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Effect of Seed Dressing Fungicides for the Control of Seedborne Mycoflora of Wheat

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Abstract: Using ISTA technique seed samples of 12 wheat (*Triticum aestivum* L.) varieties were tested, seedborne fungi isolated viz., *Alternaria tenuis, Aspergillus niger, Stemphylium herbarum, Fusarium moniliforme* and *Curvularia lunata*. Efficacy of different fungicides was evaluated for the control of seed borne fungi associated with wheat of which Baytan, Vitavax, Benlate and Captan were found highly effective. All fungicides significantly increased the seedling emergence, number of grains per spike, 1000- grain weight, grain yield per plot and per hectare over control.

Key words: *Triticum aestivum*, seed dressing, fungicides, seedborne mycoflora

Introduction

Seeds play vital role in the transmission of plant pathogens causing plant diseases. The pathogen may be externally or internally seedborne or associated with seed as contaminant. The seedborne pathogens may cause seed abortion, seed rot, seed necrosis, or reduction in germination as well as seedling damage by systemic or local infection resulting in the development of disease at later stages of plant growth. Many important diseases of plants caused by fungi spread through seeds (Neergaard, 1977). Healthy seed plays an important role for increasing successful cultivation and yield of crops. Seedborne pathogens of wheat are responsible to cause variation in plant morphology and also reducing yield 15-90 % if infected seeds are planted in the field (Wiese, 1984). Several Seedborne pathogens are known to associated with wheat seed and responsible for deteriorating seed quality during storage. Seed treatment is a biological, chemical, mechanical, or physical process designated to mitigate externally or internally seed or soilborne microorganisms, resulting in the emergence of a healthy seedling and subsequently a healthy plant. Seeds may be treated to promote good seedling establishment, to minimize yield loss or to maintain and improve quality and to avoid further spread of pathogens.

The application of chemicals to seed is safest, cheapest and could be effective means of controlling most seedborne pathogens. Fungicidal seed treatment may kill or inhibit seedborne pathogens and may form a protective zone around seeds that can reduce seed decay and seedling blight caused by soilborne pathogens, resulting and vigorous seedlings. The use of fungicides as seed treatment is the most widely followed disease control practice used in all crops (Nene and Thapliyal, 1979 and Sharvelle, 1979). In recent past the efficacy of various fungicides to control seedborne fungal mycoflora has been reported (Misra and Singh, 1972; Agarwal, 1981; Raut *et al*., 1983; Singh *et al*., 1984). Randhawa *et al*. (1985) treated wheat-stored grains with Captan, Thiram and Vitavax and found that Thiram was highly effective in protecting seed viability. El-Tayed *et al*. (1987) found Dithane M-45 and Benlate to be more effective as seed dressing fungicides against *Alternaria alternata* and *Fusarium roseum*. Izhar *et al*. (1987) obtained beneficial effects with Vitavax on grain yield and plant characteristics of wheat. Gupta *et al*. (1990) used four seed dressing fungicides against mycoflora associated with wheat seed. Captan and Dithane M-45 reduced the incidence of *Helminthosporium sativum* and *Alternaria alternata* and increased germination rates 88 and 87% respectively than Benlate.

The application of a general seed Protestant to seed helps in producing better emergence and vigorous seedlings. Seed-Protestant chemicals differ from crop to crop and from region to region. An experiment was therefore carried out to test the available seed dressing fungicides against fungi associated with seeds of commercial wheat varieties.

Materials and Methods

Isolation: Samples of twelve commercial wheat varieties viz., Mehran-89, T.J-83, Soghat, Sarsabz, Anmol, Johar, C-591, Sindh-81, Pak-70, Mexi-Pak-65, H-68 and Faisalabad-85 were collected from godown of Wheat Section, Agriculture Research Institute, Tandojam, Sindh, Pakistan. Five samples of 200 seeds each were taken randomly from each variety. Isolations were made from 200 infected seeds of each variety under aseptic conditions by standard method. After 6-7 days the fungi associated with seeds were identified by preparing their mounts and the percentage of the various fungi was counted.

