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Seed Treatment with Thiamethoxam 30 FS is Suitable for the management of Sorghum Shoot fly, *Atherigona soccata* (Rondani) in Sorghum, *Sorghum bicolor* (L)

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ABSTRACT

The field experiment was conducted during *kharif,* 2019 to study the efficacy of seed treatment with thiamethoxam 30 FS for the control of sorghum shoot fly, *Atherigona soccata* (Rondani) against the recommended practice *i.e.,* spraying of malathion @ 625 ml/ha. Treated seed samples with the test insecticide were obtained from the Forage and Millets Section, Department of Plant Breeding and Genetics, PAU, Ludhiana. The seed was treated with 10 ml Slayer 30 FS (thiamethoxam) per kg seed. Seed treatment with thiamethoxam 30 FS @ 10 ml/kg seed was found better than spraying of malathion @ 625 ml/ha and control for the management of shoot fly in sorghum but seed treatment with thiamethoxam was not effective for the management of maize borer in sorghum. Significant higher fodder yield was obtained (600 q/ha) in the treatment T_1 followed by T_2 (562.5 q/ha) in the district Amritsar. Similarly, 580 and 550 q/ha fodder yield were obtained in the treatment T_1 and T_2, respectively in the district Tarn Taran. No phytotoxicity symptoms of the insecticide either by spraying or as seed treatment were observed in any of the treatment in any of the district.

Key Words: Malathion, Seed treatment, Sorghum, Thiamethoxam 30 FS, Sorghum Shoot fly.

INTRODUCTION

Sorghum, *Sorghum bicolor* (L) plays a vital role in the economy of rural India and is an important source of fodder for animals. Sorghum is mostly grown in *kharif* season in Punjab. In India, nearly 32 per cent of sorghum crop is lost due to insect pests. Sorghum is attacked by over 150 insect species from sowing till harvest. The shoot fly, *Atherigona soccata* (Rondani) is one of the serious pests and attacks sorghum seedlings during initial one to four weeks during the rainy season. Pawar *et al* (1984) reported maximum yield losses of 75.6 per cent in grain and 68.6 per cent in fodder. The larva of this pest attacks on central whorl of the plant and causes dead heart formation. The damaged seedling is generally killed and plant grows side tillers which are further attacked under high pest population leading to considerable loss. The incidence increases as the sowing is delayed. At the boot stage, twisting of top leaves and emergence of panicles is prevented in case of severe infestation (Subbarayudu *et at*, 2002). Further, rapid population build up occurs due to its high fecundity and shorter generation span. It feeds on several other plant species including cereal crops and weeds. In view of its effects on plant stand and losses in grain yield, considerable research efforts have been made to develop strategies for its management. Plant protection during early stage of crop is very much essential, as losses through early season pest could be minimised by seed treatment of insecticides. Also, seed treatment with systemic insecticides is considered to be more selective for targeted pests, provides protection to natural enemies with least environmental pollution and hazards. Seed treatment is the easiest and economical method for timely management of shoot flies. Several chemicals are available in the market for seed treatment but thiamethoxam 30 FS

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commonly available with the Brand name Slayer 30 FS was selected because it interfere with the nicotinic acetylcholine receptors and therefore, have specific activity against the insect nervous system. This unique mode of action makes it desirable for the control of insects that are developing resistance to conventional organophosphate, carbamate and pyrethroid insecticides. It has minimal effect on beneficial insects, low toxicity towards mammals and does not produce teratogenic or mutagenic effects. Because of this selectivity, it is recommended for treatment of seeds. Therefore, present study was planned to test systemic insecticide, thiamethoxam 30 FS against sorghum shoot fly.

