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Research Paper

Influence of seed treating fungicides and grain smut incidence on seed yield and quality of *Rabi* sorghum [*Sorghum bicolor* (L.) Moench.]

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ABSTRACT

Field experiment was carried out to assess the influence of seed treating fungicides and incidence of grain smut on seed yield and quality. The treatments consisted of different fungicides. The seeds were inoculated with smut spores @ 3 g kg^{-1} then treated with vitavax power @ 3 g kg^{-1} of seeds just before sowing found to be effective in reducing the smut incidence. It was recorded significantly lower incidence of grain smut (1.10 %), seed yield per plot (1.079 kg), seed yield per hectare (1521.9. kg) over the control. Similarly, the seed quality parameters like 1000 seed weight (35.9 g) germination (92.3 %), seedling vigour index (4035) and lowest electrical conductivity (0.079 dSm^{-1}) was also noticed in the vitavax powder treatment just before sowing as compared to control.

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Key words : *Rabi* Sorghum, Fungicides, SVI, Germination.

INTRODUCTION

Sorghum [*Sorghum bicolor* (L.) Moench] is commonly known as 'Jowar' is the fifth most important cereal in the world next to wheat, rice, maize and barley. Sorghum is usually grown in both *Kharif* and *Rabi* season, especially growing of sorghum in *Rabi* season is unique to India and particularly to the southern states like Maharashtra and Karnataka where more than 50 per cent of the cultivable area is concentrated in the *Rabi* season owing to its superior grain quality and favourable agro-ecological condition for the crop production.

Productivity of sorghum crop in India is much less compared to the average productivity levels achieved in the developed countries and also less than the world average. This is because of sorghum is prone to several diseases and pests which cause considerable reduction in seed yield and its quality. Depending upon climatic condition and intensity of cultivation practices adapted, the occurrence of sorghum diseases vary. About 50 diseases are noticed in sorghum, but only 30 of them are found in India. Among them, only 10 are of major importance. Grain smut of sorghum is one among them.

The incidence of grain smut is quite common and destructive in almost all sorghum growing areas of the world. In India, it is one of the most serious diseases of the crop in states of Tamil Nadu, Karnataka, Andhra Pradesh, Uttar Pradesh, Madhya Pradesh and Maharashtra. It causes direct loss of grains by replacing grain with smut sori. Grian smut is externally seed borne disease, the causal organism is *Sporisorium sorghi* (Ehren) Link (= *Sphacelotheca sorghi* link) Clinton. The incidence up to 25 per cent has been reported in certain areas, and the value of the grain destroyed was compared at several million sterling's (Butler, 1918). During threshing the sori break releasing the spores which adhere to the surface of healthy seeds and remain dormant till next season. The incidence of grain smut of sorghum is easy to control by a cost effective treatment. This can be achieved by the seed treatment with systemic fungicides like carboxin and bavistin which was reported to be more effective than protectant fungicides. Therefore, the present investigation was carried out to evaluate the influence of fungicides seed treatment and smut incidence

on seed yield and quality of *Rabi* sorghum.

