}	1.50^{b}	1.74^{a}
			-2.59	-1.37	-1.68	-1.76	-1.6
11	Untreated Control	--	1.81^{a}	1.72^{a}	1.76^{a}	1.80^{a}	1.76^{a}
			-2.75	-2.46	-2.62	-2.76	-2.61
S.Em.±		T	0.05	0.02	0.02	0.03	0.01
		P	-	0.03	0.02	0.02	0.01
		S	-	0.01	0.01	0.01	0.06
		Y	0.03	-	-	-	0.07
		T×P	-	0.04	0.06	0.04	0.03
		T×S	-	0.03	0.04	0.03	0.02
		P×S	-	0.02	0.02	0.02	0.01
		Y×T	0.09	-	-	-	0.02
		Y×P	-	-	-	-	0.02
		Y×S	-	-	-	-	0.01
		T×P×S	-	0.06	0.08	0.08	0.04
		Y×S×T	-	-	-	-	0.03
		Y×S×P	-	-	-	-	0.02
		Y×P×T	-	-	-	-	0.05
		Y×S×P×T	-	-	-	-	0.07
C. D. at 5%		T	NS	0.06	0.07	0.07	0.04
		Y×S×P×T	-	-	-	-	NS
C.V. (%)			9.11	7.78	9.13	9.3	9.13

Figures in parentheses are retransformed values, those outside are $\sqrt{x+0.5}$ ***transformed values***

Treatment means with the letter(s) in common are not significant by DNMRT at 5% level of significance

TABLE 3
EFFECT OF DIFFERENT INSECTICIDES ON PREDATOR POPULATION IN BRINJAL (POOLED)

Sr. No.	Treatments	Conc. (%)	No. of predator/plant				Pooled over year
			Before spray	2020-21	2021-22	2022-23	
1	Thiamethoxam 25 WG	0.0084	1.20^{a}	1.07^{bc}	1.10^{c}	1.20^{c}	1.12^{cd}
			-1.16	-0.67	-0.72	-0.95	-0.78
2	Cyantraniliprole 10.26 OD	0.0054	1.22^{a}	1.07^{bc}	1.11^{c}	1.19^{c}	1.13^{cd}
			-1.16	-0.67	-0.74	-0.94	-0.78
3	Cyantraniliprole 10.26 OD	0.0072	1.20^{a}	1.05^{c}	1.10^{c}	1.20^{c}	1.12^{cd}
			-1.18	-0.62	-0.73	-0.94	-0.76
4	Cyantraniliprole 10.26 OD	0.009	1.24^{a}	1.07^{bc}	1.12^{c}	1.20^{c}	1.13^{cd}
			-1.24	-0.66	-0.78	-0.95	-0.8
5	Sulfoxaflor 21.8 SC	0.018	1.22^{a}	1.09^{bc}	1.13^{bc}	1.21^{bc}	1.14^{cd}
			-1.2	-0.69	-0.79	-0.98	-0.82
6	Sulfoxaflor 21.8 SC	0.024	1.24^{a}	1.09^{bc}	1.15^{bc}	1.22^{bc}	1.15^{c}
			-1.2	-0.69	-0.84	-1.01	-0.85
7	Sulfoxaflor 21.8 SC	0.03	1.23^{a}	1.13^{b}	1.19^{b}	1.27^{b}	1.20^{b}
			-1.16	-0.8	-0.93	-1.12	-0.95
8	Flupyradifuron 17.9 EC	0.0067	1.23^{a}	1.06^{c}	1.10^{c}	1.18^{c}	1.11^{d}
			-1.22	-0.64	-0.71	-0.89	-0.75
9	Flupyradifuron 17.9 EC	0.0089	1.21^{a}	1.06^{c}	1.11^{c}	1.20^{c}	1.12^{cd}
			-1.22	-0.64	-0.74	-0.95	-0.78
10	Flupyradifuron 17.9 EC	0.0112	1.22^{a}	1.08^{bc}	1.11^{c}	1.20^{c}	1.13^{cd}
			-1.24	-0.64	-0.75	-0.95	-0.78
11	Untreated Control	--	1.30^{a}	1.24^{a}	1.29^{a}	1.35^{a}	1.29^{a}
			-1.22	-1.03	-1.18	-1.34	-1.18
S.Em.±		T	0.03	0.02	0.02	0.02	0.01
		P	-	0.01	0.01	0.01	0.01
		S	-	0.01	0.01	0.01	0.01
		Y	0.02	-	-	-	0.01
		T×P	-	0.04	0.03	0.05	0.03
		T×S	-	0.02	0.03	0.03	0.02
		P×S	-	0.02	0.02	0.02	0.01
		Y×T	0.06	-	-	-	0.02
		Y×P	-	-	-	-	0.01
		Y×S	-	-	-	-	0.01
		T×P×S	-	0.05	0.05	0.07	0.04
		Y×S×T	-	-	-	-	0.02
		Y×S×P	-	-	-	-	0.03
		Y×P×T	-	-	-	-	0.02
		Y×S×P×T	-	-	-	-	0.04
C. D. at 5%		T	NS	0.05	NS	NS	0.03
		Y×S×P×T	-	-	-	-	NS
C.V. (%)			8.61	8.41	10.27	9.23	8.41

