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Short Communication

Effect of Containers and Duration on Seed Quality of Onion under Ambient Storage Conditions

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Onion (*Allium cepa* L.) is one of the most important bulbous vegetable cum condiment crop grown throughout the world. India is the 2nd largest producer of onion, in the world next to China. It is being grown both in *kharif* and *rabi* season occupying an area of 12.25 lakh hectares with an annual production of about 209.91 lakh MT with average productivity of 17.13 MT/ha. [1]. Yellow, red and white coloured onion bulbs are produced in India. It is generally known that onion seed is one of the shortest lived seeds of common vegetables crops, rapidly losing viability after harvest unless special precautions are taken in its storage. The red coloured cultivars have the highest storage potential, followed by the yellow skinned cultivars whereas, the white ones have the lowest storage potential [2, 3].

Major constraints in onion cultivation are the limited availability of vigorous seeds at the time of sowing due to poor storability under fluctuating ambient temperatures and higher relative humidity. The rate of loss of seed viability is mainly a function of temperature and seed moisture content [4]. It has long been known that the factors, which have the greatest influence on the longevity of seeds in storage are moisture, temperature, relative humidity and oxygen partial pressure [5]. Seed moisture content has more influential affect on seed storability than temperature. The main purpose of the seed storage is to preserve economic crops from one season to another. Many investigators reported that the speed of declined seed quality is largely dependent on temperature, seed moisture, length of storage, type of seed and storage containers [6, 7]. For maximizing production with high quality there is a huge demand of high quality vegetables seeds [8]. The present investigation has been carried out with an objective to study the effect of storage containers and durations on quality and longevity in onion seeds.

Seeds of Gujarat Anand White Onion -2 variety collected from Main Vegetable Research Station (MVRS), AAU, Anand was used for the present investigation. The experiment was designed as factorial completely randomised block design with four replications and was conducted at Department of Seed Science and Technology, BACA, AAU, Anand during 2015-16. The white onion seeds (GAWO-2) were packed in three packaging containers *viz.,* C_1: polythene bag (700 gauge), C_2: cloth bag and C_3: paper bag. The packed seeds were stored in ambient storage (Room temperature) for three different duration *viz.,* D_1: 3 months, D_2: 6 months and D_3: 9 months.

The germination per cent was determined by top of paper method and other seedling parameters were recorded as per ISTA rules [9], using four replicates of 100 onion seeds. Ten normal seedlings were selected randomly and shoot length (cm), root length (cm), seedling length (cm), seedling fresh weight (mg) and seedling dry weight was estimated following the standard method [10]. Vigour index I & II were estimated by using the procedure suggested by Abdul-Baki and Anderson [10]. Electrical conductivity of seed leachate were recorded by conductivity meter and measured following the standard procedure given by Agrawal and Dadlani [12].

Germination per cent and other seed quality parameters were significantly influenced by the various packing containers throughout the storage period (Table 1). Seed storability correlated to the seed deterioration. The reduction process affects the germination potential under ambient storage and probable reason for its higher rate are higher temperature during storage which enhance seed deterioration as does high seed moisture content

Table 1. Effect of storage containers and duration on different seed quality parameters of onion (*Allium cepa* L.)

Treatments	Parameters								
Containers	Germination (%)	Seedling root length (cm)	Seedling shoot length (cm)	Seedling length (cm)	Seedling fresh weight (mg)	Seedling dry weight (mg)	Seedling vigour index- I	Seedling vigour index- II	Electrical conductivity (μ S cm^{-1} g^{-1})
C_1:Plastic bag	76.66	2.23	5.09	7.32	191.80	20.37	578	1597	37.88
C_2: Cloth bag	57.22	1.70	3.95	5.66	137.91	16.93	378	1135	45.00
C_3: Paper bag	65.55	2.09	4.37	6.46	164.90	18.54	459	1292	41.77
S.Em.±	0.54	0.05	0.08	0.09	4.53	0.21	7.7	10.6	0.37
CD @ 5%	1.59	0.14	0.23	0.27	13.47	0.63	23.1	31.6	1.09
Storage Durations									
D_1: 3 months	85.00	2.80	5.95	8.76	235.34	22.94	746	1952	31.22
D_2: 6 months	72.56	2.04	4.57	6.61	166.29	20.80	482	1510	39.77
D_3: 9 months	41.89	1.19	2.88	4.07	92.97	12.10	187	562	53.66
S.Em. ±	0.54	0.05	0.08	0.09	4.535	0.21	7.7	10.6	0.37
CD @ 5%	1.59	0.14	0.23	0.27	13.47	0.63	23.1	31.6	1.09
Interaction									
C_1 x D_1	87.33	3.08	6.31	9.39	276.63	24.03	820	2099	30.00
C_1 x D_2	80.67	2.26	4.92	7.18	182.98	21.01	579	1695	35.00
C_1 x D_3	62.00	1.37	4.05	5.42	115.78	16.08	336	997	48.67
C_2 x D_1	83.33	2.42	5.66	8.08	200.73	22.00	674	1833	32.67
C_2 x D_2	68.33	1.62	4.24	5.86	152.77	20.63	400	1409	44.67
C_2 x D_3	20.00	1.08	1.97	3.04	60.23	8.16	61	163	57.67
C_3 x D_1	84.33	2.90	5.91	8.82	228.67	22.80	744	1923	31.00
C_3 x D_2	68.67	2.24	4.57	6.81	163.13	20.76	468	1426	39.67
C_3 x D_3	43.67	1.14	2.63	3.77	102.90	12.06	165	526	54.67
Mean (C x D)	66.48	2.01	4.47	6.48	164.87	18.61	472	1341	41.55
SEm (±)	0.93	0.08	0.13	0.16	7.85	0.37	13.4	18.4	0.64
CD (p = 0.05)	2.76	0.24	0.39	0.47	23.34	1.10	40.0	54.8	1.90
CV%	2.42	6.83	5.13	4.24	8.25	3.43	4.9	2.38	2.66

which resulted in reduced germination and vigour during prolong storage [13].