MATERIALS AND METHODS

The field experiment was conducted during *Rabi* season from October 2009 to March 2010 at Main Agricultural Research Station and laboratory studies were conducted in Department of Seed Science and Technology, University of Agricultural Sciences, Dharwad. The seeds of sorghum variety M 35-1 produced during 2008-09 *Rabi* season were obtained from the farmer were thoroughly mixed with viable spores of smut @ 3 g kg^{-1} of seeds. Before inoculation of the smut spores, the seeds surface were made wet by sprinkling of small quantity of water on it. This helped to adheres the smut spores on surface of seed for longer time. The spore material and sorghum seeds were thoroughly shaken together for about 15 minutes in a conical flask to ensure uniform application of spores to the seeds then treated with fungicides @ 3 g kg^{-1} of seeds two days after inoculation and stored for five months (June 2009 to Oct 2009). The experiment consisted of 11 seed treatments with fungicides *viz.,* T_1 (Carboxin + Thiram @ 3 g kg^{-1} of seeds *i.e.* vitavax power stored for five months), T_2 (Sulphur @ 3 g kg^{-1} , stored for five months), T_3 (Thiram @ 3 g kg^{-1} , stored, for five months), T_5 (Carbendazim + Iprodione @ 3 g kg^{-1} *i.e.* Quintal stored for five months), T_6 (Carbendazim @ 3g kg^{-1} *i.e.* Bavistin, stored for five months), T_7 (Captan + Hexaconazole @ 3 ml kg^{-1} *i.e.* Takat stored for five months), T_8 (Sulphur + Thiram @ 1.5 g + 1.5 g kg^{-1} stored for five months), T_9 (Carboxin + Thiram @ 3 g kg^{-1} of seeds *i.e.* Vitavax powder treated just before sowing), T_{10} (Sulphur @ 3 g kg^{-1} treated just before sowing) and untreated seeds as a control (T_{11}). The required quantity of sorghum seeds were treated with fungicides as per the treatments were packed in cloth bag and stored under ambient condition for five months and T_9 and T_{10} treatments were fresh seeds treated just before sowing. The experiment was laid out in randomized complete block design and replicated thrice. The details of observations were recorded on seed yield and quality parameters. The collected data of various parameters were analyzed statistically as described by Sundararaj *et al.* (1972) and Panse and Sukhatme (1978).

RESULTS AND DISCUSSION

The per cent smut incidence differed significantly due to seed treatment with fungicides (Table 1). However, the seed treatment with vitavax power just before sowing @ 3 g kg^{-1} of seeds was found to be significantly superior in reduction of smut incidence. This recorded lesser smut incidence (1.10 %) and higher smut incidence was noticed in control (8.27 %). The reduction of disease incidence was mainly because of systemic nature fungicides, they invade deeper into the seeds to reduce seed borne infection was reported by Jain and Tripathi (2007) in little millet. Similarly maximum the seed yield per plot and seed yield per hectare differed significantly due to seed treatment with fungicides. However, the seed treated with vitavax powder just before sowing @ 3 g kg^{-1} of seeds recorded significantly maximum seed yield per plot (1.079 kg) and seed yield per hectare (1521.9 kg) which was at par with seed treatment with sulphur just before sowing @ 3 g kg^{-1} of seeds (1.014 kg/plot and 1430.7 kg/ha), minimum yield was recorded in control (Table 1). The increase in the seed yield per plot, per hectare and 1000 seed weight might be due to better performance of growth parameters and the less incidence of grain smut. The reduction in seed yield may be attributed due to pathogen induced imbalance in the physiology of host tissue during infection and successive growth (Jain and Tripathi, 2007 in little millet) and also adverse effect of smut pathogens on morphology, yield attributing parameters. The similar results were also reported by Shah and Mariappan (1988) in sorghum, Jain (2004) in kodomillet and Guarav *et al.* (2008) in wheat.

The 1000 seed weight (Table 1), seed germination and seedling vigour index differed significantly due to the seed treatment with fungicides (Table 2). The maximum 1000 seed weight ((35.9 g)) seed germination (92.31 %), seedling vigour index (4035) were attributed due to the vitavax power (carboxin + thiram) seed treatment just before sowing which was at par with sulphur seed treatment just before sowing. While, the lower seed quality parameters were noticed in control. However, the electrical conductivity did not differ significantly due to seed treatment with fungicides. This may be due compactness of seed coat for certain period after harvesting. Whereas lower electrical conductivity (0.079 dSm^{-1}) was observed in the seed treatment with vitavax power (carboxin + thiram) just before sowing over control. This might be due to the systemic action of fungicides was reflected upon their reproductive health and quality of seed. The higher seed quality parameters may be because of the seeds are bold and free from field fungi and not heavily infected by smut. The lesser electrical conductivity may be due to the seed treatment reduces the leaching losses. The reduction in germination may be due to the higher infection leads to shriveling of seed in these plants may also have contributed towards reduction of 1000 seed weight and corresponding reduction in germination was reported by Gaurav *et al.* (2008) in wheat . The similar

Table 1: Effect of seed treatment with fungicides and grain smut incidence on yield parameters of *Rabi* sorghum

