Indian Journal of Entomology 85(1): 184-187 (2023) DoI. No.: 10.55446/IJE.2022.526

EFFICACY OF SEED TREATMENT AND FOLIAR APPLICATION OF AGAINST SOYBEAN STEM FLY *MELANAGROMYZA SOJAE*

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ABSTRACT

A field experiment on the effectiveness of seed treatment and foliar application of insecticides against soybean stem fly *Melanagromyza sojae* (Zehntner) was carried out at the All India Coordinated Research Project (AICRP) on Soybean, Gandhi Krishi Vignan Kendra (GKVK), Bengaluru, Karnataka during kharif 2017. The seeds treated with thiamethoxam 30FS @ 10 ml/kg seed and foliar application of thiamethoxam 25WG 0.40 g/ l at 30 days after germination (DAG) were found effective. It was on par with seeds treated with imidacloprid 48FS @ 1.25 ml/ kg seed and foliar application of imidacloprid 17.8SL @ 0.50 ml/ l at 30 DAG. The plots treated with these gave higher grain yield of 1794.48 and 1678.89 kg/ ha, respectively. Higher net gain of 1: 4.22 was obtained from the seeds treated with thiamethaxom 30FS @ 10 ml/ kg seed and foliar application of thiamethoxam 25WG 0.40 g/ l at 30 DAG; and it proved to be highly cost effective. The foliar application of chlorantraniliprole 18.5SC @ 0.30 ml/ l at 10 and 30 DAG was equally effective compared to thiamethoxam and recorded the C: B ratio of 1: 3.94. The plots treated with quinalphos 25EC @ 2 ml/ l at 10 and 30 DAG led to the least stem tunneling of (26.73%) and the low grain yield of 1177.78 kg/ ha.

Key words: Soybean, *Melanagromyza sojae*, thiamethoxam 30FS, thiamethoxam 25WG, seed treatment, foliar application, stem tunneling, yield, C: B ratio

Soybean [*Glycine max* (L.) Merrill] provides 40% protein and 20% edible oil, besides minerals and vitamins, and it has many uses (Roopa and Kambrekar, 2019). India is the fifth largest producer of soybean followed by China. Major soybean producing states are Madhya Pradesh, Maharashtra, Rajasthan, Karnataka, Uttar Pradesh, Andhra Pradesh and Gujarat. In Karnataka, soybean occupies an area of 0.27 million ha with the production of 0.17 mt and productivity is 639 kg/ ha (Anonymous, 2017). The insect pests often pose a serious threat to the soybean production, by decreasing the yield losses and impairing the quality of the produce (Singh et al., 2000). More than 65 insect species have been reported from Karnataka, infesting the soybean from cotyledon to harvesting stage of the crop (Rai et al., 1973; Adimani, 1976; Thippaiah, 1997). In India, the Stem fly, *Melanagromyza sojae* (Zehn.) (Diptera: Agromyzidae) is emerged as a major insect pest in the soybean at different growth stages (Kundu and Srivastava, 1991; Kumar et al., 2009; Manjanaik et al., 2013; Gaur et al., 2015). The soybean crop is prone to *M. sojae* infestation at all the stages of the crop. The *M. sojae* maggot enters the stem through the leaf petiole and feeds on the stem pith (Van et al., 1998). Crop grown in the sandy soils and under prolonged dry spell prone for severe *M. sojae* infestation and cause 100% crop loss (Talekar and Chen, 1983). The infestation by *M. sojae* on the early stages of the crop growth cause high seedling mortality, and affects the yield (Gangrade and Kogan 1980; Talekar, 1990), and yield losses of 20 to 30% have been reported (Singh and Singh, 1992; Venkatesan and Kundu, 1994; Jayappa, 2000). Foliar application of insecticides is not effective against stem fly, as the larva concealed inside the stem and feed on the internal content of the stem, plant lose the strength and fell on ground. Its presence is detected when plants project the visible symptoms like leaf wither and death of the plant (Kavitha, 2006). The application of insecticides is popular among the farming community due to quick and affective control. Hence, the study was taken on effectiveness of seed treatment and foliar application of insecticides against *M. sojae*.

