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Evaluation of seed quality parameters after the post-harvest of accelerated aged seed of wheat varieties

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Abstract
The present investigation on "Evaluation of seed quality parameters of post-harvest aged seed and assess the storability of wheat varieties through accelerated ageing" was conducted at Seed Testing Laboratory department of Seed Science and Technology, VCSG UUHF, College of Forestry, Ranichauri, Tehri Garhwal, Uttarakhand during 2015-16. For this purpose four varieties of wheat *viz*. VL-802, VL-829, VL-892 and UP-1109 were subjected to accelerated ageing at 45^0 C and 100% relative humidity for 15, 30 and 45 days along with control. Aged seed from different treatments of each variety were subjected to laboratory experiment after crop harvesting for evaluating first count, standard germination, root length shoot length, fresh and dry root weight. Under the laboratory conditions, every treatment showed significantly difference for seed quality parameters after accelerated ageing. Variety VL-892 had more capable to maintain the seed quality attributes after 15, 30 and 45 days of accelerated ageing period as considered being good storer under ambient condition. Whereas, VL-829 and UP-1109 showed the medium storer and VL-802 poor storer variety on the basis of seed quality and yield parameters. Rapid decline in seed yield contributing characters ware observed in VL-802 whereas, less reduction observed in VL-892.

Keywords: quality parameters, accelerated, wheat varieties, evaluation

Introduction

Wheat (*Triticum aestivum* L.) is the most important crop in the world and this is major crop among other three cereal crops i.e. rice, maize and barley that provided 20 percent of the energy in human food (Ahmadi *et al*., 2004; Shewry, 2009) [1, 25]. Wheat is one of the major sources of carbohydrate which is staple diet for human beings and provides about 20% food calories to the world. It contains 70% carbohydrates, 12% proteins, 2.2% crude fiber, 2% fat, about 1.8% minerals (FAO, 2002) [10]. It also contain other nutrients such as starch, protein, fiber, vitamin B, vitamin E and minerals that help to build and repair muscular tissue, digestion and provide energy (Kumar *et al*., 2011) [18].

Seed vigour plays an important role to determine the capacity of seed lot to germinate under wide range of environmental condition. There are several parameters such as seedling length, seedling dry weight, electrical conductivity, cool test, cold test; accelerated ageing and dehydrogenase activity are used to determine seed vigour of crop.

Pre and post storage conditions are also responsible for the deterioration of seed. In many cases there is long gap between the time of seed production and the time of next planting. Therefore, it is essential to know about the storability of seed of different crops under given storage conditions and also to uncover the varietal differences, if any, for various seed quality determinants like germination and vigour up to next planting season. For this purpose, a test is designed to evaluate the storability of seed by artificial ageing is known as accelerated ageing. It is a physiological stress test that permits controlled deterioration of seeds due to expose to high temperature and high relative humidity (greater than 90%) (ISTA, 2006) [12]. It is considered as the prediction test for seed storability as this test bring changes in the seed at the cellular level as that at long terms storage comparatively within a short period of time by exposing seeds to increased temperature ($40\text{-}45^0$) and a higher (99-100% RH) relative humidity (Delouche and Baskin,1973) [8].

Therefore, keeping the above points in view the present investigation was undertaken with following objectives to evaluate the effect of accelerated ageing on seed quality parameters in

Pre and post-harvest aged seed and assess the storability of wheat varieties through accelerated ageing.

Material and Method

In accelerated ageing test, seed sample of four wheat varieties VL-802, VL-829, VL-892, and UP-1109 were taken in muslin cloth bags. This muslin cloth bags was placed on the desecraters which is already filled with water in such a way that seed places in muslin cloth bags were 2-3 cm above the water. The lid of desecraters is covered with tape and tied with rubber band. These desecraters were then placed in an incubator at 45^0C for 15, 30 and 45 days of ageing. These aged seeds were sown in field and after harvesting of crop. These seeds further utilized under laboratory experiment to predict the quality of the seeds.

Experiment was conducted in two factorial Complete Randomized Design (CRD). Test of significance were recorded on basis of CD differences at 5%.

