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Germination percentage in sorghum with different seed dressers and their effect on oviposition of sorghum shoot fly

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Abstract
The present research was conducted to study the germination percentage in sorghum with different seed dressers and their effect on oviposition of sorghum shoot fly during 2013-14. The results revealed that the treatment thiamethoxam 35 FS @ 5 ml/kg seeds recorded highest percentage of germination (92%) and all the treatments were significantly superior over control (68%). Other seed dressers which recorded better germination in order of merit were imidacloprid 17.8 SL @ 10 ml/kg (90%), chlorpyriphos 20 EC @ 4 ml/kg (80%), carbosulfan 25 EC @ 6 ml/kg (74%) and cartap hydrochloride 50 SP @ 2 g/kg (72%) germination. Maximum numbers of eggs were observed on the cartap hydrochloride 50 SP@ 2 g/ kg treated seed plot. The yield data indicate that the treatment with thiamethoxam 35 FS @ 5 ml/kg seed produced highest grain yield (3462 kg/ha). The maximum net monetary returns 1:56.25 (ICBR) were realized by the treatment thaimethoxam 35 FS@5 ml/kg seed.

Keywords: Seed dresser, grain yield, seed treatment, sorghum shoot fly oviposition

1. Introduction
Sorghum (*Sorghum bicolor* (L)) is the world's important food crop and is the major staple food next to rice and wheat, also known as poor man's food and act as prime crop that plays vital role in the economy of rural India. Sorghum is used as a source of food and also as an important source of fodders for animals. Sorghum is grown mostly in Kharif season in Vidarbha and Maharashtra. India is the largest sorghum growing country in the world with an area of 6.32 million ha with production of 6.03 million tonnes and productivity of 954 kg/ha [2]. It is grown in all seasons irrigated as well as rainfed conditions. Since, sorghum is often grown on poor soils by the farmers who have little resources for the control of insecticides and other inputs [7]. Shoot fly is widespread pest of significant importance which attack sorghum seedlings during initial one to four weeks. Amongst them shoot fly, *Atherigona soccata* (Rondani) causes maximum yield losses of 75% in grain and 68% in fodder as reported by [12]. However, it is common to see decrease in cultivation of sorghum crop due to heavy infestation of shoot fly. The incidence increases as the sowing is delayed. Plant protection during early stage of crop is very much essential, as losses through early season pest could be minimized by different seed dressers of insecticides. In view of these objective and considering insecticides to be the inevitable component of IPM, selective insecticides need to be tested for developing cost effective management approach for sorghum shoot fly. Seed dressers as systemic insecticides are considered to be more selective for targeted pests, providing protection to natural enemies with least environmental pollution and hazards. Therefore, planned to test newly launched systemic seed dressers insecticides *viz*, thiamethoxam 35 FS, imidacloprid 17.8 SL, carbosufan 25 EC, chlorpyriphos 20 EC and cartap hydrochloride 50 SP against sorghum shoot fly.

2. Materials and Methods
The present investigation was conducted during 2013-14 at Entomology Section, College of Agriculture, Nagpur. Insecticides *viz.,* thiamethoxam 35 FS, imidacloprid 17.8 SL, carbosufan 25 EC, chlorpyriphos 20 EC and cartap hydrochloride 50 SP (Table 1) were used as seed treatment under field condition on sorghum seed (var. CSH-9).

2.1 Seed treatments: Required quantity of sorghum seeds and insecticides were put in polythene bag and mixed thoroughly. Few drops of water i.e. @ 2 ml/100 g were sprinkled on

the mixture of seeds and insecticide. The mixture was stirred frequently till uniform coating of insecticides occurred. The treated seeds were spread on a paper in a room and kept overnight for drying.

2.2 Method of sowing: Two seeds were dibbled at each hill keeping 10 cm distance in between two hills. 8 days after germination plants were thinned to retain one healthy plant per hills.

2.3 Intercultural operations: Timely operations like weeding, hoeing, thinning, and clipping were carried out as and when required.

2.4 Germination percentage: 100 sorghum seeds of each treatment were sown in another place, adjacent to the experimental area. After 7 days counted total number of germinated seeds from total sown seed and germination percentage was worked out.

2.5 Oviposition of sorghum shoot fly: Five seedlings of sorghum were selected randomly from experimental plots. The observation regarding oviposition of sorghum shoot fly were recorded on 7th, 14th and 28th days after germination,

2.6 Grain yield: Yield from each plot was recorded and converted to kg/ ha.

2.7 Statistical analysis: The data, on the various aspects were subjected to analysis of variance. Grain yields were recorded per plot immediately after threshing the harvested ear heads [6].

3. Results and Discussion

3.1 Effect of different seed treatments on germination percentage of sorghum

The data of germination percentage (Table 1) revealed that the treatment thiamethoxam 35 FS @ 5 ml/kg seeds recorded highest percentage of germination (92%) and found statistically superior over other seed dressers and control (68%). Other seed dressers which recorded better germination in order of merit were imidacloprid 17.8 SL @ 10 ml/kg (90%), chlorpyriphos 20 EC @ 4 ml/kg (80%), carbosulfan 25 EC @ 6 ml/kg (74%) and cartap hydrochloride 50 SP @ 2 g/kg (72%) as compared to control (68%). The present findings are in confirmation with the results recorded by [1] and [5] where they found higher germination percentage in seed treated with thiamethoxam 70 WS @ 3 and 6 g/kg (90.90%) and imidacloprid 70 WS @ 6 g/kg seed (85.80%). These finding are in conformity with the result [11] who observed higher germination percentage (92%) with imidacloprid 70 WS @ 12 g/kg seed followed by thiamethoxam 25 WG @ 1.50 g/kg seed (90%).

