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EVALUATION OF DIFFERENT READY-MIX INSECTICIDES AGAINST THE INSECT PEST OF SESAME

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ABSTRACT

Field trial was carried out at Regional Research Station, Anand Agricultural University, Anand during summer, 2022 to evaluate the efficacy of ready-mix insecticides against insect pest of sesame. Among the seven insecticides, acephate 50% + imidacloprid 01.80% SP, pyriproxyfen 5% + fenpropathrin 15% EC as well as beta-cyfluthrin 08.49% + imidacloprid 19.81% w/w OD were found to be most effective against whitefly. Whereas, acephate 50% + imidacloprid 01.80% SP, thiamethoxam 12.60% + lambda-cyhalothrin 09.50% ZC as well as beta-cyfluthrin 08.49% + imidacloprid 19.81% w/w OD were found to be most effective against jassid. While, treatments of thiamethoxam 12.60% + lambda-cyhalothrin 09.50% ZC, chlorantraniliprole 8.80% + thiamethoxam 17.50% SC as well as profenophos 40% + cypermethrin 04% EC were found most effective against leaf webber and capsule borer. These findings were further augmented with higher seed yield from the treated plots of thiamethoxam 12.60% + lambda-cyhalothrin 09.50% ZC (1287 kg/ha), acephate 50% + imidacloprid 01.80% SP (1246 kg/ha) and pyriproxyfen 5% + fenpropathrin 15% EC (1157 kg/ha). Looking to the Incremental Cost Benefit Ratio (ICBR), the highest (1:11.00) return was obtained with the treatment of thiamethoxam 12.60% + lambda-cyhalothrin 09.50% ZC followed by acephate 50% + imidacloprid 01.80% SP (1: 7.09) and pyriproxyfen 5% + fenpropathrin 15% EC (1: 4.59). In nutshell, application of acephate 50 % + imidacloprid 01.80% SP and thiamethoxam 12.60% + lambda-cyhalothrin 09.50% ZC to sesame crop for effective management of insect pests.

Key words : Capsule borer, ICBR, Jassid, Seed yield and Whitefly.

Introduction

Sesame (*Sesamum indicum* Linnaeus), often known as the “Queen of oil seeds”. Sesame is the oldest indigenous oil plant with longest history of its cultivation in India. It is rich in oil content (50%) and protein content (25%) (Panday *et al.*, 2017). The sesame crop is predominantly cultivated in tropical and subtropical regions. In India, the cultivation is mainly confined to Uttar Pradesh, Rajasthan, Madhya Pradesh, Andhra Pradesh, Odisha, Gujarat etc (Choudhary *et al.*, 2020). India contributes the highest sesame acreage of about 16.22 lakh hectares with production of 6.57 lakh tonnes and productivity of 405.70 kg/ha (Anonymous, 2022b). In Gujarat, total sesame growing area is 2.08 lakh hectares with production of 1.33 lakh tones and productivity is 641.22 kg/ha (Anonymous, 2022a). The yield potential of sesame has not been fully achieved because of several biotic and abiotic factors. One of the significant constraints in sesame production is the extensive damage inflicted by various insect pests. Earlier, 29 insect species (Rai, 1976) were known to damage the crop but recently, the situation has significantly evolved with emerging new pest challenges. Among 67 insect pests damaging sesame crop (Ahirwar *et al.*, 2009). Major insect pests of sesame are leaf webber or roller and capsule borer, *Antigastra catalaunalis* Duponchel; gall fly, *Asphondylia sesame* Felt; whitefly, *Bemisia tabaci* (Gennadius) and jassid, *Orosius albicinctus* Distant. These pests inflict harm to the crop at various growth stages, impacting both the quality and quantity of the yield, leading to significant losses ranging from 25 to 90 per cent in seed yield(Ahuja and Kalyan, 2001). Seed damage due to leaf webber and capsule borer was reported from 73.40 to 100 per cent in Gujarat (Kapadia, 1996) and 10 to 60 per cent in Uttar Pradesh (Singh *et al*., 2003). Jassid responsible to transmit phyllody diseases in sesame (Esmailzadeh-Hosseini *et al*., 2007). Insecticides are the primary weapons to control any insect pest. The present requirement underscores the importance of utilizing not only diverse groups of environmentally friendly chemicals but also those that provide effective control of insect pest populations through innovative modes of action. The effectiveness of these chemicals must be examined to ensure efficient and cost-effective control of this pest. In light of this, the current study aims to assess the efficacy of ready-mix insecticides for the management of insect pests in sesame.