Result and Discussion

First count (%)

Variety VL-892 showed the highest mean value of the first count (75.83%) followed by VL-829 (74.75%), VL-802 (67.50%) and UP-1109 (63%). The interaction due to variety and accelerated ageing period had significant differences for first count (%) (Table 1). Reduction in first count (%) from control to 45 days accelerated ageing was 72.33% to 58.00% in VL-802, 82.33 to 67.33 in VL-829, 82.00% to 69.33% in VL-892 and 70.66% to 56.66% in UP-1109. In 15 days accelerated aged seed, significant reduction in first count (%) was observed minimum in VL-802 (0.45%) and maximum in UP-1109 (9.42%) over control. At 45 days accelerated aged seed, maximum reduction in first count (%) was observed in VL-802 (19.81%) and UP-1109 (19.81%) followed by VL-829 (18.21%) and VL-892 (15.45%) and over AA1.

Standard germination (%)

Variety VL-892 showed the highest mean value of the standard germination (81.00%) followed by VL-829 (79.41%) VL-802 (77.75%) and UP-1109 (71.75%). the interaction due to variety and accelerated ageing had significant difference for the standard germination. (Table 2). Reduction in plant height control to 45 days accelerated ageing was 86.00% to 72.00% in VL-802, 85.66% to 73.00% inVL-829, 86.00% to 75.00% in VL-892 and 78.33 to 67.00 in UP-1109. In 15 days accelerated aged seed, significant reduction in minimum in VL-892 (3.48%) and maximum in UP-1109 (8.93%) over control. At 45 days accelerated aged seed, maximum reduction in standard germination (%) was observed in maximum in VL-802 (16.27%) followed by VL-829 (14.77%), UP-1109 (14.46%) and VL-892 (12.79%) over control and at this stage.

Shoot length (cm)

Variety VL-892 showed the largest mean value shoot length (9.70cm) followed by VL-829(8.40cm), VL-892 (7.44 cm) and UP-1109 (6.52 cm). The interaction due to variety and accelerated ageing period had significant for shoot length (cm) (Table 3). Reduction in shoot length from control to 45 days accelerated ageing 8.40cm to 6.56 cm in VL-802, 9.46cm to 6.90cm in VL-829, 11.46cm to 8.59cm in VL-892 and 8.10cm to 5.76cm in UP-1109. In 15 days accelerated aged seed, significant reduction in shoot length was observed minimum in VL-802 (5.23%) and maximum in UP-1109 (23.08%) over control. At 45 days accelerated aged seed, maximum reduction in shoot length was observed in UP-1109 (28.88%) followed by VL-829 (27.06%), VL-892 (25.04%) and VL-802 (21.09%) over control.

Root length (cm)

Variety VL-892 showed the largest mean value of root length (19.13cm) followed by VL-802 (16.55cm), VL-829 (16.49cm) and UP-1109 (15.96cm). The interaction due to variety and accelerated ageing period had significant for the root length (cm) (Table 4). Reduction in root length from control to 45 days accelerated ageing was 17.33cm to 15.80cm in VL-802, 19.40cm to 14.93cm in VL-829, 19.93cm to 18.06cm in VL-892 and 16.80 cm to 15.00cm in UP-1109. In 15 days accelerated aged seed, significant reduction in root length was observed in maximum in VL-829 (20.30%) and minimum in VL-892 (0.35%) over control. AT 45 days accelerated aged seed, maximum reduction in shoot length was observed in VL-829 (23.04%) followed by UP-1109 (10.71%), VL-892 (9.38%) and VL-802 (8.82%) over control.

Fresh weight (g)

Variety VL-892 showed the maximum mean value of fresh weight (0.97g) followed by VL-802 (0.96g), VL-829 (0.94g) and UP-1109 (0.80g). The interaction due to variety and accelerated ageing period showed the significant differences for the fresh weight (g) (Table 5). Reduction in fresh weight from control to 45 days accelerated ageing was 1.04g to 0.87g in VL-802, 1.01g to 0.87g in VL-829, 1.06g to 0.73g in VL-892, and 0.93g to 0.67g in UP-1109. In 15 days accelerated aged seed, significant reduction in fresh weight (g) was observed minimum in VL-892 (0%) and maximum in UP-1109 (11.82%) over control. At 45 days accelerated aged seed, maximum reduction in fresh weight (g) was observed in VL-892 (31.13%) followed by UP-1109 (27.95%), VL-802 (22.11%) and VL-829 (13.86%) over control.