Treatments	Per cent smut incidence	Seed yield per plot (kg)	Seed yield per hectare (kg)	1000 seed weight (g)
T_1 Carboxin + Thiram (3g kg^{-1} of seeds) *i.e.* Vitavax Power (stored for five months)	1.55	0.978	1379.4	35.0
T_2 Sulphur (3g kg^{-1} of seeds) (stored for five months)	2.24	0.887	1251.5	34.2
T_3 Thiram (3g kg^{-1} of seeds) (stored for five months)	3.76	0.795	1120.8	32.8
T_4 Captan (3g kg^{-1} of seeds) (stored for five months)	5.40	0.749	1057.0	32.1
T_5 Carbendazim + Iprodione (3g kg^{-1} of seeds) *i.e* Quintal (stored for five months)	3.50	0.823	1160.8	33.3
T_6 Carbendazim (3g kg^{-1} of seeds) *i.e* Bavistin (stored for five months)	1.90	0.929	1309.8	34.6
T_7 Captan + Hexaconazole (3ml kg^{-1} of seeds *i.e.* Taka(stored for five months)	6.35	0.722	1018.4	31.2
T_8 Sulphur + Thiram (1.5 g + 1.5 g kg^{-1} of seeds) (stored for five months)	2.55	0.866	1221.4	33.8
T_9 Carboxin + Thiram (3g kg^{-1} of seeds) *i.e.* Vitavax Power (fresh seeds treated just before sowing)	1.10	1.079	1521.9	35.9
T_{10} Sulphur (3g kg^{-1} of seeds) (fresh seeds treated just before sowing)	1.38	1.014	1430.7	35.4
T_{11} Untreated Control (stored for five months)	8.27	0.670	945.4	29.5
Mean	3.46	0.865	1219.7	33.4
S.E.	0.07	0.083	117.5	1.2
C.D. @ 5%	0.20	0.25	346.63	3.48

Table 2: Effect of seed treatment with fungicides and its effects on per cent of seed germination, seedling vigour index and electrical conductivity of *Rabi* sorghum

Treatments	Per cent seed germination	Seedling vigour index (SVI)	Electrical conductivity (dSm^{-1})
T_1 Carboxin + Thiram (3g kg^{-1} of seeds) *i.e.* Vitavax Power (stored for five months)	90.7 (72.34)*	3782	0.080
T_2 Sulphur (3g kg^{-1} of seeds) (stored for five months)	89.3 (70.99)	3524	0.087
T_3 Thiram (3g kg^{-1} of seeds) (stored for five months)	87.3 (69.21)	3218	0.094
T_4 Captan (3g kg^{-1} of seeds) (stored for five months)	86.7 (68.61)	3152	0.098
T_5 Carbendazim + Iprodione (3g kg^{-1} of seeds *i.e.* Quintal (stored for five months)	88.3 (70.00)	3307	0.093
T_6 Carbendazim (3g kg^{-1} of seeds) *i.e.* Bavistin (stored for five months)	90.3 (71.96)	3642	0.083
T_7 Captan + Hexaconazole (3ml kg^{-1} of seeds) *i.e.* Taka(stored for five months)	86.0 (68.03)	3060	0.105
T_8 Sulphur + Thiram (1.5 g + 1.5 g kg^{-1} of seeds) (stored for five months)	88.7 (70.37)	3383	0.089
T_9 Carboxin + Thiram (3g kg^{-1} of seeds) *i.e.* Vitavax Power (fresh seeds treated just before sowing)	92.3 (74.06)	4035	0.079
T_{10} Sulphur (3g kg^{-1} of seeds) (fresh seeds treated just before sowing)	91.7 (73.37)	3891	0.079
T_{11} Untreated Control (stored for five months)	85.3 (67.50)	2909	0.105
Mean	88.8 (70.59)	3446	0.090
S.E.	1.2	134.1	0.011
C.D. @ 5%	3.46	421.5	NS

* Figures in the parenthesis are arcsine transformed values; NS- Non Significant

results were also reported by Gothwal *et al.* (1976) in wheat, Haq and Khan (2000) in sorghum and Yadav and Duhan (1993) in pearl millet. It is concluded that the seed treatment with vitavax power just before sowing @ 3 g kg^{-1} of fresh seeds effectively controlled the grain smut incidence and enhanced the seed yield and quality of *Rabi* sorghum.

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