

yield (13.31 q/ha) which was 10.7% higher than control. Similarly application of Kinetin resulted in significant increase (7.7%) in grain yield over control. Grain yield did not undergo any significant change due to application of GA. Among various growth regulators it was noted that triaccontanol gave significantly higher stover yield (19.22 q/ha) representing 13.5% increase over control. Other growth regulators, however, did not cause any significant variation in stover yield. Different growth regulators did not bring out any significant variation in harvest index of the crop. Results further reveal that grain yield of soybean increased significantly in response to increasing levels of phosphorus. Highest grain yield (15.73 q/ha) was obtained with 60 kg P<sub>2</sub>O<sub>5</sub>/ha level and was significantly higher than that produced by 40 kg P<sub>2</sub>O<sub>5</sub> (13.66 q/ha) and 20 kg P<sub>2</sub>O<sub>5</sub>/ha (11.0 q/ha).

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Application of 20, 40 and 60 kg P<sub>2</sub>O<sub>5</sub>/ha increased the grain yield by 11.1, 37.9 and 58.8% respectively, as compared to control. An examination of data presented in Table 3 show that application of 20, 40 and 60 kg P<sub>2</sub>O<sub>5</sub>/ha increased the stover yield by 1.68, 4.84 and 6.51 q/ha over control, representing 11.6, 33.6 and 45.2% increase, respectively.

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## SEED TREATMENT OF CABBAGE SEEDS BY CHEMICAL AND NON CHEMICAL METHODS ON THE VIABILITY

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#### ABSTRACT

Influence of seed treatment with fungicides, bactericide, hot water and antagonists on the viability of cabbage seeds was assessed. 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 resulted in higher germination.

Seed treatment with fungicides to control the seed borne fungi and maintain the seedling vigour is essential. In Denmark, a profit of 8 to 9 million dollars was obtained in a single year by cereal seed treatment with fungicides (Stapel 1966). Sivaprakasam *et al.* (1975) reported higher germination in sorghum seeds treated with thiram, benomyl, carbaxin and captan at 2 g per kg throughout the period of 8 months of storage. The present study reports the efficacy of fungicides, bactericide, hot water and antagonists on the viability of cabbage seeds during storage.

#### 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 10<sup>9</sup> 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).

Table 1. Effect of seed treatment with fungicides, bactericide, hot water and antagonists on the viability of seeds (in per cent).

Treatment	Period after treatment in months			Mean
	0	3	6	
Carbendazim	97.25 (81.32)	88.66 (70.42)	75.00 (60.00)	86.77 (70.58)
Thiram	86.66 (68.60)	85.00 (67.24)	70.00 (56.77)	80.55 (64.20)
Streptocycline	85.00 (67.24)	70.00 (56.77)	62.33 (52.13)	72.44 (58.71)
Streptocycline + thiram	84.00 (66.50)	72.33 (58.28)	66.33 (54.52)	74.22 (59.77)
Hot water	90.66 (72.62)	84.00 (66.50)	74.33 (59.57)	82.99 (66.23)
Trichoderma viride	85.33 (67.49)	82.00 (64.89)	72.00 (58.24)	79.78 (63.54)
Trichoderma harzianum	84.00 (66.50)	78.33 (62.28)	74.00 (59.56)	78.78 (62.78)
Control	82.00 (64.89)	69.00 (56.16)	62.33 (52.13)	71.11 (57.73)
Mean	86.86 (69.39)	78.67 (62.82)	67.54 (56.62)	

(Figures in parentheses represent transformed values)

Comparison of significant effects

	SED	CD (P=0.05)
Treatments	1.42	2.86**
Periods	0.87	1.75**
Treatments x periods	2.46	4.95**

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 and six months. The germination test was conducted by roll towel method proposed by International Seed Testing Association (1985).

## RESULTS AND DISCUSSION

Seed treated with carbendazim recorded higher germination percentage of 86.77 followed by hot water and thiram which recorded germination percentages of 82.99 and 80.55 respectively as against 71.11 in control.

Seeds treated with streptocycline and streptocycline + thiram recorded lower germination percentages of 72.44 and 74.22 respectively which were on par with control. Seeds treated with *T. viride* and *T. harzianum* recorded lower germination percentages than that of carbendazim upto the three months of storage. However, all the seeds were stored for a period of six months in respect of this parameter. Untreated seeds constantly recorded poor germination throughout the storage period. The seed germination decreased with increased storage period (Table 1).

The results of germination tests revealed that seeds treated with carbendazim recorded higher

germination than untreated ones. Seeds treated with hot water and thiram also recorded higher germination. Grewal and Kapoor (1966) reported that treatment with different fungicides prolonged the viability of barely and wheat seeds. The beneficial effects of seed treatment with fungicides on germination were reported by Singh et al. (1974) in soybean, Sivaprakasam et al. (1975) in sorghum and sunflower. Minton (1972) reported that seed treatment with quitozene and disulfoton individually and in combination reduced germination of cotton seeds.

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