Research Paper :

Seed treatment, an eco-friendly management tactic for the suppression of insect pests in sorghum

R. A. BALIKAI

International Journal of Plant Protection, Vol. 4 No. 2 (October, 2011) : 381-384

SUMMARY

A field trial was conducted at the Regional Agricultural Research Station, Bijapur, Karnataka, India during *Rabi* season of 2005-06 to find out eco-friendly management tactics for the suppression of insect pests in sorghum. The results revealed that, the seed treatment with thiamethoxam 70 WS @ 3 g/kg seeds proved highly effective against shoot fly and significantly superior over rest of the treatments by recording 5.2 per cent deadhearts. The next best treatment in respect of shoot fly suppression was seed treatment with thiamethoxam 70 WS @ 2 g/kg seeds which in turn was on par with imidacloprid 70 WS @ 5g/kg seeds. With respect to aphid incidence, three treatments *viz*., whorl application of carbofuran 3G @ 8 kg/ha at 35-40 days after sowing (DAS), spray with endosulfan 35 EC @ 0.07% at 35-40 DAS and seed treatment with thiamethoxam 70 WS @ 3 g/kg seeds with low aphid incidence of 9.3, 10.2 and 10.2 per cent aphid index, respectively were highly effective and significantly superior over rest of the treatments. The seed treatment with thiamethoxam 70 WS @ 3 g/kg seeds proved highly effective in reducing the sorghum stripe disease incidence (5.2%) and significantly superior over rest of the treatments except seed treatment with imidacloprid 70 WS @ 5 g/kg seeds (8.2%). Seed treatment with thiamethoxam 70WS @ 3 g/kg seeds recorded highest grain yield (22.5 q/ha) and fodder yield (54.3 q/ha) and followed by seed treatment by imidacloprid 70 WS @ 5 g/kg seeds (21.7 and 52.1 q/ha grain and fodder yield, respectively) and thiamethoxam 70 WS @ 2 g/kg seeds (20.4 and 51.3 q/ha grain and fodder yield, respectively) and were at par with each other.

Correspondence to :

R.A. BALIKAI
Department of Agricultural Entomology, College of Agriculture, University of Agricultural Sciences, DHARWAD (KARNATAKA) INDIA

Balikai, R.A. (2011). Seed treatment, an eco-friendly management tactic for the suppression of insect pests in sorghum. *Internat. J. Plant Protec.,* **4**(2) : 381-384.

Key words :
Seed treatment, Shoot fly, Aphid, Stripe virus disease, Thiamethoxam, Sorghum

Received :
July, 2011
Revised :
August, 2011
Accepted :
September, 2011

Sorghum is vulnerable to over 150 insect species from sowing to the final crop harvest (Sharma, 1985). In this region three insect pests namely, shoot fly, shoot bug and aphid are the important regular pests. The sorghum shoot fly, *Atherigona soccata* Rondani causes severe damage in the early stage and lasts up to four weeks causing severe reduction in plant population. Maximum yield losses of 75.6% in grain and 68.6% in fodder have been reported by Pawar *et al.* (1984). Its incidence is greater in late sown crop in rainy and post rainy seasons in India. Several workers have tried different insecticides for this pest (Shivpuje and Thombare, 1983; Patil *et al*., 1992; Panchabhavi and Kotikal, 1992). Sorghum aphid, *Melanaphis sacchari* (Zehntner) is distributed in Asia, Africa and America. It prefers to feed on the under surface of older leaves, resulting in premature drying of leaves, non-filling of grains and deterioration of fodder quality. Spraying or dusting of several insecticides are being recommended for its control. The shoot bug, *Peregrinus maidis* (Ashmead) previously considered to be of minor importance, but now with the introduction of new sorghum genotypes of different maturity periods in certain parts of Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu has become a serious pest. The shoot bug is a major hurdle in *Rabi* sorghum production by causing dual problem of direct loss by sucking the sap and indirect damage by transmitting sorghum stripe virus disease. Hence, it comes in the way of harvesting potential yield of grain and fodder. Managing the pest in established sorghum ecosystem through chemical spraying has several limitations. Farmers are unable to go for spraying due to increased cost of production of sorghum and also phytotoxic effect of these insecticides on foliage. Hence, different seed dressers were evaluated in comparison with spray and granules for the management of sorghum pests.