Figures in parentheses are retransformed values, those outside are $\sqrt{x+0.5}$ ***transformed values***

Treatment means with the letter(s) in common are not significant by DNMRT at 5% level of significance

3.4 Impact on yield:

The data on brinjal yield presented in Table 4 clearly reveled that plot sprayed with sulfoxaflor 21.8 SC 0.03 per cent @ 12.5 ml/10 liter of water recorded maximum yield duringfirst (286.61 q/ha) followed by the treatment sulfoxaflor 21.8 SC 0.024 per cent @ 10 ml/10 liter of water (255.68 q/ha) and Thiamethoxam 25 WG 0.0084 per cent @ 3.36 g/10 liter of water (248.97). While Lowest yield was observed in untreated control with 182.24 q/ha.

3.5 % LLB (Little leaf of brinjal) infestation:

There was no significant difference in % BLB infestation observed among all the treatments. Minimum % BLB infestation (4.36%) was observed in the plots treated with Sulfoxaflor 21.8 SC, 0.0300% (Table 5).

3.6 Pesticide Residue Analysis:

Pesticide residue analysis for the best treatment was made at Bio science Research Centre, S. D. Agricultural University, Sardarkrushinagar and it can be seen from the results that the residue of sulfoxaflor 21.8 SC 0.03 per cent @ 12.5 ml/10 liter of water was found below quantification limit (Table 6).

TABLE 4
EFFECT OF DIFFERENT INSECTICIDES ON FRUIT YIELD OF BRINJAL (POOLED)

Sr. No.	Treatments	Conc. (%)	Yield (q/ha)			
			2020-21	2021-22	2022-23	Pooled over year
1	Thiamethoxam 25 WG	0.0084	218.64^{abc}	244.69^{b}	283.58^{ab}	248.97^{bc}
2	Cyantraniliprole 10.26 OD	0.0054	189.81^{cd}	221.54^{bc}	251.11^{abc}	220.82^{de}
3	Cyantraniliprole 10.26 OD	0.0072	200.86^{bcd}	228.52^{b}	260.31^{abc}	229.90^{bcde}
4	Cyantraniliprole 10.26 OD	0.009	215.12^{abc}	245.19^{b}	274.14^{ab}	244.81^{bcd}
5	Sulfoxaflor 21.8 SC	0.018	211.23^{bc}	239.81^{b}	274.32^{ab}	241.79^{bcde}
6	Sulfoxaflor 21.8 SC	0.024	232.04^{ab}	251.85^{ab}	283.15^{ab}	255.68^{b}
7	Sulfoxaflor 21.8 SC	0.03	249.88^{a}	288.95^{a}	320.99^{a}	286.61^{a}
8	Flupyradifuron 17.9 EC	0.0067	196.05^{bcd}	209.88^{bc}	242.04^{bc}	215.99^{e}
9	Flupyradifuron 17.9 EC	0.0089	205.62^{bcd}	216.30^{bc}	239.38^{bc}	220.43^{de}
10	Flupyradifuron 17.9 EC	0.0112	206.98^{bcd}	217.35^{bc}	250.55^{abc}	224.96^{cde}
11	Untreated Control	--	169.57^{d}	184.51^{c}	192.66^{c}	182.24^{f}
S.Em.±		T	11.89	12.91	20.97	8.21
		Y	-	-	-	4.76
		Y×T	-	-	-	15.89
C. D. at 5%		T	35.08	38.08	61.86	23.11
		Y ×T	-	-		NS
C.V. (%)			9.87	9.65	13.91	11.69

Treatment means with the letter(s) in common are not significant by DNMRT at 5% level ofsignificance

TABLE 5
EFFECT OF DIFFERENT INSECTICIDES ON LLB INFESTATION IN BRINJAL (POOLED).