Materials and Methods

Field study on evaluation of different ready-mix insecticides against insect pest of sesame, a field experiment was conducted at Regional Research Station, Anand Agricultural University, Anand during summer, 2022 (Lat: 22.530161^0; Long: 72.964606). Required plots having a plot size of 2.4 × 3 m (Gross plot) were prepared to accommodate all the eight treatments (Fig. 1). The healthy seeds of sesame variety Gujarat Junagadh Til 5 (GJT 5) was sown by dibbling method (2 seeds per hill) with the spacing of 30 × 15 cm was adopted. Selected ready-mix insecticide molecules that are known to have novel mode of action and depicted in Table 1.

Fig. 1 : General view of experiment on bio-efficacy of different insecticides against insect pests infesting sesame during summer season.

Method of Recording Observations : All agronomical practices were followed to raise sesame crop. The first spray was applied at appearance of insect pests population and the second spray was applied 15 days after first spray. All the insecticides were applied as a foliar spray using a knapsack sprayer fitted with hollow cone nozzle. The observations were recorded one day before first spray as well as 1, 3, 7 and 15 days after each spray.

The population of sucking insect pests (nymphs and adults) was counted from three (upper, middle and lower) leaves per plant. Number of larva(e) per plant (leaf webber and capsule borer) was recorded. Alongside this, healthy and damaged leaves, flowers and capsules per plant was also recorded and per cent damage was worked out. As per the formula given by Khosla (1977).

$$\text{Leaf/flower/capsule damage (\%)} = \frac{\text{Number of damaged leaf/flower/capsule}}{\text{Total number of leaf/flower/capsule}} \times 100$$

Seed yield was recorded from each net plot area and statistically analysed by adopting standard statistical technique (Steel and Torrie, 1980). For finding out the economics of different treatments evaluated against different insect pests infesting sesame, Incremental Cost Benefit Ratio (ICBR) was worked out.

Results and Discussion

Whitefly, *Bemisia tabaci* : The data on whitefly population are presented in Table 2. It was evident that acephate + imidacloprid (2.22 whiteflies/three leaves) was found significantly most effective and it was at par with

Table 1 : Details of insecticidal treatments.

Tr. No.	Treatments	Conc. (%)	Dosage	
			g a.i./ha	g/ml in 10 litre of water
T_1	Beta-cyfluthrin 08.49% + Imidacloprid 19.81% w/w OD	0.0113	56.5	4
T_2	Chlorantraniliprole 8.80% + Thiamethoxam 17.50% SC	0.0299	144.65	11
T_3	Pyriproxyfen 5% + Fenpropathrin 15% EC	0.0200	100	10
T_4	Thiamethoxam 12.60% + Lambda-cyhalothrin 09.50% ZC	0.0055	27.5	2.5
T_5	Acephate 50% + Imidacloprid 01.80% SP	0.1036	518	20
T_6	Emamectin benzoate 1.50% + Fipronil 3.50% SC	0.0050	25	10
T_7	Profenophos 40% + Cypermethrin 04% EC	0.0880	440	20
T_8	Untreated control	-	-	-

*__Note__: The concentration was worked out by using 500 litres of water per ha for spraying.

Table 2 : Bio-efficacy of insecticides against insect pest infesting sesame (Pooled over periods and sprays).

