

Studies of Seed Borne Fungi

I. Effect of Seed Treatment on *sorghum* Seeds in Storage

by

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Introduction : Seed deterioration due to various seed borne microflora is a common feature under faulty conditions of storage leading to loss of seed viability. The effect of seed treatment prior to storage appeared to offer a certain amount of protection during storage. Examination of various seed samples of *sorghum* revealed the frequent occurrence of many fungi. Hence studies on the effect of different fungicides on *sorghum* seeds in storage were conducted. The results of this study are presented in this paper.

Materials and Methods : I. *Studies on the efficacy of different fungicides on treated seeds in storage :* Seeds of *sorghum* variety CO 18 were treated with eleven (dry seed dressing) fungicides at the rate of 1 g/500 g of seed and were stored in paper covers under laboratory temperature (27°-29°C) at relative humidity 80%. The treatment was done by using the electrically operated seed dressing machine devised by Ramakrishnan *et al* (1965). The following fungicides were tested with the 12th treatment as control.

Name of fungicides tested :

1. T. M. T. D.
2. Fernasan (Bis (dimethyl thiocarbonyl) disulphide)
3. Thiram
4. Flit 406 (N-[trichloromethylthio] 4-Cyclohexene dicarboximide)
5. Sandoz 6335 (3% mercury as organo)
6. Dow 9 B (Zinc, 2, 4, 5 Trichloro phenoxide)
7. Tillex (Ethyl mercury chloride)
8. Ceresan dry (Phenyl mercury acetate)
9. New Improved Ceresan (Ethyl mercury phosphate)
10. Agrosan G. N. (Tolyl mercury acetate)
11. Samesan (2 Chloro (Hydroxy mercuric phenol)

The efficacy of the treatments was assessed against four seed borne fungi viz., *Aspergillus niger*, *Fusarium moniliforme*, *Curvularia pallescens* and *Helminthosporium tetramera* as described by Ramakrishnan *et al* (1965). Two replications were maintained in each case. The plating of seeds were carried out at monthly intervals for a period of 19 months. The germination percentage of seeds after 19 months were also recorded. The initial germination of the *sorghum* seed prior to seed treatment and storage was also recorded.

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II. *Effect of storage on the fungicide content of sorghum seeds treated with various compounds:* The assay method based on the diffusion of fungicides from the seeds into the agar medium containing the conidia of the test fungi described by Arny and Curtlaben (1956) was followed. The amount of particular fungicide present in a given sample is estimated by comparison of the diameter of inhibition zones around seeds from the test sample with the diameter of the zones produced by the standards *i. e.*, seeds treated with graded amounts of same fungicide. The fungicides T. M. T. D., Agrosan G. N. and Captan were used in the studies. CO 18 sorghum seeds were treated with the above fungicides at 2 g, 1.75 g, 1.50 g, 1.25 g, 1.0 g, 0.75 g, 0.50 g, 0.25 g per kilo of seed (0.2%, 0.175%, 0.15%, 0.125%, 0.1%, 0.075%, 0.05% and 0.025% respectively). The test fungi mentioned under item (i) above were used in this case also. The inhibition zones produced by the standards were recorded and compared with the inhibition zones produced by the same fungicides used in storage studies.

Results: I. *Studies on the efficacy of different fungicides on treated seeds of storage:* The diameter of inhibition zone produced in each treatment against the four test fungi during the nineteen months of storage are presented in Table I to 4. In general a gradual reduction in the efficacy of all treatments

TABLE 1. Percentage of area of growth of different fungi

S. No.	Treatments	Mean of uninhibited area			
		<i>Aspergillus niger</i>	<i>Fusarium moniliforme</i>	<i>Curvularia pallescens</i>	<i>Helminthosporium tetramera</i>
1.	T. M. T. D.	68.33	67.50	68.18	70.62
2.	Fernasan	70.87	70.72	70.17	71.25
3.	Thiram	70.83	69.95	70.46	71.47
4.	Flit 406	81.38	78.77	78.87	79.05
5.	Sandoz 6335	81.44	79.44	79.93	79.05
6.	Dow 9 B	84.74	84.74	84.72	85.16
7.	Tillex	87.22	85.25	87.36	86.88
8.	Ceresan dry	79.72	78.72	77.51	78.95
9.	New improved ceresan	80.17	76.29	77.99	77.75
10.	Agrosan GN	80.56	78.48	79.26	77.75
11.	Semesan	87.58	86.67	87.17	86.66
12.	Control	90.00	90.00	90.00	90.00
	Months S. E.	1.32	1.45	1.48	1.41
	C. D.	3.70	4.06	4.14	3.94
	Treatments S. E.	1.05	1.15	1.18	1.12
		2.95	3.22	3.30	31.14