MATERIALS AND METHODS

A field trial was conducted at the Regional Agricultural Research Station, Bijapur, Karnataka, India during *Rabi* season of 2005-06 under rainfed conditions in Randomized Block Design, replicated thrice with eleven treatments including an untreated check (Table 1). M 35-1 sorghum variety was planted by dibbling the seeds at a spacing of 60 cm x 15 cm in a plot size of 3.6m x 4.5 m, each having six rows of 4.5 m length. The thinning operation was done a week after emergence of the crop. For granular insecticides in T_1 and T_2, granules were applied in seed furrow at the time of sowing. For the treatments involving seed treatment (from T_3 to T_6), sorghum seeds were treated with test insecticide using 1 per cent acacia gum followed by shade drying for three hours before sowing. For the treatments involving seed treatment (T_7 and T_8), sorghum seeds were treated with test insecticides using 20 ml of water per kilo gram of seeds, followed by shade drying for three hours before sowing. The total number of plants and number of plants showing deadheart symptoms were recorded in each treatment on 28th day after emergence of the crop. The percentage of deadhearts caused by shoot fly was worked out and subjected to angular transformations before analysis. The per cent aphid index was recorded by following the methods of Balikai and Lingappa (2002) when the aphid incidence was at its peak during January second week. Total number of plants and number of plants showing sorghum stripe disease (SStD) symptoms were recorded from the net plot of each treatment. The data were subjected to angular transformations before statistical analysis. Later, grain and fodder yields were recorded, converted to quintals per hectare and analyzed statistically.

RESULTS AND DISCUSSION

Among the eleven treatments, the maximum incidence of shoot fly (38.7% deadhearts) was recorded in the untreated plot (Table 1). All the insecticidal treatments significantly reduced the incidence of shoot fly except whorl application of carbofuran 3G @ 8kg/ha at 35-40 days after sowing (DAS) and spray with endosulfan 35 EC @ 0.07% at 35-40 DAS. The seed treatment with thiamethoxam 70 WS @ 3 g/kg seeds proved highly effective against shoot fly and significantly superior over rest of the treatments by recording 5.2 per cent deadhearts. The next best treatment in respect of shoot fly suppression was seed treatment with thiamethoxam 70WS @ 2 g/kg seeds which in turn was on par with imidacloprid 70 WS @ 5 g/kg seeds. Karibasavaraja *et al.* (2005) also reported that, the seed treatment with thiamethoxam 70 WS @ 5 and 4 g a.i./kg seeds were very effective in reducing shoot fly incidence even under high pest population. The results of the present study are in conformity with the findings of Balikai (2003) who reported 4.5 per cent shoot fly deadhearts with thiamethoxam 70 WS @ 4 g/kg seeds. The results are also in agreement with the findings of Mote *et al.* (1995); Hiremath *et al.* (1995) and Balikai (1998) with respect to efficacy of imidacloprid. Similarly, the results of study conducted by Katole *et al.* (2003) also support the present findings.

With respect to aphid incidence, three treatments *viz.*, whorl application of carbofuran 3 G @ 8 kg/ha at 35-40 days after sowing (DAS), spray with endosulfan 35 EC @ 0.07% at 35-40 DAS and seed treatment with thiamethoxam 70 WS @ 3 g/kg seeds with low aphid incidence of 9.3, 10.2 and 10.2 per cent aphid index, respectively were highly effective and significantly superior over rest of the treatments. The next best treatments in respect of aphid suppression included seed treatment with thiamethoxam 70 WS @ 2 g/kg seed, seed treatment with imidacloprid 70 WS @ 5g/kg seeds and seed treatment with imidacloprid 70 WS @ 2 g/kg seeds recorded 14.3, 14.3 and 16.5 per cent aphid index, respectively. The remaining treatments (soil application of Phorate 10 G @ 15 kg/ha (0.9 g/m.r.), soil application of Carbofuran 3 G @ 20 kg/ha (1.2 g/m.r.), seed treatment with Endosulfan 35 EC @ 5.0 ml + 20 ml water and seed treatment with Imidacloprid 200 SL @ 2.0 ml + 20 ml water) were significantly inferior to above all treatments in giving protection against aphids. With respect to aphid incidence, the results are in agreement with the findings of Balikai and Lingappa (2003) with respect to efficacy of imidacloprid 70 WS.

As far as the disease incidence is concerned, all the insecticidal treatments significantly reduced the disease incidence except seed treatment with Endosulfan 35 EC @ 5.0 ml + 20 ml water and seed treatment with Imidacloprid 200SL @ 2.0 ml + 20 ml water. The seed treatment with thiamethoxam 70 WS @ 3 g/kg seeds proved highly effective in reducing the sorghum stripe disease incidence (5.2%) and significantly superior over rest of the treatments except seed treatment with imidacloprid 70 WS @ 5 g/kg seeds (8.2%). The next best treatment in respect of disease suppression was seed