MATERIALS AND METHODS

The field experiment was laid out in the *kharif* season 2019 to study the efficacy of seed treatment with thiamethoxam 30 FS (T1) for the control of sorghum shoot fly against the recommended practice *i.e.,* spraying of malathion @ 625 ml/ ha (T2) whereas untreated plot was considered as T3. Treated seed samples with the test insecticide were obtained from the Forage and Millets Section, Department of Plant Breeding and Genetics, PAU, Ludhiana. The seed was treated with 10 ml Slayer 30 FS (thiamethoxam) per kg seed. The sowing of the trial was done on 20.06.2019 in the district Amritsar and on 29.05.2019 in the district Tarn Taran with plot size of 500 m^2 for each treatment. Both the treatments were compared with control plots. The crop was grown in rows 22 cm apart using all the recommended package of practices *i.e.,* fertilizer application, irrigation etc. The observations on per cent dead hearts due to sorghum shoot fly were collected at 14, 21 and 28 days after germination of the crop from all the 3 treatments. The data for dead heart formation was recorded from 10 different locations per treatment. Dead heart incidence (dead hearts and total number of plants per 1m row length) was recorded from 10 randomly selected locations from each treatment.

Per cent dead hearts were calculated using the formula

$$\text{Per cent DH} = \frac{\text{Number of DH}}{\text{Total number of Plants per 1 m row length}} \times 100$$

Dead hearts formed due to the attack of maize borer, *Chilo partellus* were also recorded one month after sowing of the crop. The phytotoxicity symptoms, if any, were also recorded in 20 days old seedlings. Besides, the natural enemy population was also recorded in all the treatments. At last, the green fodder yield was recorded at 60-70 days after sowing or 50 per cent flowering. The data thus obtained were subjected to statistical analysis and critical difference was calculated at 5 per cent level of significance.

RESULTS AND DISCUSSION

The experimental results revealed significant differences in dead heart formation by shoot fly in sorghum among all the treatments at 14, 21 and 28 days after germination of the crop in comparison to control in the district Amritsar. No dead heart formation was recorded in the treatment T_1 while 3.11 per cent dead heart formation was seen in the treatment T_2, 14 days after germination of the crop (Table 1). The dead heart formation was 0.23 and 3.58 per cent in the treatments T_1 and T_2, 21and 28 days after germination of the crop, respectively.

The experimental results revealed significant differences in dead heart formation by shoot fly in sorghum among all the treatments at 14, 21 and 28 days after germination of the crop in the district Tarn Taran also. Dead heart formation recorded was nil in the treatment T_1 while 3.28 per cent dead heart formation was seen in the treatment T_2, 14 days after germination of the crop. The dead heart formation was 0.47 and 3.93 per cent in the treatments T_1 and T_2, respectively, 21 days after germination of the crop while it was 0.23 and 3.59 in the treatments T_1 and T_2, respectively, 28 days after germination of the crop (Table 2).

Table 1. Percent dead hearts formed due to sorghum shoot fly in district Amritsar.

Treatment	Per cent dead hearts formed due to sorghum shoot fly after		
	14 days	21 days	28 days
Seed treatment with Thiamethoxam 30 FS (T_1)	0.00	0.23	0.23
Spray of Malathion (T_2)	3.11	3.58	3.58
Untreated control (T_3)	5.02	5.50	5.74
CD (p=0.05)	1.40	1.54	1.48

Treatment T_1 gave better control of the sorghum shoot fly in sorghum than the treatment T_2 and control in both the districts. Treatment T_1 provided effective control of the shoot fly damage even up to 28 days of germination of the crop in both the districts. Hence, it can be concluded that Treatment T_1 was better than any other treatment for the management of shoot fly in sorghum. The efficacy of thiamethoxam 30 FS can be attributed to the systemic properties of the insecticide which means that it is quickly absorbed by plants and transported to all of its parts, including pollen, where it acts to deter insect feeding. An insect can absorb it in its stomach after feeding or through direct contact, including through its tracheal system. Seed treatment with thiamethoxam 30 FS @ 5 ml/ kg seed was also found effective in reducing shoot fly incidence by Sandhu (2016). Similarly, seed treatment with thiamethoxam 70 WS @ 3 g/ kg seed was found very effective against sorghum shoot fly (Daware *et al,* 2012). Khandare *et al* (2014) suggested that sorghum seed treatment with thiamethoxam 35 FS @ 5 ml/ kg provided highest germination percentage (92%) and minimum number of dead hearts (9.56%) as compared to control (51.28%). Vadodaria *et al* (2001) confirmed the efficacy of thiamethoxam as seed dresser against sucking pests of cotton.