Dry weight (g)

Variety VL-802 showed the maximum mean value of the dry weight (0.72g) followed by VL-829 (0.55g), VL-892 (0.52g) and UP-1109 (0.42g). The interaction due to variety and accelerated ageing period showed the non-significant differences for the dry weight (g) (Table 6). Reduction in dry weight in control to 45 days accelerated ageing was 0.90 to 0.56g in VL-802, 0.80 to. 30g in VL-829, 0.93 to 0.20g in VL-892 and 0.80 to 0.13 in UP1109. In 15 days accelerated aged seed, significant reduction in dry weight in dry weight was observed maximum in UP-1109 (50%) and minimum in VL-892 (24.73%) over control. At 45 days accelerated aged seed, maximum reduction in dry weight (g) was observed in UP-1109 (83.75%) followed by VL-892 (78.49%), VL-829 (62.5%) and VL-802 (37.77%) over control.

Moisture content (%)

Variety VL-892 showed the maximum moisture content (12.28%) followed by UP-1109 (12.06%), VL-829(11.77%) and VL-802 (11.52%). the interaction due to variety and accelerated ageing period showed the significant difference for the moisture content (%) (Table 7). Reduction in moisture content in control to 45 days accelerated ageing was 9.10 to 13.78% in VL-802, 9.10 to 14.77% in VL-829, 9.78 to 14.44% in VL-892 and 8.79 to 15.82% in UP-1109. In 15 days accelerated aged seed, significant reduction in moisture content was observed in maximum in VL-892 (16.97%) and minimum in UP-1109 (12.88%) over control. AT 45 days accelerated aged seed, maximum reduction was observed in VL-829 (48.17%) followed by UP-1109 (44.43%), VL-802 (33.96%) and VL-892 (32.27%) over control and at this stage.

In present study, results revealed that in all the accelerated aged seed lots (0, 15, 30 and 45 days) of each genotype, quality decreased with the passage of ageing period. The test weight of each seed lot decreased with ageing**.** Similar finding was reported in coriander (*Corandrum sativum* L.) by Kumar (2007) [17], in *Salvia* L. and Afshari *et al*., (2011) [4], reported that seed ageing caused reduction in 1000 seed weight

Standard germination percentage decreases as period of ageing increases in all the four varieties. Similar results were observed in Indian mustard seeds (Verma *et al.*, 2003) [29], in onion (Kumar, 2004) [15], in wheat (Singh, 2009) [27] and in four vegetables seeds (carrot, cucumber, onion and tomato) by Alhamdan *et al.*, 2011 [3].

Moradi and Younesi, 2009; Seiadat *et al.*, 2012 [20, 24] showed negative effect of ageing in relation to seed performance, germination percentage and seedling indices. Akhter *et al.* (1992) [2] suggested that decreasing in germination% was related to chromosomal aberrations that occur under long storage conditions. Decreasing of Germination% in aged seeds can be due to reduction of α-amylase activity and carbohydrate contents (Bailly, 2004) [6] or denaturation of proteins (Nautiyal *et al.*, 1985) [22].

Seedling length (cm) and seedling dry weight (mg) in all the four varieties decreased significantly with an increasing of ageing period. These results are an agreement with the finding was reported in urd bean and mung bean by Singh *et al.*, 2003 [26], in Indian mustard seeds by Verma *et al.*, 2003 [29]; in onion by Kumar, 2004 [15]. In coriander by Desraj, 2002 [9]; Kumar, 2007 [17]; Kumar, 2010 [14]; in turnip by Khan *et al.*, 2005 [16]; in wheat by Singh, 2009 [27] and in chickpea by Kapoor *et al.*, 2010 [14].

Increasing seed age decreased germination and this result is in accordance with Janmohammadi *et al.* (2008) [3] and Saha and Sultana (2008) [23] in soybean.