Effect of seed dressing fungicides on germination of wheat seed In pots: 100 seed taken from each variety were treated with seven fungicides i.e. Baytan, Benlate, Vitavax, Captan, Derosal, Dithane M-45 and Rizolex at 2 gm per kg seed. Five treated seeds were planted in the sterilized pots of 22-cm diameter containing sterilized soil. They were irrigated with sterilized water. After 6 weeks percentage of germinated seedlings was recorded. The root length and shoot length of seedlings was also recorded. The experiment was conducted in randomized complete block design with three replications. The untreated seeds were kept as control (Randhawa *et al*., 1985).

Field experiment: The experiment was conducted as Randomized Complete Block Design, subplots measuring 4 x 1.22 m^2 having 7 rows with 20 cm apart at wheat section, ARI, Tandojam. Seven fungicides, Baytan, Benlate, Vitavax, Captan, Derosal, Dithane M-45 and Rizolex were treated as seed dressing on most susceptible commercial wheat variety (Pak-70) at 2 gm seed. Untreated seeds used as control. The crop was harvested at maturity on 15th April. The parameters studied were seedling emergence, plant height (cm) near soil line, number of grain per spike, 1000-grain weight, grain yield per plot and per hectare.

Results and Discussion

Five fungal species were isolated , the most common were *Alternaria tenuis, Aspergillus niger, Stemphylium herbarum, Fusarium moniliforme* and *Curvularia lunata* from the seeds of 12 wheat varieties (Table 1). Fungi were identified on the basis of their typical colony characteristics and conidial morphology.

Table 1: Frequency of grain storage fungi associated with 12 wheat varieties

Wheat varieties	Total No. of seed studied	Seed-boron fungi isolated	No. of infected grain with fungi	Percentage
Pak-70	200	*A. tenuis*	96	47.5
		A. niger	30	15.0
		S. herbarum	28	14.0
		F. monilifotme	15	7.5
		C. lumata	07	3.5
Mehran-89	200	*A. tenuis*	85	42.5
		A. niger	26	113.0
		S. herbarum	25	12.5
		F. monilifotme	12	6.0
		C. lumata	05	2.5
Soghat	200	*A. tenuis*	68	34.0
		A. niger	20	10.0
		S. herbarum	20	10.0
		F. monilifotme	08	4.0
		C. lumata	-	-
Johar	200	*A. tenuis*	65	32.5
		A. niger	18	9.1
		S. herbarum	16	8.0
		F. monilifotme	10	5.0
		C. lumata	03	1.5
C-591	200	*A. tenuis*	63	31.5
		A. niger	17	8.5
		S. herbarum	16	8.0
		F. monilifotme	09	4.5
		C. lumata	-	-
Mexi-Pak 65	200	*A. tenuis*	58	29.0
		A. niger	15	7.5
		S. herbarum	17	8.5
		F. monilifotme	06	3.0
		C. lumata	-	-
T.J-83	200	*A. tenuis*	55	27.5
		A. niger	14	7.0
		S. herbarum	15	7.5
		F. monilifotme	-	-
		C. lumata	-	-
Faisalabad-85	200	*A. tenuis*	52	26.0
		A. niger	13	6.5
		S. herbarum	11	5.5
		F. monilifotme	04	2.0
		C. lumata	-	-
Sindh-81	200	*A. tenuis*	48	24.0
		A. niger	12	6.0
		S. herbarum	09	4.5
		F. monilifotme	-	-
		C. lumata	-	-
H-68	200	*A. tenuis*	46	23.0
		A. niger	12	6.0
		S. herbarum	07	3.5
		F. monilifotme	-	-
		C. lumata	-	-
Sarsabz	200	*A. tenuis*	44	22.0
		A. niger	08	4.0
		S. herbarum	06	3.0
		F. monilifotme	-	-
		C. lumata	02	1.0
Anmol	200	*A. tenuis*	45	22.5
		A. niger	07	3.5
		S. herbarum	05	2.5
		F. monilifotme	03	1.5
		C. lumata	-	-

