

EFFECTS OF FUNGICIDES ON GERMINATION AND SEEDLING HEALTH OF INFESTED GROUNDNUT (*ARACHIS HYPOGAEA* L.)

BY

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Infested groundnut seeds with different microorganisms showed higher percentage of germination when treated with Emisan₆ and Dithane M45 than all other fungicides, used in dry seed treatment. Regarding root length of the seedlings, longer root length was observed in all treatments though Blitox and Bavistin showed no significant differences in comparison to control. In case of shoot length, there is no significant differences among the treatments.

INTRODUCTION

Various types of microorganisms remain associated with the kernels of groundnut under congenial conditions in storage and in fields. These kernels are usually sown in the fields, used directly as the cattle feeds or as a supplement to poultry feeds. Infected kernels when sown in the fields, the microorganisms cause seed rot, root rot, collar rot, or afla root to the seedlings. It also ceases the seed viability resulting to poor germination of groundnut seeds. Among the microorganisms remain associated with seeds, *Aspergillus niger*, *A. flavus*, *Penicillium* sp., *Rhizopus* sp. *Mucor* sp, *Machrophomina phaseolina*, *Fusarium* sp. and bacteria are most common (Chohan and Gupta, 1968). Usually the infested seeds are treated with different fungicides and kept for some time and are sown in the fields. The present study was conducted to evaluate the viability of seeds with respect to seed germination and seedling emergence of infested groundnut seeds after fungicidal treatment.

MATERIALS AND METHODS

Seeds of groundnut were collected from different farmers of Nadia district, West Bengal, mixed together and divided into two lots, variety local, spreading type : one lot of seed was treated with different fungicides as dry seed treatment and the other as wet seed treatment.

Fungicides used

Fungicide	Chemical nature	Usual dose	Manufacturer
Dithane M45	Zinc + manganous ethylene bisdithiocarbamate	0.4%	Indofil Chem. Ltd.
Dithane Z78	Zinc ethylene bisdithiocarbamate	0.4%	Indofil Chem. Ltd.
Thiram	Tetramethyl thiorum disulphide	0.4%	May & Baker (India) Pvt. Ltd.
Captaf-75 SD	N-trichloromethyl thio-4-cyclohexene-1, 2 dicarboximide	0.25%	RalliesIndia Ltd.
Blitox 50	Copper-oxychloride	0.4%	Rallis India Ltd.
Bavistin 50	Methyl-2-benzimidazole carbamate	0.2%	BA SF India
Emisan 6	Methoxyethyl mercury chloride	0.25%	Excel Indust. Ltd.

Seed treatment

Dry seed treatment was made by taking 200 g of seeds in a conical flask alongwith the required amount of fungicides and mixed thoroughly by shaking the flasks for 15 minutes in wrist action shaker. Similarly, wet seed treatment was made by taking 200 g of seeds, fungicide and 25 ml of distilled water in a conical flask and shaken for 15 minutes. After this operation, a thin layer of fungicide was coated the seeds. These fungicide coated seeds were then dried in shade. In both the cases control (without fungicide) was also parallally run for comparison.

Storage of treated seeds

Fungicide treated seeds were stored in polythene bags separately at room temperature for 3 months. Periodically (at 21 days interval) seeds from different polythene bags were studied to observe the effect of fungicides on viability of seeds, seedling emergence and growth of seedlings.

Seedling emergence and growth of seedlings

Treated seeds were sown in sterilized sand containing pots with 3 replications for each treatment. Twenty seeds were sown in each replication and kept under full sun shine. Seeds were sown in sand at 2-2.5 cm depth. Sand was sterilized at 20 lbs pressure for 40 minutes in autoclave. Sterilization was made for 2 conse-

cutive days. Watering was done regularly to maintain the moisture level for seed germination and plant growth. After 20 days of sowing, percentage of germination and growth of the seedlings were observed. Untreated seeds were also sown in sterile sand as control and was also observed for comparison. Seeds treated with both the methods (dry and wet) were studied. The data were statistically analysed using split plot design.

RESULTS AND DISCUSSION

Germination of seeds

Groundnut seeds treated with different fungicides viz. Dithane M45, Dithane Z78, Emisan₆, Blitox₅₀, Bavistin, Captaf and Thiram at their usual doses and stored upto 63 days. Periodically (21 days interval) the seeds were incubated in Petri-plates (4' diam) at $20^{\circ}\text{C} \pm 1^{\circ}\text{C}$ for 4 days both in light and dark. In each plate 10 seeds were observed, their percentage of germination was counted. Side by side untreated seeds were also incubated for comparison. Data are presented in Table 1.