Seed ageing had significant effects on first count, germination percentage, normal seedling percentage, fresh weight, seedling dry weight**.** These results are in agreement with reports **(**Bailly, 2004; Seiadat *et al*., 2012; Ansari and Sharif Zadeh, 2013) [6, 24, 5] they showed negative effects of aging on germination characteristics. The present study was similar with the finding of Saha and Sultana, (2008) [23] and Mohammadi *et al*., (2011) [19] in soybean.

Akhtar *et al*., (1992) reported that germination characteristics were decreased with an increased ageing might be due to chromosomal aberrations that occur under long storage conditions.

The decreases in both root and shoot lengths and seed germination by accelerated aging may be a result of progressive loss of seed viability reported by Mosavi *et al*., 2011 [21].

Seed aging can cause membrane damage (Bewley, 1986) and solute leakage (Bewley and Black, 1994) [7] and disrupt RNA transcription and protein synthesis (Thornton *et al.*, 1993) [28], leading to reductions in rate and percentage of seed germination, seedling fresh weight, dry weight, and root shoot length.

Ghahfarokhi *et al*., (2014) [11] reported that germination percentage, germination index, normal seedling percentage, seedling dry weight, and weight of utilized (mobilized) seed reserve decreased significantly as seed ageing progressed. Decreasing of germination percentage in aged seeds can be due to reduction of α-amylase activity and carbohydrate contents or denaturation of proteins.

Conclusion

It is significantly to mention that results of present study have helped in the better understanding of the effect of ageing period on seed quality determinants as well as on performance of selected wheat varieties studies. Based on the results it can be inferred that during accelerated ageing VL-892 showed least reduction in yield contributing character as well as quality parameters than other three varieties. More pronounced effect of ageing was found in VL-802 due to increased moisture content. Significant varietal differences for germination%, seed vigour indicated the possibility of identifying good variability of wheat variety on the basis of laboratory parameters VL-892 followed by VL-829 was good storer variety which could be used for carry over seed as for multiplication. It is concluding that deterioration occurs during different time of ageing period in wheat varieties. It is suggested that breeder and farmer can use wheat seed that was stored under ambient conditions for cultivation upto three and four year.

Table 1: Effect of accelerated ageing on first count of post harvested wheat varieties

Accelerated Ageing Period	**Varieties**				
	VL-802	**VL-829**	**VL-892**	**UP-1109**	**Mean**
0	72.33	82.33	82.00	70.66	76.83
15	72.00	78.00	77.66	64.00	72.91
30	67.66	71.33	74.33	60.66	68.50
45	58.00	67.33	69.33	56.66	62.83
Mean	67.50	74.75	75.83	63.00	70.27
	Variety	Accelerated ageing	Variety ×Accelerated ageing		
SE±	0.43	0.43	0.86		
CD (5%)	1.24	1.24	2.48		

Table 2: Effect of accelerated ageing on standard germination of post harvested wheat varieties

Accelerated Ageing period	**Varieties**				
	VL-802	**VL-829**	**VL-892**	**UP-1109**	**Mean**
0	86.00	85.66	86.00	78.33	84.00
15	80.00	80.66	83.00	71.33	78.75
30	73.00	78.33	80.33	70.33	75.50
45	72.00	73.00	75.00	67.00	71.75
Mean	77.75	79.41	81.08	71.75	77.50
	Variety	Accelerated ageing	Variety ×Accelerated ageing		
SE±	0.32	0.32	0.65		
CD (5%)	0.93	0.93	1.87		

Table 3: Effect of accelerated ageing on shoot length of post harvested wheat varieties

Accelerated Ageing period	**Varieties**				
	VL-802	**VL-829**	**VL-892**	**UP-1109**	**Mean**
0	8.40	9.46	11.46	8.10	9.35
15	7.96	8.53	9.56	6.23	8.07
30	6.83	7.86	9.20	6.00	7.47
45	6.56	6.90	8.59	5.76	6.95
Mean	7.44	8.19	9.70	6.52	7.96
	Variety	Accelerated ageing	Variety ×Accelerated ageing		
SE±	0.97	0.97	0.19		
CD (5%)	0.28	0.28	0.56		