Table 1: Effect of different seed dressers on germination percentage of sorghum.

No. of Treatments	Insecticides	Dose / kg seed	Germination percentage (%)
T_1	Thiamethoxam 35 FS	5 ml	92
T_2	Imidacloprid 17.8 SL	10 ml	90
T_3	Carbosulfan 25 EC	6 ml	74
T_4	Chlorpyriphos 20 EC	4 ml	80
T_5	Cartap hydrochloride 50 SP	2 gm	72
T_6	Control		68
	'F' test		Sig.
	SE(m)±	-	0.05
	CD at 5%		0.15

Figures in parenthesis are square root transformed values

3.2 Cumulative effect of different seed dressers on oviposition of sorghum shoot fly

Cumulative effect on oviposition on sorghum seedlings is given in Table 2 and revealed that the treatments cartap hydrochloride, chlorpyriphos and imidacloprid, in which 5.00, 4.75 and 4.16 eggs/plant were observed and found to be on par with each other and were significantly superior over control (2.75 eggs/plant). The results obtained in present investigation was corroborative with the investigation of [13], who observed maximum eggs of shoot fly on sorghum emerged from treated seeds with imidacloprid 70 WS @ 10g/kg. Similar observations was noticed by [9] who observed that, eggs laying was more on seedlings raised from carbosulfan seed treatment (32.66) eggs followed by seed treatment with imidacloprid (25.33 to 33.33 eggs) per 5 seedling, indicating oviposition preference to healthy seedlings, since eggs laying was significantly less on the weak seedlings. The other treatments carbosulfan (4.00 eggs/plant) and thiamethoxam (3.50 eggs/plant) were found on par with each other as compared to control (2.75 eggs/plant). It was thus observed that cartap hydrochloride, chlorpyriphos and imidacloprid induced healthy sorghum seedlings which attracted shoot fly for egg laying. The present results are in agreement with [10] and confirmed that shoot fly eggs on sorghum seedling were more in all seed treatment than control with increasing dose of imidacloprid.

Table 2: Cumulative effect of different seed dressers on oviposition of sorghum shoot fly.

No. of Treatments	Oviposition on seedlings (No. of eggs / plant)			
	7 DAG	14 DAG	28 DAG	Mean
T_1	2.75 (1.77)	4.25 (2.17))	3.50 (2.00)	3.50 (1.87)
T_2	4.00 (2.11)	4.75 (2.28)	3.75 (2.05)	4.16 (2.04)
T_3	3.00 (1.86)	5.00 (2.34)	4.00 (2.11)	4.00 (2.00)
T_4	4.5 (2.22)	5.50 (2.44)	4.25 (2.17)	4.75 (2.18)
T_5	4.25 (2.17)	5.75 (2.49)	5.00 (2.34)	5.00 (2.23)
T_6	2.25 (1.65)	3.75 (3.50)	2.50 (1.73)	2.75 (1.65)
'F' test				Sig.
SE(m)±				0.07
CD at 5%				0.21

Figures in parenthesis are square root transformed values. DAG: Days after germination.

3.3 Effect of different seed dressers on grain yield of sorghum

Significantly highest grain yield (3462 kg/ha) was obtained from the plots treated with thiamethoxam 35 FS @ 5 ml/kg and which was significantly superior over all other treatments (Table 3). Imidacloprid 17.8 SL 10 ml/kg was second in order of merit recording (3333 kg/ha) The treatments carbosulfan, cartap hydrochloride was found on par with each other yielding 3018 and 2833 kg/ha grain yield, respectively. The seed dressers chlopyriphos (2203 kg/ha) was found better in yield over control which recorded lowest yield i.e. 1333 kg/ha.

The results of present investigation regarding yield were in conformity with [8] are 19.77 q/ha, [3] with 22.05 q/ha and [4] with 30.71 q/ha when they reported higher grain yield with seed treatment thiamethoxam followed by imidacloprid. Overall results of the present field investigations concluded that the seed treatment with thiamethoxam 35 FS @ 5 ml/kg and imidacloprid 17.8 SL 10 ml/kg found significantly superior over control. This enhanced plant growth and higher grain yield of sorghum was due attributed to phytotonic effect of the seed treatment of thiamethoxam and imidacloprid molecules. Therefore, the highest ratio (1: 56.25) of ICBR was found in thiamethoxam 35 FS@5 ml/kg.

Table 3: Effect of different seed dressers on grain yield and economics of sorghum.

No. of Treatments	Grain yield (kg / plot)		Grain yield (kg / ha)	ICBR
	Total of 4 replication	Mean		
T_1	7.47	1.87	3462	1 : 56.25
T_2	7.21	1.8	3333	1 : 11.75
T_3	6.52	1.63	3018	1 : 14.39
T_4	4.78	1.19	2203	1 : 9.3
T_5	6.11	1.53	2833	1 : 16.56
T_6	2.86	0.72	1333	-----
'F' test		Sig.		
SE(m)±		0.045		
CD at 5%		0.136		

Figures in parenthesis are square root transformed values.

4. Conclusion

The present study concluded that neonecotinoids i.e. thiamethoxam 35 FS 5 ml/kg, was found to be the promising seed treatment in sorghum crop. The observation of efficiency of the different treatments against oviposition of shoot fly showed that treatment with cartap hydrochloride 50 SP @ 2 g/kg recorded highest number of eggs 5.00 eggs/plant. Whereas treatment with chlorpyriphos 20 EC 4 ml/kg and imidacloprid 17.8 SL 10 ml/kg recorded 4.75 and 4.16 eggs/plant. However lowest number of oviposition was recorded in a treatment control i.e. 2.75 eggs/plant) and ultimately it can help to increase grain yield kg/ha. As regard ICBR 1:56.25 was found to be most economically viable treatment.

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