

INFLUENCE OF SEED TREATMENT WITH FUNGICIDES, BACTERICIDE HOT WATER AND ANTAGONISTS ON THE SEEDLING VIGOUR OF CABBAGE*

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Seeds treated with carbendazim at 2 g per kg, in hot water at 50°C for 30 min and thiram at 2 g per kg produced longer roots. The seedlings raised from seeds treated with hot water, carbendazim, thiram and the antagonist *Trichoderma viride* produced longer shoots. Seedlings raised from seeds treated with carbendazim, *T. harzianum*, hot water, thiram and *T. viride* produced higher dry matter production. Carbendazim and hot water increased the vigour index values.

The fungicides, antibiotics and antagonists applied to the seeds have been observed to produce profound biological effects in seedlings. The beneficial effect of seed treatment with pesticides on root length (Ramadoss, 1985), shoot length (Kannaiyan *et al.*, 1975) and index value (Ramadoss, 1985) was reported. However, adverse effect on seedling vigour due to seed treatment with pesticides was also reported by Mathur and Mathur (1985). With a view to assess the effect of seed treatment with fungicides, bactericide and antagonists the present study was carried out in cabbage.

MATERIALS AND METHODS

The seeds of cabbage cv. September obtained from the State Department of Horticulture and Plantation Crops were treated with fungicides by dry seed dressing. The seeds were shaken with the fungicides in a plastic container for 15 min. In case of antibiotics, the seeds were soaked in antibiotic solutions (0.01

per cent) for 2 h and shade dried. In case of combination of seed treatment with fungicides and antibiotics, the seeds were treated first with antibiotics and 24 h later with fungicides. Hot water treatment was given by dipping the seeds in water bath at 50°C for 30 min.

Trichoderma viride and *T. harzianum* grown on PDA medium for 14 days were suspended in sterile distilled water, blended and filtered through a muslin cloth. The filtrate containing conidia was centrifuged at 3000 g for 10 min. The supernatant was discarded and the conidial pellet was resuspended in sterile distilled water. The process was repeated again and finally the conidia were suspended in 10 ml of 0.1 per cent carboxy methyl cellulose solution. The concentration was adjusted to 4.8 to 5.2 X 10⁹ conidia per ml using a haemocytometer. Three ml of this suspension was used to coat 10 g of cabbage seeds following the method of Sivan *et al.* (1984).

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The treated seeds were stored in polyethylene bags for six months at laboratory conditions ($30 \pm 2^\circ\text{C}$) and relative humidity varying from 60 to 90 per cent. One lot of untreated seeds was stored to serve as control.

The seeds were tested immediately after seed treatment and also at intervals of three to six months. The studies on root length, shoot length, dry matter production and vigour indices were conducted with the treated seeds to assess the seedling vigour.

i) Root length

Five normal seedlings were taken at random from the germination test on 10th day after germination and the root length was measured in cm from collar region to the tip of root and recorded.

ii) Shoot length

Five normal seedlings which were taken for measuring root length were also used for measuring the shoot length. The shoot length was measured in cm from the collar region to the tip of the shoot and recorded.

iii) Dry matter production

Five normal seedlings were selected at random from each treatment and dried in a hot air oven maintained at 85°C for 24 h and cooled in a desiccator. Then the weight of dried seedlings was recorded in mg.

iv) Vigour index

The vigour index based on germination percentage and dry matter was calculated using the following formula and expressed as whole

numbers by following the procedure suggested by Abdul-Baki and Anderson (1973).

RESULTS AND DISCUSSION

Seedlings raised from seeds treated with carbendazim produced longer roots of 9.42 cm followed by hot water and thiram which recorded root length of 9.29 and 9.19 cm respectively. Seedlings raised from seeds treated with streptomycin and *T. harzianum* produced root length on par with control. In general, significant reduction of root length was observed in all treatments with increase in storage period (Table 1).

Seedlings raised from seeds treated with hot water, carbendazim, thiram and *T. viride* were superior to other treatments in producing seedlings with longer shoot length of 8.45, 8.44, 8.16 and 8.12 cm respectively. Seedlings raised from seeds treated with streptomycin produced shorter shoot length of 6.80 cm as against 7.36 cm in untreated control. Reduction of shoot length was observed in all the treatments with increased storage period (Table 2).

Seedlings raised from seeds treated with carbendazim, *T. harzianum*, hot water, thiram and *T. viride* produced higher dry matter of 8.22, 8.22, 8.20, 7.97 and 7.92 mg respectively as against 7.48 mg in control. Streptomycin and streptomycin + thiram recorded dry matter of 7.42 mg which were on par with control. The dry matter production decreased with increased storage period (Table 3).