Effect of Storage Containers on Seed Quality Parameters

Storage containers had significant effect on seed quality during storage. Significantly highest germination per cent (77) along with highest seedling length (7.32 cm), vigour indices *viz.,* vigour index I (578), vigour index II (1597) as well as lowest electrical conductivity (37.88 $\mu Scm^{-1}g^{-1}$) were recorded in the plastic bag (C_1) due to its moisture and vapour impervious nature followed by the paper bag (C_3) container, which recorded (66%) germination irrespective of storage period. The seeds stored in the cloth bag (C_2) recorded lowest germination per cent (57), vigour index I (378) and vigour index II (1135) with highest electrical conductivity (45 $\mu Scm^{-1}g^{-1}$). The same trend was followed for other seed quality parameters in this container. The fast reduction in the cloth bag is attributed to its moisture pervious nature. Seed is highly hygroscopic living material and absorbs moisture from the surrounding atmosphere. This higher moisture in the seed may be the main reason of quick quality deterioration in the seeds of cloth bag. The results are in concurrence with the earlier finding of [14, 15] in onion seeds. Effects of storage containers and duration on seedling fresh weight and dry weight (mg) differed significantly. The highest seedling fresh weight (191.80 and 164.90 mg) and dry weight (20.37 and 18.54 mg) wererecorded in plastic bag followed by paper bag, respectively. Plastic bag (C_1) indicated higher seedling fresh weight which might be due to lower moisture content regulated by the plastic bag. Lower moisture content regulated lower respiration rate, metabolic

activity during the storage period. Similar findings have been reported by Doijode [16] in onion seeds, Saxena *et al.* [17] in onion, cabbage, radish, okra and pea and Padma and Reddy [18] in brinjal.

Effect of Storage Duration on Seed Quality Parameters

Similarly, storage duration also showed significant effect on seed germination potential and its quality. In case of storage durations, seeds stored for 3 months (D_1) recorded significantly highest germination per cent (85) and which was maintained above minimum standards up to 6 months storage. The highest seedling length (8.76 cm), vigour index I (746), vigour index II (1952) as well as lowest electrical conductivity (31.22 $\mu Scm^{-1}g^{-1}$) was recorded in same storage duration. The lowest germination per cent (42) with lowest seedling length (4.07 cm), vigour index I (187), vigour index II (562) as well as highest electrical conductivity (53.66 μ S cm^{-1} g^{-1}) were recorded when seeds were stored for 9 months (D_3). Onion seeds are hygroscopic and absorb moisture from surrounding environment and rapidly lose its viability. Increase in storage duration causes higher deterioration due to higher seed leachate and probable reason for its higher rate high seed moisture content which resulted in reduced germination and vigour during prolong storage.

Interaction Effect of Storage Container and Storage Duration on Seed Quality Parameters

Combined effect of storage containers and durations also found significant influence on germinability and quality of onion seeds. The seeds packed in plastic bag (700 gauge) and preserved in the ambient storage up to 3 months (C_1D_1) recorded highest germination per cent (87%) and maintained the germination potential above the Indian minimum seed certification standard (70%) even after 6 months of storage period. The same treatment combination showed highest seedling length (9.39 cm), vigour index I (820), vigour index II (2099), due to faster germination, subsequent cell division and elongation. The lowest electrical conductivity (30 $\mu Scm^{-1}g^{-1}$) was recorded in same treatment combination which was followed by paper bag storage. The storability of cloth bag stored seeds was drastically reduced as per enhanced storage duration. The cloth bag storage seed recorded lowest seed quality due to its moisture pervious nature, Higher moisture content might have increased respiratory activities of seeds and shortened the seeds life and the quality parameters were also decrease as storage period advance. This is in accordance with the findings of [4, 19] in onion seeds. The seeds packed in cloth bag and preserved in the ambient storage up to 9 months (C_2D_3) recorded lowest germination per cent (20%), seedling length (3.04 cm), vigour index I (61), vigour index II (163). This may be due to damage to proteins and nucleic acids, membrane enzyme and such degenerative changes resulted in the complete disorganization of membranes and cell organelles reported by [20, 21]. The highest electrical conductivity (57.67 $\mu Scm^{-1}g^{-1}$) was recorded in the onion seeds when stored in cloth bag up to 9 months (C_2D_3 -Higher seed leachate recorded by the onion seeds as per increased storage period under ambient condition and was agreement with findings of [22, 23]. The same treatment combination (C_2D_3) recorded lowest seedling fresh (60.23 mg) and dry weight (8.16 mg) due to higher leachate of seeds and enzymatic activity throughout the storage period. Highest electrical conductivity (54.67 μ S cm^{-1} g^{-1}) was observed in the onion seeds stored incloth bag for 9 months under ambient storage condition. These results were agreement with the earlier finding [19, 22-24].

The seed quality parameters, except electrical conductivity, showed decreasing trend throughout the three storage durations irrespective of storage containers. Among the storage containers the plastic bag exhibited higher seed quality parameters even at the end of 9 month storage duration and it maintained the germination per cent above the Indian Minimum Seed Certification Standard up to 6 month of storage duration under ambient storage condition.

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