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EFFECT OF PRE-HARVEST FUNGICIDE TREATMENT ON SORGHUM (*SORGHUM BICOLOR* (L.) MOENCH) SEED MYCOFLORA

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Three fungicides viz., Aureofungin, Bavistin and Dithane M-45 were tested for their efficacy to control the infection of developing seeds of sorghum by fungi. In field conditions, seasonal spray applications of these chemicals at concentration 0.2% each, separately, at three physiological stages viz., boot-leaf, flowering and milky stage showed varied incidence of mycoflora. Continuous spray schedule at every boot-leaf, flowering and milky stages was highly effective in reducing the fungal incidence to a greater extent irrespective of the fungicides used. Among the fungicides used Bavistin showed high persistence as far as its antifungal activity is concerned.

Key Words : Pre harvest, fungicide, treatment, *Sorghum*, seed mycoflora.

Early flowering in improved cultivars of *Sorghum bicolor* (L.) Moench often results in the exposure of developing grain to wet, humid conditions favours the infection of the grains by field fungi. Such infected grains were found to be discoloured, with poor germinability and poor field standing when used in the next season. Apart from these the moldy grains were also proved to be contaminated with mycotoxins resulting in health hazards in the higher organisms on consumption. Since the head mold problem in sorghum is a major constraint all over the world therefore in the present investigation the ear heads of sorghum were sprayed with different fungicides at different stages of development starting from bootleaf stage to milky stage in order to control many field fungi.

MATERIALS AND METHODS

Sorghum cultivar IS 3800 was grown in the experimental plot at Mysore, during kharif season. Water solutions of 0.2% Aureofungin Sol; Bavistin 50% WP (2 (methoxycarbamoyl) - benzimidazole) and Dithane M-45 (Zinc and Manganese ethylene bisdithiocarbamate) were tested.

The fungicides were sprayed individually to the ear heads of the randomly selected plants at different stages of development viz., boot-leaf (59 days), flowering (73 days) and milky stages (86 days). In one set the fungicidal spray was given at only once, in case of boot-leaf, flowering and milky stages. In the another set the fungicides were sprayed twice *i.e.*, one at boot-leaf and milky stage; flowering and milky stages. Apart from these the fungicidal spray was given thrice at the rate of one spray per stage like boot-leaf, flowering and milky stages.

For each fungicidal treatment at different growth stages, 100 plants were used as replicates in the randomised manner. Plants treated with distilled water were taken as controls.

On fifteenth day of milky stage the test ear heads were harvested separately according to their treatment and sundried in order to reduce the seed moisture to about 12%. Dry ear heads were threshed gently and the seeds were pooled separately. 400 seeds of each treatment were subjected to standard blotter method (Anon, 1976) and were incubated for a period of one week under 12/12 h alternate cycles of near ultraviolet light (NUV) and darkness. On the 8th day of incubation the mycoflora associated with the different test samples were analysed. The samples were stored for a period of two months and the persistence of the fungicides was assessed based on the incidence of mycoflora.

RESULTS AND DISCUSSION

The per cent incidence of mycoflora of the seed samples of different treatment is presented in table 1. *Alternaria alternata, Cladosporium* spp., *Fusarium moniliforme, F. oxysporum, F. semitectum* and *Phoma* spp., were more common. However,

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Table 1: Impact of pre-harvest fungicidal treatment and growth stages on the occurrence of seed mycoflora in sorghum.

Fungi	Control	Per cent incidence of seed mycoflora* in samples treated with fungicides at different growth stages																				
		Aureofungin							Dithane M-45							Bavistin						
Growth stages		1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Actinomycetes	6	-	2	-	-	4	-	-	3	-	1	-	-	-	-	2	-	-	-	1	-	3
Alternaria alternata	34	28	25	22	12	19	29	18	20	23	18	14	25	18	21	49	28	29	21	18	34	41
Aspergillus flavus	2	-	3	-	-	-	1	-	25	-	4	-	1	-	-	1	-	2	-	-	1	-
A. niger	1	2	-	-	1	-	-	-	-	1	-	-	-	2	-	5	-	-	-	1	-	1
Cephalosporium-sp	3	-	2	4	1	-	1	-	-	-	1	-	-	-	3	2	3	-	-	-	1	1
Cladosporium spp.	18	12	6	8	4	2	12	9	12	15	6	10	6	9	7	6	14	12	4	8	19	14
Colletotrichum graminicola	6	2	1	3	-	1	2	5	4	-	-	-	4	-	2	-	1	1	-	2	-	-
Curvularia lunata	17	9	10	6	12	8	7	6	7	2	9	3	7	8	8	8	12	7	1	9	4	5
Drechslera halodes	6	2	-	1	1	1	-	2	4	2	1	3	2	1	1	-	2	3	1	2	4	1
D. longirostrata	1	-	-	-	-	-	1	-	3	-	-	-	-	-	-	-	1	-	-	-	-	-
D. oryzae	1	-	-	1	-	-	1	-	-	-	1	-	2	-	-	-	1	-	-	-	-	-
D. rostrata	4	3	2	-	1	3	4	2	4	3	1	2	-	4	3	2	3	5	25	4	2	2
D. sorghicola	3	-	2	-	1	2	-	1	-	2	-	-	2	-	-	-	1	-	-	-	-	-
D. tetramera	2	-	1	-	-	-	-	2	1	-	-	-	-	-	1	-	-	-	-	-	-	1
Fusarium moniliforme	56	49	46	39	21	42	34	42	38	19	22	8	12	17	15	38	40	26	3	18	21	14
F. oxysporum	22	11	14	13	7	8	7	3	8	6	9	3	4	4	7	5	2	3	1	3	2	5
F. semitectum	14	16	7	9	12	8	13	15	11	13	6	4	8	9	11	5	7	3	2	2	4	5
F. solani	5	2	-	3	1	4	4	5	4	2	-	5	-	3	2	2	1	-	-	4	-	3
Gonatobotrys simplex	8	1	2	7	3	-	3	-	8	-	2	-	-	-	4	7	3	-	1	5	4	2
Nigrospora sp.	2	1	-	1	-	1	-	-	1	1	2	-	-	-	1	-	-	-	-	1	-	1
Penicillium sp.	0.5	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-
Phoma sp.	6	8	6	2	4	9	6	7	12	6	4	3	10	2	5	9	4	2	2	2	3	6
Trichoderma sp.	4	3	5	2	1	1	3	2	3	-	1	-	-	-	-	0.5	1	-	-	2	-	-
Trichothecium sp.	2	1	-	1	-	2	4	1	-	2	-	-	-	0.5	-	1	-	2	-	-	-	1
Seed germination (%)	70	69	71	68	72	66	68	70	73	69	71	76	70	65	70	72	69	67	80	71	74	72