Conclusion : 1, 3, 2, 8, 9, 10, 4, 5, 6, 7, 11, 12 1, 2, 3, 8, 9, 4, 10, 5, 6, 11, 7, 12

1, 3, 2, 9, 10, 3, 4, 5, 6, 7, 11, 12 1, 2, 3, 10, 9, 8, 4, 5, 6, 11, 7, 12

Significant at 1% level

as evidenced by inhibition zones was observed with the progress of storage period. The fungicide T. M. T. D. was found to afford good protection to the sorghum seeds against test fungi stored for 19 months after treatment. The fungicides Fernasan and Thiram which followed T. M. T. D. (and which also contain the same active ingredients as T. M. T. D.) were also effective. Among the organo mercurials, Ceresan (dry), New Improved Ceresan, Agrosan G. N. and Sandoz 6335 were active against all the four test fungi upto 10 months while Tillex and Samesan were not effective beyond 4 months. Flit 406 was effective upto 9 months only. Dow 9 B (organic) was effective upto 6 months. The viability of treated seeds at the end of one year and after 18 months was found to be highest in T. M. T. D. followed by Fernasan and Thiram while there was no germination in the control (Table 2). The viability was found reduced considerably in organo-mercurials.

TABLE 2. *Efficacy of different fungicides on treated seeds in storage-seed germination*

S. No.	Treatments	Germination percentage	
		After 12 months of storage	After 18 months of storage
1.	T. M. T. D.	62	54
2.	Fernasan	60	48
3.	Thiram	52	50
4.	Flit 406	52	44
5.	Sandoz 6335	14	2
6.	Dow 93	12	0
7.	Tillex	2	0
8.	Ceresan dry	20	2
9.	New improved Ceresan	22	10
10.	Agrosan GN	20	2
11.	Samesan	8	2
12.	Control	0	0

Initial germination 96%

II. *Effect of storage on the fungicide content of sorghum seeds treated with various compounds:* The inhibition zones produced by the different dosages of the fungicides T. M. T. D., Agrosan G. N. and Captan are given in Table 3. The inhibition zone gets reduced with the decrease in the dosage of the fungicide. It was further observed that there was a gradual reduction in the inhibition zone by the treated seeds as the period of storage increases. So it is evident that the efficacy of treated seeds gets reduced with load of the fungicide and also with the increase of the period of storage. The effective

optimum dosage of Agrosan G.N. was found to be 0.1% in the case of *Aspergillus niger* while it was 0.05% in the case of *Curvularia pallescens* and *Helminthosporium tetramera*. It is interesting to note that T. M. T. D is effective even at very low concentrations as 0.025% against the four test fungi. The germination of the seeds treated with various dosages was tested after 5 months and is given in Table 4. The germination was found to be good up to 0.15% concentration with T. M. T. D.

TABLE 4. Effect of storage on the fungicide content of sorghum seeds—percentage of germination after 5 months of storage

Concentration of the fungicide	Germination percentage			
	TMTD	Agrosan GN	Captan	Control
0.200 %	83	75	76	70
0.175 %	78	73	74	70
0.150 %	77	70	73	70
0.125 %	69	67	71	70
0.100 %	66	63	74	70
0.075 %	70	63	70	70
0.050 %	72	63	70	70
0.025 %	70	62	70	70

Initial germination before the treatment was 82 %.

Discussion: Viability of sorghum seeds can be preserved by seed treatment while in storage. The fungicide T.M.T.D affords effective protection to seeds in storage followed by Fernasan and Thiram which also contain the same active ingredient. The viability of the seeds treated with the above chemicals was also found to be high in storage than the untreated seeds.