The observations were also recorded for the attack of other insect pests particularly maize borer, *Chilo partellus* at the two locations (Table 3). Seed treatment with thiamethoxam 30 FS was not found effective for the control of maize borer when compared with the control treatment in both the districts. Per cent dead heart formation recorded due to maize borer was 8.63 and 8.03 in the district Amritsar and Tarn Taran, respectively in the treatment T_1. However, spraying of the crop with malathion at 2-4 leaf stage of the crop has been found effective in controlling the dead heart formation due to maize borer as compared to control in both the districts. The per cent dead hearts formation was 5.51 and 5.13 in the treatment with spray of malathion, whereas in the control treatment it was 9.67 and 10.22 per cent in the district Amritsar and Tarn Taran, respectively. Hence, it can be concluded that seed treatment with thiamethoxam 30 FS was not effective for the management of maize borer in sorghum. Alam (2020) tested diamide and neonicotinoid group of insecticides against maize borer, *Chilo partellus* (Swinhoe) as seed treatment.

Table 2. Percent dead hearts formed due to sorghum shoot fly in district Tarn Taran.

Treatment	Per cent dead hearts formed due to sorghum shoot fly after		
	14 days	21 days	28 days
Seed treatment with Thiamethoxam 30 FS (T_1)	0.00	0.47	0.23
Spray of Malathion (T_2)	3.28	3.93	3.59
Untreated control (T_3)	5.65	6.45	6.22
CD (p=0.05)	1.34	1.24	0.98

Table 3. Incidence of other insect-pests after one month of sowing (Maize borer).

Treatment	Per cent incidence of maize borer	
	Location 1 (Amritsar)	Location 2 (Tarn Taran)
Seed treatment with Thiamethoxam 30 FS (T_1)	8.63	8.03
Spray of Malathion (T_2)	5.51	5.13
Untreated control (T_3)	9.67	10.22
CD (p=0.05)	2.15	2.99

Table 4. Green fodder yield at 60 days after germination

Treatment	Green fodder yield (q/ha)	
	Location 1 (Amritsar)	Location 2 (Tarn Taran)
Seed treatment with Thiamethoxam 30 FS (T_1)	600	580
Spray of Malathion (T_2)	562.5	550
Untreated control (T_3)	512.5	500
CD (p=0.05)	10.49	9.96

Among the tested insecticides (Tetraniliprole 480 FS, Imidachloprid 600 FS and thiamethoxam 30 FS), thiamethoxam 30 FS @ 2.4 g/kg of seed was found least effective for the management of maize borer as seed treatment in maize (Alam, 2020).

Observation on the fodder yield was also recorded in both the districts. Significant difference in the fodder yield was obtained in all the treatments as compared to control in both the districts. The fodder yield obtained was 600 q/ha in the treatment T_1 followed by the treatment T_2 (562.5 q/ha) in the district Amritsar (Table 4). Similarly 580 and 550 q/ ha fodder yield was obtained in the treatment T_1 and T_2, respectively in the district Tarn Taran. The results of present investigation regarding yield Khandalkar (2006), Balikai (2011) and Daware (2011) who recorded grain yield of 19.77, 22.05 and 30.71 q/ha with thiamethoxam as seed treatment. No phytotoxicity symptoms of the insecticide with spraying and as seed treatment on the crop were observed in any of the treatment in any of the district.

CONCLUSION

The results revealed significant differences in dead heart formation by shootfly in sorghum when seed was treated with thiamethoxam @ 10 ml/ kg seed at 14, 21 and 28 days after germination of the crop in the district Amritsar and Tarn Taran. Hence seed treatment with thiamethoxam may be recommended for the control of sorghum shootfly, *Atherigona soccata* (Rondani) in sorghum.

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