Table 1 : Effect of insecticides on pest incidence and yield of *Rabi* sorghum

Tr. No	Treatments	% Dead-hearts due to shoot fly	% Aphid index	% Sorghum stripe disease incidence	Grain yield (q/ha)	Fodder yield (q/ha)
T_1	Phorate 10 G @ 15 kg/ha (0.9 g/m.r.) (Soil application)	20.4 (26.8) [e]	48.3 (44.0) [d]	25.2 (30.1) [e]	16.2 [cd]	45.1 [c]
T_2	Carbofuran 3 G @ 20 kg/ha (1.2 g/m.r.) (Soil application)	18.2 (25.3) [e]	47.4 (43.5) [d]	27.8 (31.8) [e]	15.1 [cd]	44.3 [c]
T_3	Imidacloprid 70 WS @ 2 g/kg seeds (Seed treatment)	12.6 (20.8) [cd]	16.5 (24.0) [c]	14.3 (22.2) [cd]	18.4 [bc]	47.2 [bc]
T_4	Imidacloprid 70 WS @ 5 g/kg seeds (Seed treatment)	10.5 (18.9) [bc]	14.3 (22.2) [bc]	8.2 (16.5) [ab]	21.7 [ab]	52.1 [a]
T_5	Thiamethoxam 70 WS @ 2 g/kg seeds (Seed treatment)	8.4 (16.8) [b]	14.3 (22.2) [bc]	10.5 (18.9) [bc]	20.4 [ab]	51.3 [ab]
T_6	Thiamethoxam 70 WS @ 3g/kg seeds (Seed treatment)	5.2 (13.1) [a]	10.2 (18.6) [a]	5.2 (13.1) [a]	22.5 [a]	54.3 [a]
T_7	Endosulfan 35 EC @ 5.0 ml + 20 ml water (Seed treatment)	10.1 (18.5) [bc]	48.3 (44.0) [d]	29.3 (32.8) [ef]	16.5 [cd]	45.5 [c]
T_8	Imidacloprid 200 SL @ 2.0 ml + 20 ml water (Seed treatment)	14.2 (22.1) [d]	45.7 (42.5) [d]	30.1 (33.3) [ef]	15.3 [cd]	45.0 [c]
T_9	Carbofuran 3 G @ 8 kg/ha (Whorl appln.) at 35-40 DAS	38.5 (38.4) [f]	10.2 (18.6) [a]	17.1 (24.4) [d]	16.2 [cd]	46.2 [c]
T_{10}	Endosulfan 35 EC @ 0.07% (Spray) at 35-40 DAS	39.8 (39.2) [f]	9.3 (17.7) [a]	16.2 (23.7) [d]	15.5 [cd]	44.5 [c]
T_{11}	Untreated Check	38.7 (38.5) [f]	50.3 (45.2) [d]	35.2 (36.3) [f]	13.3 [d]	37.4 [d]
	S.E.±	1.0	1.5	1.3	1.3	1.5
	C.D. (P=0.05)	2.9	4.4	3.8	3.7	4.5
	C.V. (%)	6.6	8.4	8.7	12.6	5.7

* Figures in the parentheses indicate arcsin transformations,
DAS- Days after sowing, m.r.= meter row,
Figures in the columns followed by same letters are not significantly different at 5% level.

treatment with thiamethoxam 70WS @ 2 g/kg seeds (10.5%) which in turn was on par with imidacloprid 70 WS @ 2 g/kg seeds (14.3%). The disease suppression by seed treatment with thiamethoxam 70 WS @ 3 g/ kg seeds and imidacloprid @ 5 g/kg seeds are in accordance with the previous workers (Bheemanna *et al*., 2003 and Vijayakumar, 2004).

With regard to grain yield, seed treatment with thiamethoxam 70 WS @ 3 g/kg seeds recorded highest grain yield (22.5 q/ha) and it was on par with seed treatment by imidacloprid 70 WS @ 5g/kg seeds (21.7 q/ ha) and thiamethoxam 70 WS @ 2 g/kg seeds (20.4 q/ ha). The next best treatment in this respect was seed treatment with imidacloprid 70 WS @ 2 g/kg seeds (18.4 q/ha) which was on par with all other treatments except seed treatment with thiamethoxam 70 WS @ 3 g/kg seeds and untreated check. With respect to fodder yield, seed treatment with thiamethoxam 70 WS @ 3 g/kg seeds recorded highest fodder yield (54.3 q/ha) followed by seed treatment with imidacloprid 70 WS @ 5 g/kg seeds (52.1 q/ha) and thiamethoxam 70 WS @ 2 g/kg seeds (51.3 q/ ha) and were on par with each other. The latter treatment was on par with seed treatment by imidacloprid 70 WS @ 2 g/kg seeds (47.2 q/ha) which in turn was on par with remaining all other treatments except untreated check. These results corroborate with the findings of previous workers with respect to imidacloprid (Mote *et al.,* 1995; Hiremath *et al.,* 1995; Balikai, 1998; Balikai 1999; Balikai, 2000; Balikai, *et. al*. 2001 and Bheemanna *et al*., 2003). The results of the present study are in conformity with the findings of Balikai (2003) who reported highest grain yield of 32.1 q/ha with thiamethoxam 70 WS @ 4 g/kg seeds. Similarly, the results of study conducted by Katole *et al.* (2003) and Vijayakumar (2004) also support the present findings.

