

Seed Quality Enhancement through Priming in Onion

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(Received : December 2017; Revised : April 2018; Accepted : April 2018)

Onion (*Allium cepa* L.) is the second most important vegetable crop after tomato in the world which is known as the "Queen of the Kitchen" because of its characteristic flavour. India is the second largest producer of onion after china as it produces 18.9 million tones of onion from about 1.18 million hectares. Major onion producing states of India are Maharashtra, Madhya Pradesh, Karnataka, Gujarat, Bihar, Andhra Pradesh, Rajasthan, Haryana and Tamil Nadu [1]. Onion seeds have shortest life span among the vegetable crops and loose the viability rapidly after harvest. Hence, it possesses a serious problem for the carry-over seed stocks, unless special precautions are taken in its storage. The main reason of low quality of onion seeds include long flowering period resulting in different stages of seed maturity in the umbel, very fast reduction in seed viability if stored in sub-optimal conditions and seed infestation with fungi [2]. Seed invigoration implies an improvement in seed vigour by any post harvest treatment resulting in improved germinability, greater storability and better field performance than the corresponding untreated (control) seed. Priming can slow down some of the ageing-induced deteriorative events and thus, improve seed performance [3]. Pre-sowing seed treatments with water, plant growth regulators, agro-chemicals, fungicides etc also have been reported not only maintain the quality of seeds during storage but also enhance it in several crop species [4]. Fungicide treatments are discouraged due to toxic residues and development of resistance in pathogens. Thus, there is an urgent need for safer method of pathogen control. Moreover, due to heavy chemical use in intensive cropping systems, concerns to environmental health have been raised world over. Hence, bio friendly compounds like chitosan, *Aloe vera*, *Trichoderma* and other growth regulators have gained attention in recent times. These have shown positive results in increasing

growth and development of many crops along with imparting pest and disease resistance in them. Onion seeds show poor germination with slow growth of seedling and it has short storage life. Hence, considering the above facts, the present study was undertaken to enhance the seed quality by priming treatments.

The study was conducted on freshly harvested seed of onion variety Hisar 2. Laboratory study was conducted in Department of Seed Science & Technology and field study was carried out in experimental area of Department of Vegetable Sciences, C.C.S. H.A.U. Hisar during 2016-17. The seeds were invigorated for 8 hours at room temperature with following priming treatments: T₁ - Control, T₂ - Hydration and dehydration, T₃ - Hydration with 25 ppm chitosan, T₄ - Hydration with 50 ppm chitosan, T₅ - Hydration with 75 ppm chitosan, T₆ - Hydration with 100 ppm chitosan, T₇ - T₁₊ trichoderma @ 5 gm/kg, T₈ - T₁₊ trichoderma @ 10gm/kg, T₉ - Hydration with 100 ppm GA₃, T₁₀ - Hydration with 200 ppm GA₃, T₁₁ - Hydration with 300 ppm GA₃, T₁₂ - Hydration with 1% *Aloe vera*, T₁₃ - Hydration with 2% *Aloe vera*, T₁₄ - Hydration with 3% *Aloe vera*, and T₁₅ - Seed coating with *Aloe vera* gel.

The primed seed was dried back at room temperature to bring their original moisture content before assessing the various quality parameters. After drying to a safer moisture level i.e. 6%, the seeds were stored in the plastic bags (700gauge) under ambient conditions and the observations were recorded on various seed quality parameters. The observations on germination percentage as per ISTA [5], seedling vigour indices by Baki and Anderson [6], electrical conductivity as per AOSA [7], field emergence index by the method as described by Maguire [8], mean emergence/germination time (MET/MGT, days) methods as per Ellis and Roberts [9], total seedling emergence (%) was determined by

method suggested by Kharb [10]. Average height of 10 randomly selected seedlings of one month from each treatment was calculated and expressed in centimeters. The factorial experiment in completely randomized design (CRD) as well as in randomized complete block design (RBD) was conducted in three replicates for laboratory and field parameters, respectively and data was subjected to the statistical analysis as described by Panse and Sukhatme [11].

Among all the treatments, maximum germination was observed in the seeds hydrated with 100ppm GA₃ & seeds coated with *Aloe vera* gel (89.00) followed by seeds hydrated with 100ppm chitosan (87.33), while minimum was observed in control (80.33). Similar trend was observed for other seed quality parameters also and maximum seedling length (20.33 and 19.90 cm), seedling dry weight (30.67 and 29.87 mg), vigour index-I (1809.37 and 1771.10), vigour index-II (2729.63 and 2658.43) was observed in the seeds hydrated with 100ppm GA₃ & seeds coated with *Aloe vera* gel, respectively. It is reported that gibberellins promote germination and play an important role in mobilization of endosperm reserves during germination of seeds [12]. During seed germination, in carbohydrate rich crops, gibberellins are released from the embryo into the aleurone layer where