Sr. No.	Treatments	Conc. (%)	LLB infestation (%)			
			2020-21	2021-22	2022-23	Pooled over year
1	Thiamethoxam 25 WG	0.0084	12.42[a]	13.96[a]	13.10[b]	13.59[cde]
			-4.76	-5.95	-4.76	-5.16
2	Cyantraniliprole 10.26 OD	0.0054	13.96[a]	16.36[a]	15.74[ab]	15.74[abcd]
			-5.95	-8.33	-7.14	-7.14
3	Cyantraniliprole 10.26 OD	0.0072	12.42[a]	15.16[a]	15.74[ab]	14.86[abcde]
			-4.76	-7.14	-7.14	-6.35
4	Cyantraniliprole 10.26 OD	0.009	10.89[a] (3.76)	13.96[a]	13.10[b]	13.10[de]
				-5.95	-4.76	-4.82
5	Sulfoxaflor 21.8 SC	0.018	12.42[a] (4.76)	15.16[a]	15.75[ab]	14.86[abcde]
				-7.14	-7.14	-76.35
6	Sulfoxaflor 21.8 SC	0.024	12.42[a] (4.76)	15.49[a]	14.57[ab]	14.57[bcde]
				-7.14	-5.95	-5.95
7	Sulfoxaflor 21.8 SC	0.03	10.89[a] (3.57)	12.42[a]	13.10[b]	12.61[e]
				-4.76	-4.76	-4.36
8	Flupyradifuron 17.9 EC	0.0067	13.96[a] (5.95)	17.89[a]	18.38[a]	17.11[ab]
				-9.52	-9.52	-8.33
9	Flupyradifuron 17.9 EC	0.0089	13.96[a] (5.95)	17.89[a]	17.21[ab]	16.72[ab]
				-9.52	-9.52	-8.33
10	Flupyradifuron 17.9 EC	0.0112	12.42[a] (4.76)	16.69[a]	17.21[ab]	15.84[abc]
				-8.33	-8.33	-7.14
11	Untreated Control	--	15.16[a] (7.14)	17.89[a]	18.38[a]	17.50[a]
				-9.52	-9.52	-8.73
S.Em.±		T	1.56	1.758	1.5	0.81
		Y	-	-	-	0.47
		Y×T	-	-	-	1.57
C. D. at 5%		T	NS	NS	NS	2.27
		Y ×T	-	-		NS
C.V. (%)			21.08	19.372	16.62	17.93

Treatment means with the letter(s) in common are not significant by DNMRT at 5% level of significance

TABLE 6
PESTICIDE RESIDUE ANALYSIS FROM THE FRUIT OF BRINJAL

Sr. No.	Sample Name	Pesticide tested	Results ppm	LoD ppm	LoQ ppm	Maximum residue limits MRL (ppm) in raw feed		
						Codex	EU	Other country
1.00	Harvest after spray "0" day	Sulfoxaflor	BQL	0.00	0.01	1.5 Vegetables	0.30	2.00
2.00	Harvest after spray "1" day	Sulfoxaflor	BQL					
3.00	Harvest after spray "3" day	Sulfoxaflor	BQL					
4.00	Harvest after spray "5" day	Sulfoxaflor	BQL					
5.00	Harvest after spray "7" day	Sulfoxaflor	BQL					
6.00	Harvest after spray "14" day	Sulfoxaflor	BQL					
7.00	Untreated Control	Sulfoxaflor	BDL					

IV. CONCLUSION

Sulfoxaflor 21.8 SC 0.03 per cent @ 12.5 ml/10 liter of water recorded minimum white fly and jassid population, no effect on predator and highest yield and proved to be the most effective treatment against sucking pests of brinjal.

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