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# Assess the effect of natural ageing on seed quality of Wheat seed (*Triticum aestivum* L.)

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**Abstract**
The present study entitled "Assess the effect of natural ageing on seed quality of Wheat seed (*Triticum aestivum* L.)" was conducted during *rabi* 2018 -2019 at Department of Seed Science and Technology and Oil Seed Farm of CSAUA&T, Kanpur in Seed Testing Laboratory. The freshly stored seed was observed highest seed quality parameters *i.e*., germination percent, seedling length, seedling dry weight and seed vigour indices as compared to seeds that were stored for 6 months. In both the variety highest standard germination was observed in WH-1105 (70.61%) while lowest was observed in WH-1124 (69.93%). The longest seedling length was observed in WH -1105 (16.85 cm) while shortest was observed in WH -1124 (16.09 cm). In both the variety maximum vigour Index- I was observed in WH-1105 (1500.45) while minimum was observed in WH-1124 (1425.74). The maximum vigour index-II was observed in WH-1105 (11.52) while minimum was observed in WH -1124 (10.56). Based on the results, WH-1105 was found as superior variety in majority of the viability and vigour constraints results whereas WH - 1124 variety was recorded inferior. Among the storage periods the physiological parameters maximum was record ed. in the month of July and minimum in month of December. Conclusion found that comparing the result obtained in the months of July WH -1105 recorded better performance and WH-1124 recorded moderate and poor performance in maximum vigour test in wheat.

**Keywords:** Seed, germination percentage, quality parameter, and seedling vigour

## Introduction
Wheat (*Triticum aestivum* L.) is a crop of global significance. Wheat is the main staple food crop of India. It is grown in diversified environments; approximately one- sixth of the total arable land in the world is cultivated with wheat crop. Wheat is grown in all the continents of the world.

Wheat is an annual plant of gramineae family. Eighteen species of wheat have been described and recognized (Perciva 2019) [17], only a few are of importance in agriculture. In India, three species of *Triticum viz. aestivum, durum* and *dicoccum* are cultivated which covered of area approximately 87, 12, and 1 percent respectively. The common wheat (*Triticum aestivum* L.) which is good for chapatti making and bakery products is grown in whole country. The macaroni wheat (*Triticum durum)* which is good for suji, semya, sphagetti and macaroni is grown only central and south India and that to under rain fed conditions. The emmer wheat (*Triticum dicoccum*) which is good for the south Indian dish uppumav, is grown only on limited acreage in T.N., A.P., M.H. and Gujarat. In addition to this wheat is also consumed in various other preparations such as Dalia, halwa, sweet meals, backed leavened bread, flakes, cakes, biscuits etc.

Maximum area under wheat is in china followed by India. In regard to average yield per hectare UK ranks first followed by France. The average wheat yield is only 3537 kg per hectare in India which is much lower than most of the wheat growing countries of the world. In India, the maximum acreage and production of wheat is in Uttar Pradesh but Punjab state produce highest average yield per hectare 3525 kg/ha followed by Haryana 2304 kg/ha (anonymous 2022) [1]. India contributes about 12 percent in total wheat production of the world. Seed is a crucial component that has a significant impact on crop output and productivity. Higher quality seed is regarded as the most important and basic input for boosting productivity and increasing net monetary rewards per unit area (Hemming *et al*., 2018) [6]. Poorly handled seeds in storage performs poorly in the field, diminishing yields and affecting food security (Kaske *et al*., 2019) [9]. Improper storage conditions lowers the seed germination capacity, seed quality degradation, and loss of potentiality (Bhandari *et al*. 2017) [5].

Physiological quality of the seeds is influenced by storage temperature, humidity, chemical effects, production settings, harvesting, illnesses, and insects during seed storage. Furthermore, storage environment and packing materials have substantial impact on seed quality and proximate composition (Tabakovic *et al*., 2019) [16]. Duration of the storage and storage conditions also may induce some physical, chemical and biochemical alterations in seed (Rahouma, 2021) [14] and influencing the grain quality. Prolonged storage of wheat seed also causes reduction in seed germination, seedling vigour, and increases in germination time, insect infestation and finally, loss in seed weight (Khatri *et al*., 2019) [10]. The germ damage of the seed also influenced by the storage conditions, further, germ effects drastically and leads to the viability loss (Khatri *et al*., 2019) [10]. Hence, to retain seed quality, seed should be properly stored in decent storage facilities (Afzal *et al*., 2019) [3]. Furthermore, proper storage of the food grains is very important to retain the nutritional quality and to maintain the suitability to the consumption (Karta *et al*., 2019) [7]. Poor storage conditions significantly decrease proximate composition, nutritional composition of grains and yields poor quality products (like flours) (Hemming *et al*., 2018) [6]. However, there are many advanced grain storage techniques practicing in the contemporary world, the usage of those technologies in under developed countries like in Ethiopia is technically and economically challenging Karta *et al*., 2019) [7].