Kamal and Mughal (1968), Khan *et al.* (1974) observed the presence of *Alternaria, Helminthosporium, Fusarium, Curvularia, Stemphylium, Rhizopus, Cladosporium, Aspergillus* and *Penicillium* species in wheat seeds. Grzelak and Sztrmer (1982) also found *Alternaria tenuis, Botrytis cinerea* and *Fusarium* spp. as predominant fungi from triticale seeds. The similar fungi were isolated and reported by Singh (1983), Martin *et al.* (1984) and Sejiny *et al.* (1984). Ghosh and Nandi (1986) observed that several species of *Aspergillus* and *Penicilium jenseni* are responsible for deteriorating wheat grains during storage. Kunwar (1989) also

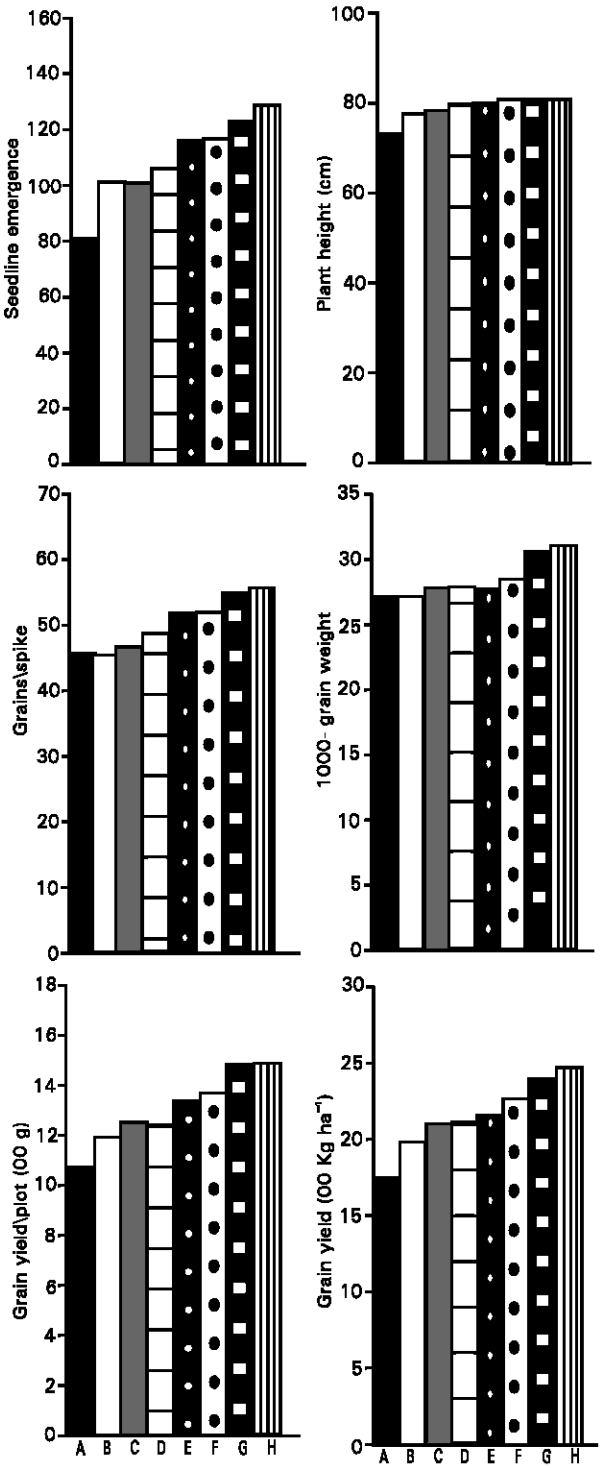

Fig. 1: Effect of different fungicides on yield parameters of wheat variety (Pak-70)
A = Control B = Rizolex C = Derosal
D = Dithane-45 E = Captan F = Benlate
G = Vitavax H = Baytan

isolated *Aspergillus* spp., *Penicillium* spp., followed by *Alternaria alternata* from 50% samples of the stored wheat seeds.