MATERIALS AND METHODS

The field experiment was conducted at the All India Coordinated Research Project on Soybean, Zonal Agricultural Research Station, Gandhi Krishi Vignan Kendra, Bengaluru (latitude 12°58' N and longitude 77° 35' E, altitude 930 m AMSL). Experiment was laid out in a randomized Complete block design with three replications and eight treatments. The plot size was 3.0 x 3.0 m, the spacing between the rows was 30 cm and between the plants was 10 cm. The soybean cultivar JS-335 was sown in the second week of August during kharif 2017 and followed standard agronomic practices except plant protection measures. The treatments viz., T_1: Seed treatment with thiamethoxam 30 FS @ 10 ml/kg seed and foliar application of thiamethoxam 25WG @ 0.40 g/ l at 30 days after germination (DAG), T_2: Seed treatment with imidacloprid 48FS @ 1.25 ml/ kg seed and foliar application of imidacloprid 17.8SL @ 0.50 ml/ l at 30 DAG, T_3: Seed treatment with chlorpyriphos 20EC @ 5 ml/ kg seed and foliar application chlorpyriphos 20EC @ 2 ml/ l at 30 DAG, T_4: Foliar application of quinalphos 25EC @ 2 ml/ l at 10 and 30 DAG, T_5: Foliar application of lambda cyhalothrin 2.5EC @ 1ml/ l at 10 and 30 DAG, T_6: Foliar application of fipronil 5SC @ 1.50 ml/ l at 10 and 30 DAG, T_7: Foliar application of chlorantraniliprole 18.5SC @ 0.30 ml/ l at 10 and 30 DAG, T_8: Untreated control.

The seeds were treated with the thiamethoxam @ 10 ml/ kg seeds, imidacloprid @1.25 ml/kg seeds and chlorpyriphos @ 5ml/kg seeds. The required quantity of seeds were spread in plastic bowls, prescribed quantity of the insecticide emulsion was then sprinkled on the seeds, the seeds were turned repeatedly to ensure the uniform seed coating with the insecticide. The treated seeds were dried under shade for 30 minutes before sowing. The foliar application of the treatments were taken up with thiamethoxam 25WG @ 0.40 g/ l, imidacloprid 17.8SL @ 0.50 ml/ l and chlorpyriphos 20EC @ 2 ml/ l at 30 days after germination. The insecticides quinalphos @ 2ml/ l, lambda cyhalothrin @ 1 ml/ l, fipronil @ 1.50 ml/ l and chlorantraniliprole @ 0.30 ml/ l were given as foliar application at 10 and 30 days after germination in sequence**.** Observations on the seedling mortality due to stem fly infestation was recorded at 20 and 30 DAG by counting the total number of plants in four rows and the number of plants infested and the infested plants expressed in % seedling mortality. Observations on the stem tunneling were recorded from the ten randomly selected plants. The stem of the plants was split opened vertically with the help of knife. Length of the stem and per cent stem tunneled were recorded. Observations were recorded at 30 days after germination, at maturity and prior to harvesting of the crop. Length of the stem and tunnel length were measured for calculating the % stem tunneling. Harvesting was done at physiological maturity of the crop. The seeds were dried under sunlight for two days to reduce the moisture % and then yield/ plot was recorded and converted into yield in kg/ ha. Prevailing market prices of the produce, cost of the insecticides and cost of laborers were considered for calculating the C: B ratio.

RESULTS AND DISCUSSION

The seeds treated with thiamethoxam 30 FS @ 10ml/ kg seed and foliar application of thiamethoxam 25WG @ 0.40 g/ l at 30 DAG followed by the seeds treated with imidacloprid 48FS @ 1.25 ml/ kg seed and foliar application of imidacloprid 17.8SL @ 0.50 ml/ l at 30 DAG recorded the least seedling mortality of 11.39 and 13.65%, respectively. Both the treatments were equally effective. Foliar application of chlorantraniliprole 18.5SC @ 0.30 ml/ l at 10 and 30 DAG registered 15.18% of seedling mortality. Fipronil 5SC @ 1.50 ml/ l and quinalphos 25EC @ 2 ml/ l were less effective in reducing the seedling mortality. The least plant damage was recorded in the seeds treated with the thiamethoxam 30FS @ 10 ml/ kg seed and foliar application of thiamethoxam 25WG @ 0.40g/ l and it was significantly superior than foliar application of fipronil 5SC @ 1.50 ml/ l. Seeds treated with chlorpyriphos 20EC @ 5 ml/ kg seed and foliar application of chlorpyriphos 20EC @ 2 ml/ l had recorded 19.08% of seedling mortality, which was significantly higher than thiamethoxam 30FS @ 10 ml/ kg seed and foliar application of thiamethoxam 25WG @ 0.40 g/ l. Foliar application of chlorantraniliprole 18.5SC @ 0.30 ml/ l was effective and recorded 15.18% of seedling damage (Table 1).

