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Priming and storage for enhancement of seed quality in Chilli (*Capsicum annuum* L.)

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Abstract

The present research was undertaken to study the effect of priming and storage of seeds of chilli Freshly harvested seeds of chilli var. Anugraha were stored under ambient condition for 12 months. Seed samples were drawn after 3, 6 and 9 months of storage and subjected to priming treatments *viz.* Control (P_1), Water soaking (P_2), NaCl (10- 5M) (P_3), CaCl2 (10-5M), (P_4) KNO3 (150ppm) (P_5), PEG 6000 (-1.5MPa) (P_6) and *Pseudomonas fluorescens* (10g/kg seed) (P_7). The primed seeds were stored in two types of storage containers i.e. cloth bag (S_1) and polythene bag (700 gauge) (S_2). The seeds primed with PEG 6000 (-1.5MPa) and stored in polythene bag (700 gauge) (S_2) retained high germination percentage, speed of germination, vigour indices and lower electrical conductivity values. On the other hand, the seed quality parameters of control seeds stored in cloth bag was declined.

Key words: chilli seed, priming, storage containers.

Introduction

Chilli (*Capsicum annuum*) is one of the important vegetable crops of the world and is widely cultivated throughout the tropical and subtropical countries. There has been a great competition in the world market for chilli and hence it is necessary to increase production and productivity. The availability of quality seed is essential to achieve optimum crop stand in the field. The most important aspect in the seed production programme is maintenance of regular supply of high quality seeds to farmers. Under ambient conditions of storage, chilli loses its viability within a year.

Strategies for improving the growth and development of crop species have been investigated for many years. In more field crops seed priming techniques have been used to improved germination characteristicsis. During priming, seeds are partially hydrated so that pre-germination metabolic activities proceed, while radicle protrusion is prevented, then are dried back to the primary moisture level (McDonald, 1999). Various priming treatments have been employed to increase the rate and uniformity of seed germination (Bradford, 1986). Common priming techniques include osmo priming (soaking seeds in osmotic solutions such as polyethylene glycol), halo priming (soaking seeds in salt solutions), hydro priming (soaking seeds in water), hormone priming (soaking seeds in hormone solutions) and other various chemical solutions. Priming contributes to significant improvement in seed germination and seedling growth in different plant species.

The most important aspect to narrow down the the gap between potential and farm level yield is the use of quality seed as it ensures better germination and there by better yield. Although seed quality is governed by genetic make-up, but commonly the quality of seeds is deteriorated during storage. The performance of the primed seeds is mainly affected by the storage conditions. Consequently, this research studied the possibilities to identify priming and storage procedures of primed chilli seeds with the primary objective of maintaining the beneficial effect of this treatment.

Materials and methods

A freshly harvested seed lot of chilli (*Capsicum annuum* L.) cultivar Anugraha with moisture content of 8 % (on dry weight basis) was obtained from Deprtment of Olericulture, KAU,Vellanikkara.

Priming treatment: seeds were surface sterilized by dipping in sodium hypochlorite (5%) solution for five minutes and dried on filter paper. The surface sterilized seeds subjected to various priming treatments *viz.* Water soaking (P_2), NaCl (10^{-5}M) (P_3), $CaCl_2$ (10^{-5}M), (P_4) KNO3 (150ppm) (P_5), PEG 6000 (-1.5MPa) (P_6) and *Pseudomonas fluorescens* (10g/kg seed) (P_7). After respective priming treatment for 3 hours seeds were washed with distilled water and dried at room temperature on filter paper in shade. Primed seeds were then packed in cloth bag and polythene bag (700 guage) and stored under ambient condition.

$$\text{Rate of germination} = \frac{X1}{Y1} + \frac{(X2-X1)}{Y2} + \frac{Xn -}{} + \frac{(Xn - 1)}{Yn}$$

Where,

Xn – Number of seeds germinated at nth count

Yn – Number of days from sowing to nth count

Electrical conductivity (dsm^{-1})

Five grams of seeds were taken at random from each treatment and were soaked in $Hgcl_2$ (0.10%) solution for a minute and washed with distilled water for five times. Then the seeds were soaked in 25.00 ml of distilled water for 24 hr at room temperature. The seed leachate was collected by decanting and the volume was made up to 25.00 ml by adding distilled water and the electrical conductivity of seed leachate was measured in an electrical conductivity bridge (ELICO) with cell constant of 1.00. The estimations were done in four replications and mean value was expressed in dsm-1 (Presley, 1958).

Vigour indices

The vigour index (V I) was calculated by adopting the method suggested by Abdul-Baki and Anderson (1973) and was expressed as pure number.

vigour index (V I) I = (germination (%) x seedling dry weight)

vigour index (V I) II = germination (%) x (seedling length in cm).

Results and discussion

The seeds subjected to priming, after 3 months of storage, with PEG 6000 (1.5 MPa) and stored in polythene bag (700 gauge) recorded the maximum germination (56.3 %), speed of germination (8.2), vigour indices and minimum electrical conductivity of the seed leachate (0.704 dsm-1). It may be due to the fact that during osmopriming the transition of seeds from dry stage to germination represses the antioxidant pathways that involve CAT (catalase) and SOD (superoxide dismutase) enzymes and stimulates another pathway involving ascorbate peroxidase (APX) required for germination and seedling establishment. In control where no priming was done germination (30.54%), speed of germination (4.07), and vigour indices were low which may be due to excessive leakage of chemicals from the seeds. This is evident from the high value for electrical conductivity in control.