## Materials and Methods

A storage experiments were carried out for 6 months (M1-M6) of storage period from July to December at Seed Testing Laboratory of Department of Seed Science and Technology, C.S.A.U.A&T, Kanpur and Oil Seed Farm, Kalyanpur during 2019. Two variety of wheat was taken i.e, WH-1105 and WH-1124 from AICRP-All India Co-ordinated research project on Wheat and Barley, Haryana Agricultural University (Hisar) during 2019.

The following observation were recorded at every month during the storage period

### Laboratory Observations

1. Seed moisture content %
2. First Count %
3. Germination %
4. Seedling Length (cm) (Shoot length + Root length)
5. Seedling Dry Weight (g)
6. Seed Vigour Index- I (Germination percentage x Seedling length)
7. Seed Vigour Index- II (Germination percentage x Seedling dry weight)

**Seed Moisture Content:** The initial seed moisture contents were tested by using Wason seed moisture meter.

### Equipment

Compression unit, Moisture meter dial, Thermometer, Compression knob, Cups of different volumes.

### Procedure

A representative sample of prescribed weight or volume was obtained and placed in sample cup. It was fixed in the lower house of compression unit. The sample size of wheat was 30 gm and the volume of cup size (A) at 462 compression unit. The meter was calibrated by pressing the button "cal" and "bell" with the help of calibration knob. Sample was compressed as per requirement with the help of compression knob and scale. At required compression the meter dial (M) was read by pressing the knob "Read" and bell. Seed lot with moisture content more than the minimum seed certification standard was recommended for drying. Minimum seed certification standard for moisture percentage in wheat WH-1105 and WH-1124 seeds were recorded 7.8% and 7.8% respectively.

### First count test

For the test of first count one hundred seeds were counted randomly in three replications for each variety of wheat these seed were kept in between paper and placed for germination in germination room at 25 ± 1 $^0$C and observation were taken after 4 days.

### Germination Test

To record the percentage of germination one hundred seeds were counted in three replications for each variety and these seed were kept in between paper and placed for germination at 25±1 $^0$C and the observations were taken at 8$^{th}$ days.

### Seedling length

From each replication 10 vigorous seedlings were randomly selected. On the 8$^{th}$ day total seedling length (Shoot length + Root length) was measured with ruler in cm.

### Seedling dry weight

Ten normal seedlings were selected randomly and dried for 24 hours in hot air oven maintained at 100 $^0$C temperature. These dried seedlings were cooled for 30 minutes in desiccators'. The weight of dried seedlings was recorded in grams.

### Vigour Index

It was calculated by using formula given by Abdul Baki and Anderson (1973) [2].

Seed Vigour Index I = Germination percentage x Seedling length (cm) Seed Vigour Index II = Germination percentage x Seedling dry weight (gm)

## Results and Discussion

**Table 1:** Effect of storage period on first count of wheat

| Variety | Storage period | | | | | | Mean |
|---|---|---|---|---|---|---|---|
| Wheat | M1 | M2 | M3 | M4 | M5 | M6 | |
| WH-1105 | 83.66 (65.45) | 82.00 (64.90) | 81.33 (63.40) | 81.00 (64.16) | 80.33 (63.68) | 79.00 (62.72) | 81.22 (64.05) |
| WH-1124 | 82.00 (64.90) | 81.00 (64.16) | 80.00 (63.44) | 80.00 (63.44) | 79.66 (63.20) | 78.00 (62.03) | 80.00 (63.52) |
| Mean | 82.83 (65.17) | 81.5 (64.53) | 80.66 (63.42) | 80.5 (63.80) | 79.99 (63.44) | 78.5 (62.37) | |
| | Factor A (Variety) | | Factor M (Month) | | Interaction Ax M | | |
| .D | N.S. | | 1.103 | | N.S. | | |
| S.E.(d) | 0.309 | | 0.534 | | 0.756 | | |
| S.E.(m) | 0.218 | | 0.378 | | 0.534 | | |