they induce protein synthesis and the expression of a number of genes encoding hydrolytic enzymes, including α -amylase [13]. Gibberellins (GA) trigger the hydrolysis of reserve food material in seeds and directly affect the growth potential of the embryo thereby enhancing the germination in GA₃ primed seeds [14]. The results were supported in bell pepper [15], Okra [16], onion [17]; *Cornus capitata* [18], sunflower [19]; *Vicia villosa ssp. dasycarpa* (Ten.) [20] and fescue seed [21]. In field condition, maximum field emergence was observed in the seeds coated with *A. vera* gel (6.14) followed by the seeds hydrated with 3% *A. vera* (6.04), while minimum was observed in control (4.25). Similarly, minimum mean emergence time was observed in the seeds coated with *A. vera* gel (9.84) followed by the seeds hydrated with 3% *A. vera* (10.03), while maximum was observed in control (13.17). Maximum seedling height was observed in the seeds coated with *A. vera* gel (13.06) followed by seeds hydrated with 100ppm GA₃ (12.53), while minimum was observed in control (10.33). Maximum seedling establishment was observed in seeds coated with *Aloe vera* gel (74.00) followed by seeds hydrated with 100ppm GA₃ (72.66), while minimum was observed in control (64.33). The results were supported in onion seeds [22]. Hence, germination in onion seeds can be enhanced by

Table 1. Effect of priming treatments on various seed quality parameters of onion seeds

Treatments	Standard Germination (%)	Seedling length (cm)	Seedling Dry Weight (mg)	Vigour Index-I	Vigour Index-II	Electrical Conductivity (μ S/cm/seed)	Field Emergence Index	Mean Emergence Time	Seedling Height (cm) at one month	Seedling Establishment (%)
T ₁	80.33 (63.66)	16.26	23.00	1306.16	1847.59	0.320	4.25	13.17	10.33	64.33(53.30)
T ₂	86.33 (68.35)	17.96	25.33	1550.48	2186.73	0.310	4.87	11.34	11.40	67.66(55.33)
T ₃	84.66 (66.94)	17.46	24.67	1478.16	2088.56	0.310	4.62	11.62	10.66	66.33(54.52)
T ₄	87.00 (68.85)	18.26	26.33	1588.62	2290.71	0.310	4.26	11.51	11.36	67.00(54.92)
T ₅	87.00 (68.85)	18.23	26.00	1586.01	2262.00	0.310	4.88	11.45	11.40	68.00(55.54)
T ₆	87.33 (69.20)	18.93	26.83	1653.15	2343.06	0.320	4.28	11.17	10.60	66.33(54.51)
T ₇	85.66 (67.74)	18.16	26.00	1555.76	2227.42	0.320	5.11	11.10	12.36	69.66(56.56)
T ₈	87.00 (68.86)	19.10	27.67	1661.70	2407.29	0.310	5.24	10.87	12.43	71.36(57.82)
T ₉	89.00 (70.68)	20.33	30.67	1809.37	2729.63	0.320	5.99	10.61	12.53	72.66(58.47)
T ₁₀	85.00 (67.19)	18.13	26.01	1541.05	2210.85	0.310	4.39	11.50	11.70	68.33(55.73)
T ₁₁	86.00 (68.03)	18.90	26.70	1625.40	2296.20	0.320	4.69	11.55	12.13	68.66(55.94)
T ₁₂	84.33 (66.66)	17.26	24.00	1455.53	2023.92	0.320	5.10	11.34	11.83	68.00(55.53)
T ₁₃	87.00 (69.15)	18.36	26.43	1600.44	2303.90	0.310	5.07	11.27	11.40	66.00(54.32)
T ₁₄	86.33 (68.29)	18.03	26.00	1556.53	2244.58	0.320	6.04	10.03	12.46	71.40(57.60)
T ₁₅	89.00 (70.61)	19.90	29.87	1771.10	2658.43	0.320	6.14	9.84	13.06	74.00(59.32)
CD (p=0.05)	1.72	0.94	2.63	72.40	236.36	N.S.	4.25	0.84	0.59	2.51

* Figures in parenthesis are angular transformed values

T₁= Control, T₂= Hydration and dehydration, T₃= Hydration with 25 ppm chitosan, T₄= Hydration with 50 ppm chitosan, T₅= Hydration with 75 ppm chitosan, T₆= Hydration with 100 ppm chitosan, T₇= T₁+ trichoderma @ 5 gm/kg, T₈= T₁+ trichoderma @ 10gm/kg, T₉= Hydration with 100 ppm GA₃, T₁₀= Hydration with 200 ppm GA₃, T₁₁= Hydration with 300 ppm GA₃, T₁₂= Hydration with 1% *Aloe vera*, T₁₃= Hydration with 2% *Aloe vera*, T₁₄= Hydration with 3% *Aloe vera*, T₁₅= Seed coating with *Aloe vera* gel.

hydrating the seeds with 100ppm GA₃ or coating the seeds with 3% *Aloe vera* gel.

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