Tr. no.	Treatment	Conc. (%)	Sucking pest (No. of nymph/adult per three leaves)		Leaf webber and capsule borer				Seed yield (kg/ha)	ICBR
			Whitefly	Jassid	Larval population (No. of larvae per plant)	*Leaf damage (%)	*Flower damage (%)	*Capsule damage (%)		
1	Beta-cyfluthrin 8.49% + Imidacloprid 19.81% w/w OD	0.0113	1.72^{a}(2.46)	1.55^{a}(1.90)	1.39^{c}(1.43)	26.92^{c} (20.50)	24.08^{c} (16.65)	22.54^{d}(14.69)	1137^{abc}	1: 6.19
2	Chlorantraniliprole 8.80% + Thiamethoxam 17.50% SC	0.0299	2.28^{c}(4.70)	2.11^{c}(3.95)	0.97^{a}(0.44)	19.07^{a} (10.67)	16.09^{a} (7.68)	15.23^{b}(6.90)	1125^{abc}	1: 1.77
3	Pyriproxyfen 5% + Fenpropathrin 15% EC	0.0200	1.70^{a}(2.39)	1.83^{b}(2.85)	1.19^{b}(0.92)	22.56^{b} (14.72)	19.21^{b} (10.83)	18.95^{c}(10.55)	1157^{ab}	1: 4.59
4	Thiamethoxam 12.60% + Lambda-cyhalothrin 9.50% ZC	0.0055	2.00^{b}(3.50)	1.52^{a}(1.81)	0.95^{a}(0.40)	17.51^{a}(9.05)	15.15^{a} (6.83)	12.43^{a}(4.63)	1287^{a}	1: 11.00
5	Acephate 50% + Imidacloprid 1.80% SP	0.1036	1.65^{a}(2.22)	1.48^{a}(1.69)	1.43^{c}(1.54)	27.41^{c} (21.19)	24.57^{c} (17.29)	23.02^{d}(15.29)	1246^{a}	1: 7.09
6	Emamectin benzoate 1.50% + Fipronil 3.50% SC	0.0050	2.34^{c}(4.98)	2.17^{c}(4.21)	1.21^{b}(0.96)	22.89^{b} (15.13)	19.83^{b} (11.51)	19.08^{c}(10.69)	984^{cd}	1: 2.08
7	Profenophos 40% + Cypermethrin 4% EC	0.0880	2.31^{c}(4.84)	2.15^{c}(4.12)	0.99^{a}(0.48)	18.47^{a} (10.04)	15.57^{a} (7.20)	13.11^{a}(5.14)	997^{bcd}	1: 2.78
8	Untreated Control	-	2.93^{d}(8.08)	2.65^{d}(6.52)	1.66^{d}(2.26)	30.93^{d} (26.42)	29.83^{d} (24.74)	31.46^{e}(27.24)	860^{d}	-
S. Em. ±	Treatment (T)		0.03	0.03	0.02	0.45	0.39	0.51	51.20	
	Period (P)		0.02	0.02	0.01	0.32	0.27	0.36	-	
	Spray (S)		0.01	0.01	0.01	0.22	0.19	-	-	
	T × P		0.07	0.07	0.04	0.90	0.78	1.02	-	
	T × S		0.05	0.04	0.03	0.64	0.55	-	-	
	P × S		0.03	0.03	0.02	0.45	0.39	-	-	
	T × P × S		0.10	0.09	0.06	1.28	1.10	-	-	
F Test	T		Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	
C.V. (%)			8.70	8.85	8.83	9.55	9.30	9.09	8.07	

Note: 1. Figures outside the parentheses are $\sqrt{X+0.5}$ transformed values and those inside the parentheses are retransformed values. 2. ***Figures outside the parentheses are arcsine transformed values and those inside the parentheses are retransformed values. 3. Significant parameters and its interactions: S, P, T × P, T × S and P × S4. Treatment mean(s) with the letter(s) in common are not differed significantly by Duncan's New Multiple Range Test (DNMRT) at 5% level of significance.

pyriproxyfen + fenpropathrin and beta-cyfluthrin + imidacloprid with 2.39 and 2.46 whiteflies per three leaves, respectively. Thiamethoxam + lambda-cyhalothrin (3.50 whiteflies/three leaves) emerged as the next effective treatment. Emamectin benzoate + fipronil recorded the maximum (4.98 whiteflies/three leaves) population of whitefly and at par with chlorantraniliprole + thiamethoxam (4.70 whiteflies/ three leaves) and profenophos + cypermethrin (4.84 whiteflies/ three leaves).

Jassid, *Orosius albicinctus* : Pooled data on *O. albicinctus* population (Table 2), revealed that acephate + imidacloprid (1.69 jassids/three leaves) was significantly the superior and it was on par with thiamethoxam + lambda-cyhalothrin (1.81 jassids/three leaves) and beta-cyfluthrin + imidacloprid (1.90 jassids/three leaves). Among the evaluated insecticides, next best treatment was pyriproxyfen + fenpropathrin recorded 2.85 jassids/ three leaves followed by chlorantraniliprole + thiamethoxam (3.95 jassids/three leaves) and profenophos + cypermethrin (4.12 jassids/three leaves) and this treatment was at par with each other. However, the treatment of emamectin benzoate + fipronil recorded highest (4.21 jassids/three leaves) population of jassid.

