

Original Research Article

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Effect of Pre-Storage Seed Invigoration Treatment in Onion (*Allium cepa* L., cv. Agrifound Dark Red) for Improved Germinability and Field Performance

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ABSTRACT

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The loss of vigour and viability of high-vigour onion seeds (cv. Agrifound Dark Red) could be effectively controlled by pre-storage seed invigoration treatment with crude plant preparations viz., *Capsicum frutescens* L. (red chilli powder) @ 2g/kg of seed, *Azadirachata indica* L. (neem leaf powder) @ 2g/kg of seed, *Aegle marmelos* L. (bael leaf powder) @ 2g/kg and *Citrus limon* L. (lemon leaf powder) @ 2g/kg of seed and chemical treatment viz. mancozeb @ 2g/kg of seed. Field performances of the pre-storage treated seeds were significantly greater than that of untreated (control) seed. Among the treatments, crude plant preparations viz. lemon leaf powder and bael leaf powder showed better results in improving germinability and field performance (relation to plant height, mean bulb length, mean bulb diameter, mean bulb weight per plant etc.) over untreated control and all treated seed. Thus, based on the above results, pre-storage seed invigoration treatments with lemon leaf powder and bael leaf powder may be suggested for the maintenance of germinability during storage and field performance of onion.

Introduction

Seed vigour consists of those properties, which conclude the potential for rapid uniform emergence and development of normal seedlings under a wide range of field conditions (ASPB, 2003). The main factors affecting of seed storage capability are the content of high temperature, ambient relative humidity, and seed moisture (Abdul-Baki, 1980). The loss of viability in onion seed is very fast, normally within a year (Singh and Bhonde, 2003). In this matter poses a serious problem to maintain vigour and viability of onion seed for longer periods under ambient condition. To prevent seed deterioration and better field performance Pre-storage dry seed

invigoration treatments of stored onion seeds found effective (Sengupta *et al.*, 2005). By reason of the few work had been on onion seed, the present study was conducted at Crop Research and Seed Multiplication Farm, The University of Burdwan to evaluate the effect of various Seed invigoration treatments on germinability and field performance of onion (cv. Agri found Dark Red).

Materials and Methods

Harvest fresh Seeds of onion: cv. 'Agrifound Dar Red' (500g) were collected during March, 2016 from the local market of

Burdwan District. After collection, seeds were cleaned and dried in the sun for 5–6 days to a moisture content of 8 % for safe storage. Seeds were then stored in the 500ml capacity rubber stoppered glass bottles under ambient conditions in the laboratory till seed invigoration treatment.

After cleaning and drying seeds were divided into six lots for Pre-storage seed invigoration treatments. After treatments seeds were stored in 100 ml. capacity rubber stoppered glass bottle, each containing 50 g seeds. Onion seeds were dry-dressed with crude plant material, viz. neem leaf powder (*Azadirachta indica* L.) at 2g/kg of seed, red chilli powder (*Capsicum frutescens* L) at 2 g/kg of seed, bael leaf powder (*Aegle marmelos* L.) at 2 g/kg. of seed, lemon leaf powder (*Citrus limon* L.) at 2 g/kg of seed and chemical viz. mancozeb at 2 g/kg of seed in rubber stoppered glass bottles at room temperature ($29.83 \pm 1^\circ \text{C}$). After treatment, bottles were shaken twice in a day upto 7 days for thorough mixing of crude plant materials and chemical with the seeds and the bottles were kept in the laboratory under ambient conditions.

After treatment, seeds were subjected to natural ageing under ambient conditions for 180 days to evaluate the treatment effects on germinability. Natural ageing was done by placing the seeds of the different treatments in perforated paper packets kept in cloth bags. The cloth bags containing paper packets were shuffled at regular intervals (7 days) for uniform ageing. Germination tests were carried out following the inclined glass plates blotter method of Punjabi and Basu (1982). Germination tests of the treated and untreated seeds (minimum 400 seeds for each treatment as specified by ISTA (1996) were done immediately after treatment and after natural ageing for 180 days. Data on germination percentage, root and shoot length were

recorded after germination for 7 days at $29.83 \pm 1^\circ \text{C}$ temperature.

A field experiment was carried out at Crop Research and Seed Multiplication Farm, The University of Burdwan, West Bengal during the period 2016–17 (September to January); using completely randomized block design with three replications for each treatment. After land preparation, the plot was divided into 18 subplots (6 treatments \times 3 replications); each measuring 10 sq m (5m \times 2m). About 10 tonnes of well-rotted FYM was added at the time of land preparation. Nitrogen, phosphorus and potash was applied at 100 kg, 60 kg and 80 kg ha⁻¹ through urea, 10:26:26, single super phosphate and murate of potash, respectively. Half dose of nitrogen and full dose of phosphorus and potash were applied as basal dose before transplanting and rest half dose of nitrogen was applied in two equal splits at 30 and 60 days after transplanting. At first nursery bed was prepared following the recommended practices and then treated and untreated seeds were sown at the rate of 10 kg/ha. The cultural practices such as 45 days old seedlings were transplanted by giving a space 15 cm between the rows and 15 cm between the plants, first irrigation was given just after transplanting and further irrigations were given at 10–15 days interval during the cropping period. The other cultural practices such as intercultural operations were maintained for good bulb development, hand weeding was done as and when required and pest management practices were followed as usual.