Table 2: Effect of seed dressing fungicide on seed germination of wheat varieties in pots

		No. of germinated seeds													
Fungicides	Type of grain	An	Sar	H-68	S-18	Fal	T.J	M.P	C-591	Jo	Sog	Meh	P-70	Total	Overal germination %
Baytan	Treated	75	72	70	68	65	62	59	57	56	53	48	45	730	60.80
	Untreated	54	52	50	47	45	44	41	38	35	32	30	28	496	41.33
Vitavax	Treated	74	70	70	66	65	60	58	58	54	52	46	44	717	59.75
	Untreated	51	50	51	48	46	43	40	37	36	30	38	25	485	46.42
Benlate	Treated	71	68	67	64	64	59	56	55	50	48	40	38	680	56.66
	Untreated	48	47	47	46	44	41	40	37	33	30	25	21	460	38.33
Captan	Treated	65	64	63	62	60	57	52	50	45	44	37	35	635	52.92
	Untreated	43	42	40	38	36	35	32	30	29	25	22	20	392	32.66
Dithane	Treated	52	50	47	47	45	42	38	35	32	30	28	25	472	39.33
	Untreated	40	42	41	39	38	35	32	28	29	24	32	20	391	32.58
Derosal	Treated	45	44	45	41	42	40	37	30	28	25	20	20	417	34.75
	Untreated	41	40	40	38	38	37	32	30	25	32	20	18	382	31.38
Rizolex	Treated	45	43	44	41	41	39	37	33	25	24	18	16	406	33.83
	Untreated	44	42	42	40	38	37	37	30	25	24	10	15	377	31.42

An = Anmol, Sar = Sarsabz, S-81 = Sindh-18, Fsl = Faisalabad = 85, M.P = Mexi-Pak, Jo = Johar, Sog = Soghat
Meh = Mehran-89, T.J = T.J-83 and P-70 = Pak-70

Table 3: Effect of seed dressing fungicide on root of seedlings of wheat varieties

	Root length (cm)											
Fungicides	An	Sar	H-68	S-18	Fal	T.J	M.P	C-591	Jo	Sog	Meh	P-70
Baytan	13.44	13.34	13.28	12.88	12.88	12.84	12.80	12.78	12.72	12.7	12.40	11.58
Vitavax	13.14	12.94	12.80	12.72	12.72	12.60	12.44	12.44	12.42	12.3	12.30	12.10
Benlate	11.42	11.18	11.18	11.16	11.08	11.04	11.02	11.00	10.94	10.9	1.78	10.56
Captan	9.94	9.82	9.76	9.64	9.62	9.60	9.50	9.48	9.46	9.44	9.32	9.22
Dithane	8.72	8.66	8.56	8.48	8.42	8.42	8.34	8.32	8.32	8.32	8.28	8.18
Derosal	8.84	8.48	8.48	8.38	8.34	8.32	8.24	8.24	8.24	8.22	8.20	8.08
Rizolex	5.62	5.56	5.54	5.52	5.48	5.44	5.44	5.42	5.32	5.32	5.30	5.26
Control (-)	5.50	5.40	5.40	5.40	5.40	5.30	5.30	5.30	5.30	5.0	5.0	4.50

LSD (P = 0.05) = 0.24 C.V. = 5.81%

Table 4: Effect of seed dressing fungicides on shoot length of seedling of wheat varieties

	Root length (cm)											
Fungicides	An	Sar	H-68	S-18	Fal	T.J	M.P	C-591	Jo	Sog	Meh	P-70
Baytan	21.94	21.78	21.52	21.22	21.10	21.18	21.16	20.94	20.90	20.88	20.86	20.64
Vitavax	21.72	21.64	21.40	20.78	20.64	20.64	20.62	20.52	20.46	20.32	20.30	20.26
Benlate	20.80	20.68	20.26	20.40	20.20	19.92	19.84	19.80	19.78	19.72	19.62	19.42
Captan	18.62	18.50	18.46	18.44	18.40	18.32	18.30	18.30	18.24	18.18	18.12	18.02
Dithane	16.64	16.20	15.98	15.98	15.96	15.86	15.82	15.48	15.48	15.36	15.24	15.12
Derosal	16.64	15.14	14.92	14.92	14.72	14.70	13.78	13.72	13.40	13.34	12.96	12.74
Rizolex	10.54	10.24	10.22	10.10	10.06	10.04	9.96	9.96	9.86	9.46	9.38	7.76
Control (-)	10.50	10.20	10.10	10.10	10.10	9.80	9.40	9.40	9.30	9.20	9.20	7.20