From Table 1, it revealed that percentage of germination of seeds were very low in case of untreated control. All the treatments had improved the germination percentage side by side with a reduction of microfloral population. Cent percent germination of seeds was obtained by Emisan₆ when treated as dry soon after treatment though it reduced by 13.34 percent at 42 days of storage. Dithane M45 showed fairly good result upto 42 days of storage when used as dry seed treatment which is followed by Dithane Z78. In case of dry seed treatment it was also noted that all the treatments showed better germination percentage of seeds soon after treatment than that of after storage for different periods which were gradually decreased in most of the cases and observed lowest at 63 days after storage.

But in case of wet seed treatment Emisan₆ did not showed very good result like dry seed treatment. Here, Dithane M45 and Thiram showed more than 90 percent germination of seeds after 63 days of storage which were lower soon after treat-

Table 1. Percentage of germination of treated seeds

Period of storage (in days)	Dithane -M45	Dithane -Z78	Thiram	Emisan ₆	Blitox ₅₀	Captaf	Bavistin	Control
0	86.66	66.66	86.66	100.00	76.66	90.00	56.66	26.66
21	76.66	50.00	80.00	93.33	66.66	73.33	46.66	16.66
42	76.66	43.33	63.33	86.66	90.00	60.00	26.66	13.33
63	66.66	40.00	66.66	96.66	56.66	56.66	20.00	20.00

Results are average of 100 seeds with 3 replications.

ment. Captaf showed fairly better result followed by Dithane M45 and Thiram than that of other fungicides.

Seeds infected with *Rhizopus* sp. and bacteria did not germinated mostly but when the infection was very low, seeds did germinated. Seeds infected highly with *A. niger* or *A. flavus* or *M. phaseolina* did not germinate at all. Results were in agreement with Nataranjan *et al.* (1983) and Vir *et al.* (1972).

Effect of storage on treated seeds with respect to seedlings emergence

The experiment was conducted to know the effect of fungicides on seedling emergence after storing the treated seeds upto 63 days after treatment. Treated seeds were sown in 30 cm earthen trays in sterile sand. Untreated seeds were also sown in 30 cm earthen trays as control for comparison. The data were analysed statistically after transforming them into angular transformed values and are present in Table 2.

Table 2. *Effect of interaction among days of storage, fungicides and methods of treatment on seedling emergence of groundnut*

Fungicides	Methods of treatment (M)	Percentage of seedling emergence after different days of storage (Angular transformed value) (d)			
		0	21	42	63
Dithane M45	D	65.95	66.64	70.69	57.95
	S	67.40	56.84	62.11	57.98
Dithane Z78	D	46.92	49.88	45.00	61.73
	S	61.33	50.79	63.74	62.40
Thiram	D	59.24	57.28	63.93	64.69
	S	65.62	58.06	61.46	67.40
Captaf	D	42.03	54.33	73.79	70.50
	S	67.71	64.69	61.14	64.64
Blitox ₅₀	D	44.06	54.32	60.31	58.14
	S	64.81	59.05	61.22	55.98
Bavistin	D	43.08	39.23	34.18	57.86
	S	52.91	43.95	53.87	48.88
Emisan ₆	D	62.40	68.86	68.10	65.95
	S	63.93	62.40	56.84	59.05
Untreated control	D	31.45	26.82	30.95	35.25
	S	34.02	35.01	42.12	45.96

C.D. at 5%

9.606

D = Dry seed treatment

S = Slurry/wet treatment

The results revealed that there were higher percentages of seedling emergence from seeds treated with different fungicides than untreated control. These findings were supported by Mathur and Sharma (1971), Sharma *et al.* (1973). Among the fungicides, seeds treated with Emisan₆ produced higher number (63.44) of seedling emergence which was followed by Dithane M45 (63.29), Thiram (62.21), Captaf (62.35), Blitox₅₀ (57.31) and Dithane Z78 (35.22). Seeds treated with Bavistin produced lowest emergence. Although, there were no significant difference among Emisan₆, Dithane M45, Thiram and Captaf, but they yielded higher number of seedling than Blitox₅₀, Dithane Z78 or Bavistin. The treatment difference between Blitox₅₀ and Dithane Z78 was not significant. All the fungicidal treatments were significantly superior to untreated control.

The interaction between different fungicides and methods of seed treatment was significant.

For Blitox₅₀, Dithane Z78 and Bavistin, slurry seed treatment produced significantly higher number of seedlings than dry seed treatment. Similar trend was observed in case of Thiram and Captaf although the treatment difference was not significant. On the other hand, reverse trend in seedling emergence was observed in case of Emisan₆ and Dithane M45 when treated in dry method than slurry treatment although the treatment difference was significant in case of Emisan only. It was observed that seeds shaken only with distilled water regarded as control (in slurry treatment) yielded significantly lower seedling emergence than dry treatment.