Table 4: Effect of accelerated ageing on fresh weight (g) of post harvested wheat varieties

Accelerated Ageing period	Varieties				
	VL-802	VL-829	VL-892	UP-1109	Mean
0	1.04	1.01	1.06	0.93	3.34
15	1.02	0.95	1.06	0.82	0.96
30	0.99	0.93	1.03	0.77	0.93
45	0.81	0.87	0.73	0.67	2.57
Mean	0.96	0.94	0.97	0.80	0.92
	Variety	Accelerated ageing	Variety ×Accelerated ageing		
SE±	0.26	0.26	0.53		
CD (5%)	0.77	0.77	0.15		

Table 5: Effect of accelerated ageing on dry weight (g) of post harvested wheat varieties

Accelerated Ageing period	Varieties				
	VL-802	VL-829	VL-892	UP-1109	Mean
0	0.01	0.2	0.7	0..2	0.15
15	0.14	0.4	0.3	0.6	0.36
30	0.44	0.47	0.74	0.64	0.57
45	0..44	0.7	0.8	0.87	0.7
Mean	0.28	0.45	0.48	0.58	0.45
	Variety	Accelerated ageing	Variety ×Accelerated ageing		
SE±	1.31	1.31	0.87		
CD (5%)	0.80	0.80	0.60		

Table 6: Effect of accelerated ageing on dry weight (g) of post harvested wheat varieties

Accelerated Ageing period	Varieties				
	VL-802	VL-829	VL-892	UP-1109	Mean
0	0.01	0.2	0.7	0..2	0.15
15	0.14	0.4	0.3	0.6	0.36
30	0.44	0.47	0.74	0.64	0.57
45	0..44	0.7	0.8	0.87	0.7
Mean	0.28	0.45	0.48	0.58	0.45
	Variety	Accelerated ageing	Variety ×Accelerated ageing		
SE±	1.31	1.31	0.87		
CD (5%)	0.80	0.80	0.60		

Table 7: Effect of accelerated ageing on moisture content of post harvested wheat varieties

Accelerated Ageing period	Varieties				
	VL-802	VL-829	VL-892	UP-1109	Mean
0	9.10	9.10		8.79	9.19
15	10.77	10.77	11.78	10.09	10.86
30	12.44	12.44	13.10	13.55	12.88
45	13.78	14.77	14.44	15.82	14.70
Mean	11.52	11.77	12.28	12.06	11.91
	Variety	Accelerated ageing	Variety ×Accelerated ageing		
SE±	0.16	0.16	0.32		
CD (5%)	0.46	0.46	0.92		