Leaf webber and capsule borer, *Antigastra catalaunalis* : A close perusal of the data on larval population are shown in table 2, specifies that thiamethoxam + lambda-cyhalothrin (0.40 larva/plant) was significantly effective and it was remained at par with chlorantraniliprole + thiamethoxam (0.44 larva/plant) and profenophos + cypermethrin (0.48 larva/plant). Plots treated with pyriproxyfen + fenpropathrin (0.92 larva/ plant) and emamectin benzoate + fipronil (0.96 larva/plant) also proved significantly effective in managing the larval population and these two treatments were no significantly differs from each other. Of the all evaluated insecticides, acephate + imidacloprid recorded higher (1.54 larvae/ plant) population of *A. catalaunalis* and at par with beta-cyfluthrin + imidacloprid (1.43 larvae/plant).

Damage caused by *A. catalaunalis* : Per cent leaf, flower and capsule damage data depicted in Table 2, concluded that thiamethoxam + lambda-cyhalothrin recorded lowest 9.05, 6.83 and 4.63 per cent leaf, flower and capsule damage, respectively and proved as best insecticide among the all treatments, however, it was on par with profenophos + cypermethrin and chlorantraniliprole + thiamethoxam. Of all the evaluated treatments, pyriproxyfen + fenpropathrin and emamectin benzoate + fipronil found mediocre in their effectiveness. The treatment of acephate + imidacloprid recorded highest leaf, flower and capsule damage and it remained at par with beta-cyfluthrin + imidacloprid.

Seed yield of sesame : Significantly highest seed yield (1287 kg/ha) was recorded in thiamethoxam + lambda-cyhalothrin (Table 2) and at par with acephate + imidacloprid (1246 kg/ha), pyriproxyfen + fenpropathrin (1157 kg/ha), beta-cyfluthrin + imidacloprid (1137 kg/ha) and chlorantraniliprole + thiamethoxam (1125 kg/ha). Among the evaluated insecticides, lowest seed yield was obtained in profenophos + cypermethrin (997 kg/ha) and emamectin benzoate + fipronil (984 kg/ha). Control plots recorded the seed yield of 860 kg/ha which was significantly least as compared to the rest of the treatments.

In partial conformity with the present investigation Panday *et al.* (2018) and Kumar *et al.* (2022) reported that, application of imidacloprid 17.8 SL (0.25 ml/l) recorded lowest population of whitefly with higher seed yield. Thangjam and Vastrad (2015) revealed that imidacloprid 17.8 SL was found to be the most effective with the least population of jassid followed by lambda-cyhalothrin 5 EC and recorded highest seed yield. Ram *et al.* (2020) and Prajapat *et al.* (2020) concluded that imidacloprid 17.8 SL was found most superior for checking jassid population and it was at part with thiamethoxam 0.025 per cent. According to Fakeer and Gameel (2022), lambda-cyhalothrin 5 EC was found most effective against leaf hopper with 81.28 per cent reduction after 21 days of spraying.

Chaitra (2016) stated that emamectin benzoate 5 SG was highly effective against *A. catalaunalis* in sesame as well as profenophos 40% + cypermethrin 4% recorded significantly lowest (1.65 larvae/plant) larval population with least pod damage (15.75%) among all insecticides (Kishor, 2020). Which are completely parallel to the findings of present research. Fakeer and Gameel (2022), reported that the lambda-cyhalothrin 5 EC recorded (90.78%) highest reduction of *A. catalaunalis* larvae.

Conclusion

The significant conclusion procured from the research studies are summarized hereunder.

Application of acephate 50% + imidacloprid 01.80% SP and thiamethoxam 12.60% + lambda-cyhalothrin 09.50% ZC to sesame crop for effective management of insect pests. In the context of the ICBR of the evaluated insecticides, the highest (1: 11.00) return was obtained with the treatment of thiamethoxam 12.60% + lambda-cyhalothrin 09.50% ZC while, the treatments of acephate 50% + imidacloprid 01.80% SP and beta-cyfluthrin +

imidacloprid (1: 6.19) stood next.

Conflict of interest : Authors declare that there is no conflict of interest among, regarding the publication of this manuscript.

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