The interaction between storage period, fungicides and methods of seed treatment, methods of treatment was significant (Table 2). When seeds sown just after treatment (0 day storage) in slurry seed treatment, yielded higher number of seedlings than dry treatment for all the fungicides and also for control, although treatment difference was not significant in case of Dithane M45, Thiram and Emisan₆. At 21 days after storage, dry seed treatment produced significantly higher number of seedlings than slurry treatment in case of Dithane M45, the reverse trend was obtained in case of Captaf where seedling emergence from slurry seed treatment was significantly better than dry seed treatment. There was no differences in treatment for other fungicides. After 42 days of storage the treatment difference between two methods of seed treatments were statistically at par for Dithane M45, Thiram and Blitox₅₀. Slurry seed treatment produced significantly higher number of seedlings than dry seed treatment in case of Dithane Z78, Bavistin and control. reverse results were obtained in case of Captaf and Emisan₆. At 63 days after storage there was no treatment difference between slurry and dry seed treatment for all fungicides except for control treatment. Slurry method yielded significantly higher seedling emergence than dry treated seeds.

Effect of fungicides used as seed treatment on seedling growth

Growth of the seedlings were studied after germination of seeds upto 20 days. Their respective root or shoot length (in centimeter scale) were measured. Data were analysed statistically following split plot design.

Data with respect to root length and shoot length are presented in Tables 3 and 4.

Table 3. *Effect of interaction among days of storage, fungicides and methods of treatment on root growth*

Fungicides (F)	Method of treatment (M)	Root length (cm) observation after days			
		0	21	42	63
Dithane M45	D	23.07	22.67	24.20	24.27
	S	24.23	26.96	26.46	27.30
Dithane Z78	D	21.47	22.07	24.37	23.87
	S	27.73	25.13	22.05	28.43
Thiram	D	22.63	20.80	23.60	25.17
	S	27.37	20.86	25.36	28.00
Captaf	D	21.20	21.23	24.40	25.97
	S	30.07	25.80	23.30	28.20
Blitox ₅₀	D	21.73	20.70	22.97	23.87
	S	25.57	20.86	22.60	25.46
Bavistin	D	21.55	21.83	20.50	25.47
	S	24.20	23.16	22.16	29.56
Emisan ₅	D	22.13	21.73	21.23	22.13
	S	25.50	25.40	25.03	27.90
Untreated Control	D	21.47	20.43	21.67	23.50
	S	20.97	21.30	24.56	28.10

C.D. at 5% 2.7329 D=Dry seed treatment S=Wet treatment

From Table 3, it was revealed that the length of roots were significantly longer of the seedlings arose out of the seeds stored for 42 days and 63 days than 21 days of storage, which was significantly shorter than no storage. In case of dry seed treatment root length at 42 days of storage are significantly longer than at 21 days and no storage (0 day). The wet treatment always produced significantly longer root length than dry treatment. In case of wet (slurry) treatment, it was observed that at 63 days of storage root length was significantly higher than 21 and 42 days of storage.

It has been noted that all the fungicide treatment produced longer root length than the untreated control, although significant differences were noted in case of Dithane M45, Dithane Z78, Thiram, Captaf, Emisan and untreated control. Blitox₅₀ and Bavistin showed no significant differences with untreated control.

Table 4. Effect of fungicides, days of storage and their interaction on shoot growth

Fungicides (F)/ Period of storage (d)	Shoot length (cm) observation after days				Mean (F)
	0	21	42	63	
Dithane M45	10.88	10.68	11.20	10.95	10.98
Dithane Z78	11.56	10.58	11.08	10.21	10.86
Thiram	11.05	10.08	12.93	10.41	11.11
Captaf	11.82	10.35	12.43	10.96	11.39
Blitox ₅₀	10.65	10.66	10.85	10.08	10.56
Bavistin	10.41	10.71	10.78	10.76	10.66
Emisan ₆	8.56	10.16	11.35	10.09	10.04
Untreated control	9.23	10.13	11.41	10.35	10.28
Mean (d)	10.52	10.44	11.50	10.48	10.73
C.D. at 5%	(d)	(F)	(d & F)		
	0.4759	0.4072	0.8142		

From Table 4, it was found that among the fungicides Captaf, Thiram, Dithane M45 and Dithane Z78 had produced significantly higher shoot growth than other fungicides. Emisan₆ showed smaller shoot growth than control. Bavistin and Blitox₅₀ showed similar results like control. Captaf among the fungicides produced highest growth of the shoot, but it had no significant difference with Thiram.

Regarding the effect of interaction between fungicides and different day of storage, Dithane M45 treatment showed no significant difference in shoot length after any period of storage. Blitox₅₀ and Bavistin also showed such type of results like Dithane M45, Captaf, Thiram and Dithane Z78 showed variable types of results i.e., the length of shoot after 21 days of storage significantly reduced than soon after treatment, which again increased significantly followed by significant reduction in growth after 42 and 63 days of storage. It is also notable that in untreated control there was also significant difference after different days of storage. Findings were also suggested by Dhamnikar and Peshney (1982), Natarajan *et al.* (1983).

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