Significantly low seedling mortality was registered in the seeds treated with thiamethoxam 30FS @ 10 ml/ kg seed and foliar application of thiamethoxam 25WG @ 0.40 g/ l at 30 DAG, it was on par with the seeds treated with imidacloprid 48FS @ 1.25 ml/ kg seed and foliar application of imidacloprid 17.8 SL @ 0.50 ml/ l at 30 DAG. Foliar application of chlorantraniliprole 18.5 SC @ 0.30 ml/ l at 10 and 30 DAG recorded high seedling mortality and it was statistically significant over other treatments. The effectiveness of these insecticides used as seed treatment and foliar application

Table 1. Effectiveness of insecticides against *M. sojae*

Treatment	Seedling mortality (%)	Stem tunneling (%)	Yield (kg/ ha)	C : B Ratio
Seed treatment with thiamethaxom 30FS @ 10.00 ml/kg seed - foliar application of thiamethoxam 25WG @ 0.40g/l at 30 DAG	3.91 (11.39)	6.27 (14.38)	1794.48[a]	1:4.22
Seed treatment with imidacloprid 48FS @ 1.25 ml/kg seed - foliar application of imidacloprid 17.8SL @ 0.50 ml/ l at 30 DAG	5.58 (13.65)	7.65 (15.94)	1678.89[ab]	1:4.19
Seed treatment with chlorpyriphos 20EC @ 5.00 ml/kg seed - foliar application of chlorpyriphos 20EC @ 2ml/ l at 30 DAG	10.70 (19.08)	17.19 (24.46)	1281.48[de]	1:3.24
Foliar application of quinalphos 25EC @ 2.00 ml/ l at 10 and 30 DAG	13.58 (21.62)	20.33 (26.73)	1177.78[e]	1:2.97
Foliar application of lambda cyhalothrin 2.5EC @ 1.00 ml/ l at 10 and 30 DAG	10.88 (19.25)	12.83 (20.92)	1540.73[bc]	1:3.88
Foliar application of fipronil 5SC @ 1.50 ml/ l at 10 and 30 DAG	12.84 (20.98)	15.60 (22.23)	1418.51[cd]	1:3.54
Foliar application of chlorantraniliprole 18.5SC @ 0.30 ml/ l at 10 and 30 DAG	6.87 (15.18)	8.71 (18.34)	1729.62[a]	1:3.94
Untreated control	21.98 (27.96)	32.45 (34.73)	866.67 [f]	-
CD (p=0.05)	2.10	1.67	157.47	-
CV (%)	10.82	7.73	7.42	-

Values given in parentheses arc sine transformation; Means followed by same alphabet statistically on par

observed during the studies are in concurrence with the reports of Gopali et al. (2007), Prabhu and Patil (2016) and Shreedhara et al. (2017). Seeds treated with thiamethaxom 30FS @ 10 ml/kg seed and foliar application of thiamethoxam 25WG @ 0.40 g/ l led to significantly less stem tunneling of (14.38%). Maximum damage of 26.73% was recorded in foliar application of quinalphos 25EC @ 2 ml/ l at 10 and 30 DAG. Whereas, the seeds treated with imidacloprid 48FS @ 1.25 ml/kg seed and foliar application of imidacloprid 17.8SL @ 0.50 ml/ l registered 15.94% stem tunneling. The foliar application of the new molecule chlorantraniliprole 18.5 SC @ 0.30 ml/ l at 10 and 30 DAG registered less stem tunneling of 18.34% which was at par with the lambda cyhalothrin 2.5EC @ 1 ml/ l foliar application at 10 and 30 DAG and it recorded 20.92% of stem tunneling (Table 1).

ACKNOWLEDGEMENTS

The authors thank the faculty of AICRP on Soybean, Zonal Agriculture Research Station, UAS, GKVK, Bangalore for encouragement and field facilities.

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(Manuscript Received: December, 2021; Revised: April, 2022;
Accepted: April, 2022; Online Published: May, 2022)
Online First in www.entosocindia.org and indianentomology.org Ref. No. e21266