The data on germination of the treated seeds prior to the commencement of the experiment and after one year of storage indicates that the viability of the seeds treated with fungicide T. M. T. D is higher than the rest. The complete failure of germination in the control series indicates that the chemicals used as seed treatment have no phytotoxic effect leading to the loss of viability. Brett and Weston (1941) observed that a high level of germination was maintained over a longer period by the treated wheat seeds stored in envelopes and jute bags. In the present studies the treated seeds were stored in paper bags only and this suggests that seeds stored in paper containers may enhance the life of the seed. Reduction in the fungicidal content in the treated seeds due to long period of storage has been shown to be responsible for the inefficiency of certain fungicides. The organo-mercurial has no effect against *Aspergillus niger* at a dosage of 1 g/kg of seed (0.1%)

TABLE 3. Percentage of inhibition

Concentration of the fungicide	Percentage of inhibition in different seed borne fungi																							
	T. M. T. D.						Agrosan G. N.						Captan											
	F	C	A	H	F	H	F	C	A	H	F	H	F	C	A	H								
0.200%	25.1	23.3	37.4	20.4	24.1	20.4	36.5	28.7	22.4	19.8	21.0	17.8	16.5	12.6	18.9	13.6	23.4	12.6	22.4	12.6	12.6	17.8	19.9	20.4
0.175%	21.0	22.1	32.4	20.4	21.0	20.4	30.4	25.4	21.0	13.6	21.4	9.8	16.5	10.5	15.7	10.5	20.1	12.6	20.4	13.6	12.6	20.4	14.7	18.9
0.150%	22.0	17.8	32.4	19.9	15.7	20.4	30.4	22.4	15.7	7.8	10.5	7.8	8.3	4.1	14.7	7.8	17.8	9.8	17.8	17.5	10.5	13.6	14.7	11.5
0.125%	22.0	17.8	32.4	17.8	15.7	20.4	30.4	20.4	15.7	4.2	10.5	0	6.3	0	10.5	0	12.8	7.8	17.8	7.8	9.4	13.6	9.4	10.5
0.100%	18.9	17.8	30.4	17.8	14.7	17.8	24.1	17.8	13.6	0	10.5	0	0	0	10.5	0	12.6	5.2	12.6	5.2	7.8	7.8	7.8	7.8
0.075%	16.5	13.6	30.4	17.8	14.7	17.8	24.1	14.7	8.3	0	4.2	0	0	0	4.2	0	9.4	0	9.4	0	4.2	0	4.2	0
0.050%	16.5	13.6	30.4	17.8	14.7	14.7	21.1	13.6	4.2	0	0	0	0	0	0	0	7.8	0	7.8	0	0	0	0	0
0.025%	15.7	11.5	30.4	13.6	12.6	14.7	24.1	13.6	4.2	0	0	0	0	0	0	0	3.1	0	0	0	0	0	0	0

F — *Fusarium moniliforme*
 C — *Curvularia pallens*

H — *Helminthosporium tetramera*
 A — *Aspergillus niger*

1 — Immediately after treatment 2 — Two months after storage

0 — No inhibition zone i.e., full growth of the test fungi on the petri dishes. Under treatment control, there was no inhibition zone for all concentrations of fungicides.

concentration and against *Curvularia pallescens* and *Heminthosporium tetramera* at 0.5 g/kg of seed (0.05%) concentration. The organo-mercurials have proved to be ineffective beyond 5 to 10 months of storage due to rapid reduction in the fungicide content on the seed in storage. It is interesting to note that Tetra methyl thiuram disulphide (T. M. T. D) is very effective at low concentration as 0.025% which can be utilized with advantage in reducing the cost of fungicidal treatment.

Summary: The behaviour of *sorghum* seeds treated with various fungicides in storage was studied with reference to its effect on the seed viability. The fungicides with Tetra methyl thiuram disulphide as active ingredient *viz.* T. M. T. D., Thiram and Fernasan have proved to be significantly very effective against the test fungi upto 19 months of storage. The above fungicides have also been found to show maximum percentage of germination upto 19 months than the other treatments. The fungicidal content of the treated seeds was found to get reduced as the storage period increased. T. M. T. D was found to be very effective even at a low concentration of 0.025% (0.25 g/kg of seed) against the test fungi than the other fungicides.

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