REFERENCES

Balikai, R.A. (1998). Evaluation of imidacloprid 70 WS against sorghum shoot fly. *Agric. Sci. Digest*, **18**: 85-87.

Balikai, R.A. (1999). Bio-efficacy of imidacloprid 70 WS against sorghum shoot fly, *Atherigona soccata* (Rondani). *Insect Envi.,* **5**(1): 43-48.

Balikai, R.A. (2000). Bio-efficacy of imidacloprid 70 WS against sorghum shoot fly in *Rabi* season. *Res. on Crops,* **1**(2): 192-195.

Balikai, R.A. (2003). Evaluation of new insecticides for the management of shoot fly, *Atherigona soccata* (Rondani) on *Rabi* sorghum. Paper presented in National Symposium on Biodiversity Management for 21st Century, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, UP (India), 28-30, June 2003, p. 128-129.

Balikai, R.A., Biradar, A.P., Biradar, B.D., Tegelli, R.G. and Kolhar, R.C. (2001). Evaluation of some insecticides against sorghum shoot fly, *Atherigona soccata* Rondani. *Karnataka J. Agric. Sci.,* **14**(2): 165-170.

Balikai, R.A. and Lingappa, S. (2002). Avoidable loss in different genotypes of sorghum due to aphid, *Melanaphis sacchari* (Zehntner). *J. Aphidology*, **16**:125-128.

Balikai, R.A. and Lingappa, S. (2003). Management of aphid, *Melanaphis sacchari* (Zehntner) on *Rabi* sorghum. *J. Aphidology*, **17**(1&2): 67-72.

Bheemanna, M., Patil, B.V., Hanchinal, S.G., Anandkumar, V. and Suresh (2003). Management of sorghum shoot bug by seed treatment. Paper presented in National Symposium on Frontier Areas of Entomological Research, Indian Agricultural Research Institute, New Delhi, 5-7 November, 2003, p. 25.

Hiremath, I.G., Bhuti, S.G. and Lingappa, S. (1995). Imidacloprid- a new promising seed dress for the management of sorghum shoot fly. *Karnataka J. Agric. Sci.*, **8**: 163-167.

Karibasavaraja, L.R., Balikai, R.A., and Deshpande, V.P. (2005). Thiamethoxam 70 WS, A new promising seed dress for the suppression of sorghum shoot fly, *Ann. Pl. Protec. Sci.*, **13**(1):85-87.

Katole, S.R., Kudale, N.V. and Thakare, S.M. (2003). New systemic insecticides against internal feeders of sorghum. Paper presented in National Symposium on Frontier Areas of Entomological Research, Indian Agricultural Research Institute, New Delhi, 5-7 November, 2003, p. 26.

Mote, U. N., Mohite, A.P. and Lolage, G.R. (1995). Seed treatment of imidacloprid against sorghum shoot fly. *Pestology*, **19**: 37-40.

Panchbhavi, K.S. and Kotikal, Y.K. (1992). Effect of seed soaking in insecticides solution on the germination and on the incidence of shoot fly. *Curr. Res.,* **21**: 29-30.

Patil, B.V., Bheemanna, M., Somasekhar and Hiremath, S.C. (1992). Effect of seed soaking of insecticides on sorghum shoot fly, *Atherigona soccata* Rondani. *Indian J. Ent.*, **54**: 424-427.

Pawar, V.M., Jadhav, G.D. and Kadam, B.S. (1984). Compatibility of Oncol 50 SP with different fungicides on sorghum (CS-3541) against shoot fly (*Atherigona soccata* Rondani). *Pesticides*, **18**: 9-10.

Sharma, H.C. (1985). Strategies for pest control in sorghum in India, *Tropical Pest Management*, **31**: 167.

Shivpuje, P.R. and Thombare, P.A. (1983). Efficacy of different insecticides for the control of sorghum shoot fly. *J. Maharashtra Agric. Univ.*, **8** : 83-86.

Vijayakumar, L. (2004). Bio-ecology, seasonal incidence and management of sorghum shoot bug, *Peregrinus maidis* (Ashmead) (Homoptera: Delphacide), M. Sc. (Ag.) Thesis, University of Agricultural Sciences, DHARWAD, KARNATAKA (India).

****