Table 1 : Effect of priming on quality of Chilli seeds primied at 3, 6 , 9 months after storage

Treatments	Germination (%)			Speed of germination			Elecrtrical conductivity			Vigour index 1			Vigour index 2		
	3 M	6 M	9 M	3 M	6 M	9 M	3 M	6 M	9 M	3 M	6 M	9 M	3 M	6 M	9 M
P_1S_1	30.54	9.33	0.33	4.07	1.36	2.00	0.78	0.92	0.95	426.0	10807	21.00	315.8	92.71	19.20
P_1S_2	38.25	15.33	1.19	5.12	2.29	6.67	0.73	0.86	0.93	598.7	189.80	73.33	426.2	160.97	66.00
P_2S_1	45.92	38.33	3.66	6.27	5.21	26.33	0.72	0.54	0.83	746.7	558.13	357.00	537.5	489.87	301.23
P_2S_2	50.00	45.00	4.31	6.78	6.04	31.33	0.69	0.53	0.82	824.3	679.33	424.00	604.7	592.38	373.08
P_3S_1	47.92	46.20	4.16	6.73	6.05	30.00	0.65	0.52	0.82	738.2	694.00	410.50	595.1	582.72	348.10
P_3S_2	52.13	5.93	4.62	7.30	6.89	32.83	0.62	0.51	0.80	821.9	814.27	454.67	673.8	672.67	397.43
P_4S_1	45.46	42.73	4.33	6.25	5.60	31.33	0.69	0.49	0.80	682.3	662.73	424.17	567.7	499.89	417.38
P_4S_2	49.92	46.87	4.90	6.96	6.37	34.67	0.66	0.47	0.79	783.0	738.40	4855.33	644.3	593.58	471.65
P_5S_1	48.92	40.73	4.50	6.72	5.76	31.67	0.73	0.47	0.81	733.2	640.00	450.33	607.8	531.47	417.75
P_5S_2	52.50	45.27	5.09	7.14	6.48	35.83	0.69	0.46	0.80	834.9	737.07	531.67	672.8	601.27	484.98
P_6S_1	54.46	50.47	5.32	7.82	7.18	34.33	0.64	0.46	0.79	862.3	806.93	512.67	718.2	662.71	495.80
P_6S_2	58.17	55.33	5.79	8.23	7.52	41.00	0.59	0.44	0.79	962.3	933.80	636.67	824.5	749.88	572.08
P_7S_1	38.25	23.40	1.53	5.24	3.38	10.50	0.73	0.55	0.91	671.2	393.40	117.67	553.2	324.80	115.20
P_7S_2	43.13	29.93	1.53	5.68	3.89	11.50	0.71	0.54	0.90	776.3	521.80	126.50	644.8	425.79	129.27

The results are in conformity with the findings of Delouche (1973) who has reported that the increase in electrical conductivity in unprimed seeds was due to rapid loss of electrolytes from the seed due to membrane damage during imbibitions.

After 6 months of storage, when the seeds were treated with PEG 6000 (-1.5 M Pa) and stored in polythene bag (700 gauge) the maximum germination (55.3 %), speed of germination (7.5), vigour indices and minimum electrical conductivity of the seed leachates (0.443 dsm-1) were recorded. The electrical conductivity was found to be high in seeds stored in cloth bag (S1) when compared to that stored in polythene bag (S2). This may be due to alterations in membrane integrity that led to enhanced exudation of leachates. Similar results were reported in soybean seeds by (Schoettle and Leopold, 1984). Doijode (1986) and Karivaratharaju and Palanisamy (1987) also observed increase in leaching of electrolytes in Okra and tomato seed respectively with increased period of storage.

There was significant difference between treatments for percent germination (%), speed of germination and vigour indices when priming was done 9 months after storage. Seeds treated with PEG 6000 (-1.5 MPa) and stored in polythene bag recorded highest percent germination (37.6 %), speed of germination (5.5) The low germination percent of unprimed seeds is due to high moisture content of seeds and high electrical conductivity of the seed leachate which gives an indication of poor quality of the seeds. High germination in seeds primed with PEG 6000 (-1.5 MPa) can be expected because of the low moisture content and low electrical conductivity of the seeds. Even though the germination (%) for the best treatment was less than 60 % (minimum standard for certified seed) this will be useful in getting the precious seeds of the germplasm germinated even after 12 months of storage under ambient conditions.

The seed quality parameters of stored seeds (3, 6 and 9 months) recorded higher values of percent germination and seedling vigour indices immediately after priming with PEG 6000 (-1.5 MPa). The unprimed (control) seeds maintained minimum seed certification standards for certified seeds only up to sixth month. The seeds primed with PEG 6000 (-1.5 M Pa) and stored in polythene bag (700 gauge) after 3 months and 6 months of storage (ambient conditions) maintained seed certification standards up to eighth month and ninth month of storage respectively.

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