LSD (P = 0.05) = 0.41 C.V. = 6.72 %

The maximum germination of wheat seedlings of all 12 varieties was recorded with Baytan followed by Vitavax, Benlate, Captan and Dithane M-45 (Table 2). The percent germination for seeds of all varieties treated with Baytan ranged from 45-75%, Vitavax 44-74%, Benlate 38-71%, Captan 35-65% and Dithane M-45 25-52%, respectively. There was no significant difference in the germination of seeds treated with Derosal and Rizolex. The overall germination percentage for seeds of all varieties treated with seven fungicides ranged from 3.83-60.80%, whereas the germination for untreated seeds ranged between 31.42 to 41.33% (Table 2). Kausar (1955) and Parashar (1970) used copper fungicides to reduce the incidence of black point of wheat. Misra and Singh (1971, 1972) tested Captan and Dithane M-45 against *Alternaria tenuis* and *Helminthosporium oryzae*. Khetarpal and Agarwal (1979) obtained the similar results with Carboxin (vitavax) and Benomyl (Benlate).

The greatest root length was seed of all varieties treated with Baytan and Vitavax followed by Benlate (Table 3). The root length was significantly decreased in seeds treated with Rizolex and Derosal, but it was higher than the untreated seeds of all the varieties (control). Maximum shoot length was obtained in the seeds of all varieties treated with Baytan (21.94), followed by Vitavax (21.72) and Benlate (20.80). Whereas shoot length was significantly decreased in seedlings grown from seeds treated with Rizolex (7.76). Shoot length of seedlings obtained from Captan, Dithane M-45, Derosal and Rizolex was also greatest than the seedlings germinated from untreated seeds (Table 4). Tragner *et al.* (1980) obtained 100% control with Baytan by improving seedling vigor, quality and quantity of grains. The similar results have been reported by Agarwal *et al.* (1981), Raut *et al.* (1983) and Singh *et al.* (1984).

All the fungicides used at 2gm per kg seed significantly increased the seedling emergence as compared to untreated seeds (control). The maximum number of seedlings emergence was recorded with Baytan followed by Vitavax, Benlate, Captan and Dithane M-45 (Fig. 1). There was no significant difference in the seedling emergence with Derosal and Rizolex. Significance increase in seedling emergence has been reported when seeds were tested with Captan and Vitavax (Randhawa *et al.*, 1985) and by Bavistin, Benlate and Dithane M-45 (El-Tayed *et al.*, 1987).

The maximum plant height was recorded with Baytan followed by Vitavax and Benlate (Fig. 1). Plant height was not significantly different obtained with Captan, Dithane M-45, Derosal and Rizolex respectively. All the fungicides increased plant height at 2 gm/1 kg seed as compared to control (untreated seeds).The maximum number of grains per spike was obtained by Baytan followed by

Vitavax, Benlate, Captan and Dithane M-45 (Fig. 1). The remaining treatments Derosal and Rizolex did not show significant difference among their means when compared to control. Maximum 1000-grain weight was obtained with Baytan and Vitavax followed by Benlate (Fig. 1). The minimum grain was obtained with Rizolex. The 1000-grain weight obtained with Derosal and Rizolex was not significantly different with that of untreated seeds. Gupta *et al.* (1999) obtained similar results by using Captan, Dithane M-45 and Benlate against *Alternaria alternata* and *Helminthosporium sativum* associated with wheat. The maximum grain yield per plot and per hectare was recorded with Baytan and Vitavax followed by Benlate (Fig. 1). The lowest grain yield was obtained with Rizolex followed by Derosal. The grain yield was not significantly different among the treatments Dithane M-45, Derosal and Rizolex. All the fungicides increased the grain yield as compared to untreated seeds. Mahmuda *et al.* (1987) reported the similar results by using Vitavax and other fungicides against black point disease of wheat caused by *Helminthosporium sativum*.

From these finding it is infers that the seed health technique is primary need to avoid crop failure. Seed testing determine not only seed germination but it provides information of pathogen associated with seeds.

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