References

1. Ahmadi A, Yazdi-Samadi B, Zargar-Nataj J. The effects of low temperature on seed germination and seedling physiological traits in three winter wheat cultivars. Agr. Sci. Nat. Res. 2004; 11:117-126.
2. Akhter FN, Kabir G, Mannan MA, Shaheen NN. Aging effect of wheat and barley seeds upon germination mitotic index and chromosomal damage. J Islam Acad. Sci. 1992; 5:44-48.
3. Alhamdan AM, Alsadon AA, Khalil SO, Wahb-Allah MA, Nagar Mel, Ibrahim AA. Influence of storage conditions on seed quality and longevity of four vegetable crops. Am-Euras. J Agric. Environ. Sci. 2011; 11(3):353-359.
4. Afshari H, Eftekhari M, Faraji M, Ghaffar-Ebad A, Ghanbarimalidareh A. Studying the effect of 1000 grain weight on the sprouting of different species of Salvia L. grown in Iran. J Med. Plant. Res. 2011; 5(16):3991-3993.
5. Ansari O, Sharif-Zadeh F. Improving germination of primed mountain rye seeds with heat shock treatment. Braz. J Plant Physiol. 2013; 25(3):1-6.
6. Bailly C. Active oxygen species and antioxidants in seed biology. Seed Sci. Res. 2004; 14:93-107.
7. Bewley JD, Black M. Seeds Physiology of Development and Germination. Plenum Press, 1994, 445.
8. Delouche JC, Baskin CC. Accelerated aging techniques for predicting the relative storability of seed lots. Seed Sci. Technol. 1973; 1:427-452.
9. Desraj. Studies on viability and vigour in coriander (*Coriandrum sativum* L.). M. Sc. Thesis, submitted to CCS HAU, Hisar, 2002.
10. FAO. FAO outlook. Food and agricultural organization of United Nations, Rome, May. 2002; 2:36.
11. Ghahfarokhi1 MG, Ghasemi E, Saeidi M, Zeinab ZH. The effect of accelerated aging on germination characteristics, seed reserve utilization and malondialdehyde content of two wheat cultivars. J Stress Physiol. Bio chem, 2014, 10(2).
12. ISTA. International rules for seed testing. Seed Sci. Tech. 2006; 24:23-46.
13. Janmohammadi M, Fallahnezhad Y, Golshan M, Mohammadi H. Controlled ageing for storability assessment and predicting seedling early growth of canola cultivars (*Brassica napus* L.). ARPN J Agric. Bio. sci. 2008; (3)5-6:22-26.
14. Kapoor N, Arya A, Siddiqui M, Amir A, Kumar H. Seed deterioration in chickpea (*Cicer arietnum* L.) under accelerated ageing. Asian J Plant Sci. 2010; 9 (3):158-162.
15. Kumar A. Seed quality assessment in naturally aged seeds of onion (Allium cepa). M. Sc. Thesis submitted to CCS HAU, Hisar, 2004.
16. Khan MM, Iqbal MJ, Abbas M. Loss of viability correlates with membrane damage in aged turnip (*Brassica rapa*) seeds. Seed Sci. & Technol. 2005; 33(2):517-520.
17. Kumar A. Seed quality assessment in naturally aged seeds of coriander (*Coriandrum sativum* L.). M. Sc. Thesis submitted to CCS HAU, Hisar, 2007.
18. Kumar P, Yadava RK, Gollen B, Kumar S, Verma RK, Yadav S. Nutritional contents and medicinal properties of wheat (*Triticum aestivum* L.) sci. M. Res. 2011; 22:1-7.
19. Mohammadi H, Soltani A, Sadeghipour HR, Zeiali E. Effect of seed ageing on subsequent seed reserve utilization and seedling growth in soybean. Int. J Pl. Prod. 2011; 5(1):65-70.
20. Moradi A, Younesi O. Effects of Osmo- and Hydro-priming on Seed Parameters of Grain Sorghum (*Sorghum bicolor* L.). Aust. J Basic Appl. Sci. 2009; 3(3):1696-1700.
21. Mosavi NSM, Gholami H, Kord GH, Sadeghi M, Sedighi E. Free fatty acid and electrical conductivity changes in cotton seed (*Gossypium hirsutum*). Int. J Agric. Sci. 2011; 1(2):62-66.

22. Nautiyal AR, Thapliyal AP, Purohit AN. Seed viability. IV. Protein changes: Accompanying loss of viability in Shorea robusta. Seed Sci. Technol. 1985; 13:83-86.
23. Saha RR, Sultana W. Influence of seed ageing on growth and yield of soybean. Bangladesh, J Bot. 2008; 37(1):21-26.
24. Seiadat SA, Moosavi A, Sharafizadeh M. Effect of seed priming on antioxidant activity and germination characteristics of Maize seeds under different aging treatments. Res. J Seed Sci. 2012; 5(2):51-62.
25. Shewry PR. Wheat. J of Exp. Bot. 2009; 60:1537-1553.
26. Singh B, Singh CB, Gupta PC. Influence of seed ageing in Vigna species. Farm Sci. J. 2003; 12(1):4-7.
27. Singh D. Seed quality assessment in artificial and natural aged seed of wheat (*Triticum aestivum* L.). Ph.D. thesis submitted to CCS Haryana Agricultural University, Hisar, 2009.
28. Thornton JM, Collins ARS, Powell AA. The effect of aerated hydration on DNA synthesis in embryos of *Brassica oleracea* L. Seed Sci. Res. 1993; 3:195-199.
29. Verma SS, Verma U, Tomer RPS. Studies on seed quality parameters in deteriorating seeds in brassica (*Brassica campestris*). Seed Sci. Technol. 2003; 31:389-396.