* Data based on 400 seeds
Growth stages - 1 - Boot leaf stage, 2 = Boot leaf + Flowering stage, 3 = Boot leaf + Milky stage, 4 = Boot leaf + Flowering + Milky stage, 5 = Flowering stage, 6 = Flowering + Milky stage, 7 = Milky stage.

Table 2: Per cent incidence of mycoflora in stored sorghum seed sample given pre-harvest fungicide treatment.

Fungi	Control	Per cent incidence of seed mycoflora" in treated samples Fungicides used as spray before harvest		
		Aureofungin	Bavistin	Dithane M-45
Alternaria alternata	19	14	10	12.5
Aspergillus candidus	1.5	-	-	-
A. flavus	6	2	0.5	2.5
A. nidulans	0.5	-	-	-
A niger	2	1.5	-	2
A. ochraceus	3.5	-	-	0.5
Cladosporium spp.	16	8.5	8	8
Colletotrichum graminicola	2.5	-	-	-
Curvularia lunata	4.5	5	1	2
Drechslera halodes	1	-	-	2.5
D. rostrata	3	-	-	1.5
Fusarium moniliforme	24	10	2	6
F. oxysporum	-	1	-	-
F. semitectum	4	4	0.5	2
F. solani	-	-	-	0.5
Penicillium spp.	5.5	3	1.5	4

*Data based on 400 seeds

their per cent incidence varied with the fungicides used as well as with the physiological stages of the inflorescence. Compared to the control the treated samples showed reduction in the incidence of the majority of the mycoflora and an improved seed germination in the treated samples. Irrespective of the fungicides, the samples treated thrice each at boot-leaf, flowering and milky stage showed reduction in the per cent incidence of mycoflora with an increase in percentage of seed germination over control (Table 1). The fungicidal spray at boot-leaf stage or flowering stage or milky stage alone or at any of these two stages did not reduce the expression of fungi to an appreciable extent. As a comparative observation it has been evaluated that the Aureofungin is least effective than other fungicides.

The fungicides were also screened for their persistence under storage. The treated samples stored under room temperature for a period of two months were evaluated for the expression of fungi on them (Table 2). The sample treated with bavistin during pre-harvest stages showed least incidence of mycoflora and hence it proved the efficacy of Bavistin over Aureofungin and Dithane M-45.

The reduction in the incidence of fungi in the samples treated with fungicides continuously at boot-leaf, flowering and milky stage is probably due to their added concentration which might have affected the establishment of fungi at all stages continuously without any gap. Chahal and Dhindsa (1986) reported that the fungicidal spray at anthesis stage inhibit the fungal infection. In contrast, the sprays at flowering stage alone did not control the fungal establishment to a considerable extent. Perhaps this is due to the influence of rich nutritive substratum inspite of fungicidal spray which might have nurished and stimulated the fungi to invade into the soft floral parts with in the limited time. As per the observations of Gopinath and Shetty 91987), both time and number of fungicidal sprays are very crucial in preventing fungal colonization. Hepperly *et al.* (1982) reported weekly application of methiocarp for complete control of *F. moniliforme* but not those of *Curvularia lunata* and *Alternaria* spp. Gopinath (1984) has found that five sprays of Bavistin are essential for effective control of seedborne *Fusarium* diseases of sorghum. But in the present study it was found that the applications of Bavistin gave a significant control of *Fusarium* spp., and even *C. lunata.* The reduced incidence of mycoflora in the pretreated stored samples proved the longevity of Bavistin as an effective fungicide. The findings of Chahal *et al.* (1989) are in agreement with present results as they mentioned the superiority of Bavistin in controlling the fungi in seeds of sunflower.

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