Table 1. Effect of seed treatment with fungicides, bactericide, hot water and antagonists on root length in cm per seedling

Treatments	Period after treatment in months			Mean
	0	3	6	
Carbendazim	9.87	9.40	9.0	9.42
Thiram	9.43	9.30	8.83	9.19
Streptocycline	8.83	6.97	6.46	7.42
Streptocycline + thiram	8.86	7.90	7.16	7.97
Hot water	9.77	9.20	8.92	9.29
<i>Trichoderma viride</i>	9.30	8.83	8.46	8.86
<i>Trichoderma harzianum</i>	8.47	7.90	7.43	7.93
Control	9.20	7.17	6.17	7.53
Mean	9.22	8.33	7.80	

Comparison of significant effects

	SED	CD (P=0.05)
Treatments	0.26	0.52**
Periods	0.16	0.32**
Treatments X Periods	0.45	0.90**

**Significant at 1% level.

Table 2. Effect of seed treatment with fungicides, bactericide, hot water and antagonists on shoot length in cm per seedling

Treatments	Period after treatment in months			Mean
	0	3	6	
Carbendazim	8.80	8.60	7.93	8.44
Thiram	8.50	8.40	7.60	8.16
Streptocycline	7.57	6.57	6.26	6.80
Streptocycline + Thiram	7.77	7.43	6.50	7.23
Hot water	8.63	8.50	8.23	8.45
<i>Trichoderma viride</i>	8.60	8.33	7.43	8.12
<i>Trichoderma harzianum</i>	7.90	7.67	6.57	7.38
Control	8.20	7.60	6.20	7.36
Mean	8.25	7.81	7.10	

Comparison of significant effects

	SED	CD (P=0.05)
Treatments	0.27	0.53**
Periods	0.16	0.33**
Treatments x Periods	0.46	0.93**

** Significant at 1% level.

Table 3. Effect of seed treatment with fungicides, bactericide; hot water and antagonists on dry matter production in mg per seedling

Treatments	Period after treatment in months			Mean
	0	3	6	
Carbendazim	8.59	8.40	7.67	8.22
Thiram	8.53	8.00	7.40	7.97
Streptocycline	8.00	7.07	6.87	7.32
Streptocycline + Thiram	8.07	7.20	6.97	7.42
Hot water	8.50	8.37	7.73	8.20
<i>Trichoderma viride</i>	8.47	8.00	7.27	7.92
<i>Trichoderma harzianum</i>	8.60	8.43	7.64	8.22
Control	8.47	7.30	6.67	7.49
Mean	8.40	7.85	7.28	
Comparison of significant effects			SED	CD (P=0.05)
Treatments			0.20	0.41**
Periods			2.12	0.25**
Treatments x Periods			0.35	N. S.
** Significant at 1% level			N. S. - Not Significant	

Table 4. Effect of seed treatment with fungicides, bactericide, hot water and antagonists of vigour index based on germination percentage and dry matter production

Treatments	Period after treatment in months			Mean
	0	3	6	
Carbendazim	790.32	744.74	575.25	703.44
Thiram	739.21	680.00	518.00	645.37
Streptocycline	680.00	497.90	428.21	535.37
Streptocycline + Thiram	677.88	520.78	462.32	553.66
Hot water	770.61	703.09	575.57	683.09
<i>Trichoderma viride</i>	722.75	656.00	523.44	634.06
<i>Trichoderma harzianum</i>	722.40	660.32	565.36	643.36
Control	694.64	503.70	415.74	537.99
Mean	724.72	620.82	507.99	
Comparison of significant effects				
				SED
Treatments				18.32
Periods				11.22
Treatments x Periods				31.72
				CD (P=0.05)
Treatments				36.83**
Periods				22.35**
Treatments x Periods				63.70*9
**Significant at 1% level.				

The value for the vigour index from seeds treated with carbendazim and hot water were significantly higher which were 703.44 and 683.09 respectively as against 537.99 in control. The vigour index values due to seed

treatment with streptocycline and streptocycline + thiram did not differ significantly over control. Significant reduction in producing vigour index values was observed with prolonged storage period (Table 4).

In the present study, carbendazim, thiram and hot water treatment favoured better growth of root. Ramadoss (1985) found that seed treatment with carbendazim had increased the root length of cowpea. Significant reduction of root length was observed with increase in storage period in the present study. Abdalla and Roberts (1969) reported that deterioration associated with loss of viability during storage resulted in decreased early growth of roots in bean and peas. Loss in seed vigour during storage was also reported by Agarwal (1974) in maize.

Carbendazim, thiram, hot water and *Trichoderma viride* exerted a profound influence on shoot length. Increased shoot length and vigour of rice seedlings were observed in seeds treated with TMTD (Kannaiyan *et al.*, 1975). However, Mathur and Mathur (1985) observed decreased shoot length of pearl millet when the seeds were stored over a period of 8 months after treating with carbendazim.

Higher dry matter production of seedlings due to seed treatment with carbendazim, thiram, hot water, *T. viride* and *T. harzianum* could be attributed to the greater vigour reflected in higher percentage of germination of the seeds that had reached the autotrophic stage well in advance of others. Venkata Rao *et al.* (1970) reported that the weight of seedlings was higher due to fungicide treatment than the untreated seeds. Setia and Singh (1973) reported that in soybean dry matter of seedlings, shoot length and root length decreased with the increase in storage period.

Carbendazim was superior in enhancing the vigour indices followed by

hot water. In streptocycline and streptocycline + thiram treatments, vigour index values did not differ significantly from those of untreated seeds. The finding that carbendazim treatment increased the vigour index value, corroborates with the observations of Ramadoss (1985)

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