Data on plant height, no. of leaf, length of bulb, diameter of bulb, fresh bulb weight etc. were taken replication-wise after 125–130 days of transplanting for each treatment from ten plants those were randomly selected in each plot and tagged. Data collected on various parameters were statistically analyzed

(Fisher, 1948) to evaluate the treatment effect on germinability and field performance of onion seed. Vigour index data were calculated as germination percentage multiplied by seedling length.

Results and Discussion

Germination test conducted immediately after pre-storage treatment, treated seeds did not show any significant beneficial effect on germination percentage root length, shoot length over untreated control (Table 1). But, after natural ageing at room temperature for 180 days, germination percentage, root length and shoot length of treated seeds showed significant improvement over untreated control (Table 1). Among the treatment, lemon leaf powder followed by bael leaf powder showed significant improvement on germ inability. The field performance, especially, plant height (cm), number of leaf per plant, mean bulb length (cm) per plant, mean bulb diameter (cm) per plant, mean bulb

weight (g) per plant were significantly improved in treated seeds than the untreated control. Among treated and untreated seed, lemon leaf powder followed by bael leaf powder showed better results in improving field performance (relation to number of leaf per plant, mean bulb length (cm) per plant, mean bulb diameter (cm) per plant, mean bulb weight (g) per plant) (Table 2). But no. of leaf was maximum in lemon leaf powder than untreated (control) and all treated seed.

Extend the duration of seed storage would increase the metabolic activity of the seeds, as result decrease the reserve substance content and reduce the dry material weight of the seeds (Bewley and Black, 1994). The role of natural plant preparations could be due to reduced lipid peroxidation because volatile aldehyde production was lower in seeds treated with such preparations than in the control (Pal and Basu, 1994; Mandal *et al.*, 2000).

Table.1 Effect of pre-storage seed invigoration treatments on the germ inability of onion seed (cv. Agri found Dark Red) immediately after treatment and natural ageing under ambient conditions for 180 days [average (average 78.5 ± 1.88 RH and $29.83 \pm 1^\circ\text{C}$)]

Before ageing		Natural ageing						
	Germination (%)	Mean root length (mm)	Mean shoot length (mm)	Vigour Index	Germination (%)	Mean root length (mm)	Mean shoot length. (mm)	Vigour Index
Control	80.16	51.33	87.16	11101.35	62	16.16	59.33	4680.38
Neem leaf powder	80	49..83	96.05	11670.4	65.5	20.66	57.16	5097.21
Lemon leaf powder	80.66	49.83	95	11681.98	74	26.5	80.33	7905.42
Red chilli powder	81.16	51.16	96.76	12005.18	75	18	51.5	5212.5
Bael leaf powder	82.5	53.5	97.11	12425.32	71.5	29.5	68.16	6982.69
Mancozeb	80	48.5	97.08	11646.4	68.5	20.66	63.83	5787.56
CD (P= 0.05)	NS	NS	NS	--	2.61	1.96	3.82	--

*Treatments were given to one month old seed

*Data on germination percentage, root and shoot lengths were recorded after germination for 7 days at $30 \pm 1^\circ\text{C}$.

*Vigour index was calculated by multiplying the germination percentage with seedling length.

N.S. – Non significant

Table.2 Effect of pre-storage seed invigoration treatments on field performance and productivity of Onion (cv. Agri found Dark Red)

Treatments	Plant height (cm)	No. of leaf/plant	Mean Bulb length (cm)/plant	Mean Bulb diameter (cm)/plant	Mean Bulb weight (g) /plant
Control	43.33	8	5.83	16	48.33
Neem leaf powder	51	13	6.16	16.13	65
Lemon leaf powder	68.33	18	7.16	17.93	101
Red chilli powder	52	13.66	6.43	17	71
Bael leaf powder	56	10.33	6.6	17.33	72.33
Mancozeb	48.33	14.66	6.03	16.66	71.66
CD (P = 0.05)	11.5	4.40	0.58	2.20	4.96

Some physiological and biochemical changes directing to seed deterioration have been related to increased activity of enzymes (catalase, peroxidase, etc.), lipid auto oxidation (Basu and Rudrapal, 1980) and a subsequent events beginning with a chain of biochemical events, predominantly membrane damage and weakened of biosynthetic reactions, and then arising losses of various seed performance attributes, beginning with reduced germination rate, reduced field emergence, increased numbers of abnormal seedlings and finally seed death. The loss of viability results in irreversible chemical and structural changes to cellular constituents (Walters *et al.*, 2010).

Therefore, pre-storage seed invigoration treatments in high vigour onion seeds with crude plant materials, viz. lemon leaf powder (*Azadirachta indica* L. @ 2g/kg), bael leaf powder (*Aegle marmelos* L. @) 2g/kg) of seed respectively are recommended for the improvement of germinability and field performance.

In conclusion, seed invigoration treatment has become popular among horticultural practitioners to improve germinability as well as field performance of onion seed treated with pre storage seed invigoration treatments in high vigour onion seeds with lemon leaf

powder (*Citrus limon* L) @2g/kg) and bael leaf powder (*Aegle marmelos* L) @ 2g/kg of seed respectively.

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