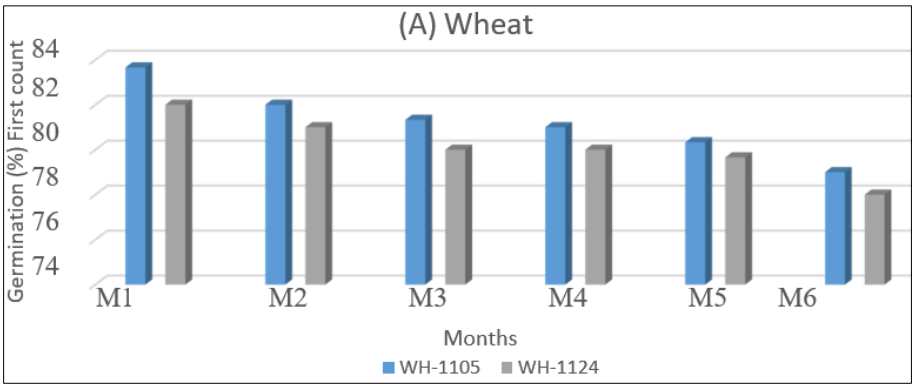


**Fig 1:** Effect of storage period on first count of wheat

Data presented in table 1 & Fig. 1 reveal that maximum germination percentage on first count was found in the month of July (82.83%) while, lowest germination percentage were found in month of December (78.5%). Among varieties highest germination (81.22%) on first count was found in WH-1105 as compared to WH-1124. Similar trend was found in standard germination percentage (table 2 & Fig. 2) i.e, declining in germination as period of storage increase in both the varieties. Maximum standard germination percentage was recorded in wheat varieties WH-1105 (73.03%) in the month of July and minimum (66.82%) in month of December. In both the variety maximum standard germination was observed in WH-1105 (70.61%) while minimum was observed in WH-1124 (69.93%) after 6 month of storage. Similar results were found by Singh (2009) [15] in wheat physiological parameters *viz.* germination percentage, viability percentage, seedling dry weight, seed vigour indices, seedling length were declined considerably with the progression of the ageing period.

**Table 2:** Effect of storage period on standard germination of wheat

| **Variety** | **Storage period** | | | | | | **Mean** |
|---|---|---|---|---|---|---|---|
| **Wheat** | **M1** | **M2** | **M3** | **M4** | **M5** | **M6** | |
| WH-1105 | 92.00 (73.59) | 92.00 (73.59) | 89.00 (70.64) | 88.33 (70.03) | 86.66 (68.60) | 85.00 (67.22) | 88.83 (70.61) |
| WH-1124 | 91.00 (72.55) | 90.00 (71.57) | 89.33 (70.99) | 88.00 (69.74) | 86.33 (68.34) | 84.00 (66.42) | 88.22 (69.93) |
| Mean | 91.5 | 91.00 | 89.16 | 88.16 | 86.49 | 84.5 | |
| | (73.07) | (72.58) | (70.81) | (69.88) | (68.47) | (66.82) | |
| | **Factor A (Variety)** | | **Factor M (Month)** | | **Interaction AxM** | | |
| C.D | N.S. | | 1.355 | | N.S. | | |
| S.E.(d) | 0.379 | | 0.656 | | 0.928 | | |
| S.E.(m) | 0.268 | | 0.464 | | 0.656 | | |

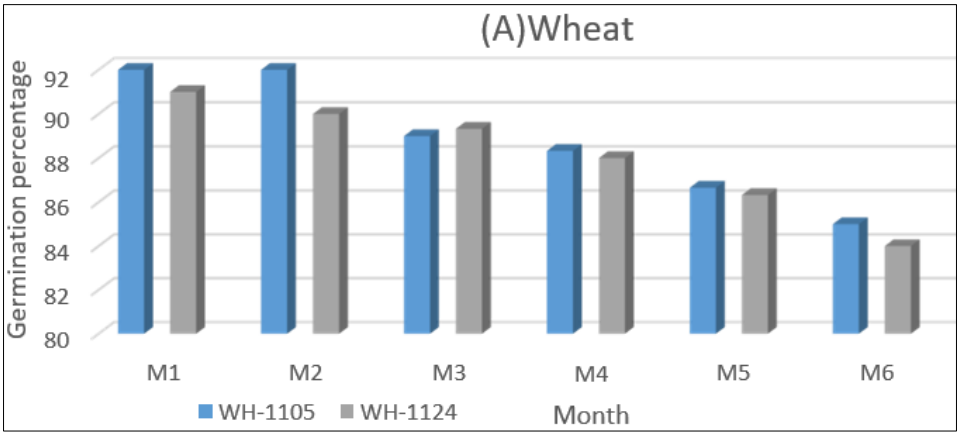


**Fig 2:** Effect of storage period on standard germination of wheat

**Table 3:** Effect of storage period on seedling length (cm) of wheat

| **Variety** | **Storage period** | | | | | | **Mean** |
|---|---|---|---|---|---|---|---|
| **Wheat** | **M1** | **M2** | **M3** | **M4** | **M5** | **M6** | |
| WH-1105 | 18.70 | 18.36 | 16.63 | 16.28 | 16.00 | 15.16 | 16.85 |
| WH-1124 | 21.59 | 18.53 | 16.77 | 13.87 | 13.14 | 12.63 | 16.09 |
| Mean | 20.14 | 18.45 | 16.70 | 15.08 | 14.57 | 13.90 | |
| | **Factor A (Variety)** | | **Factor M (Month)** | | **Interaction AxM** | | |
| C.D | N.S. | | 1.387 | | 1.962 | | |
| S.E.(d) | 0.388 | | 0.672 | | 0.950 | | |
| S.E.(m) | 0.274 | | 0.475 | | 0.672 | | |

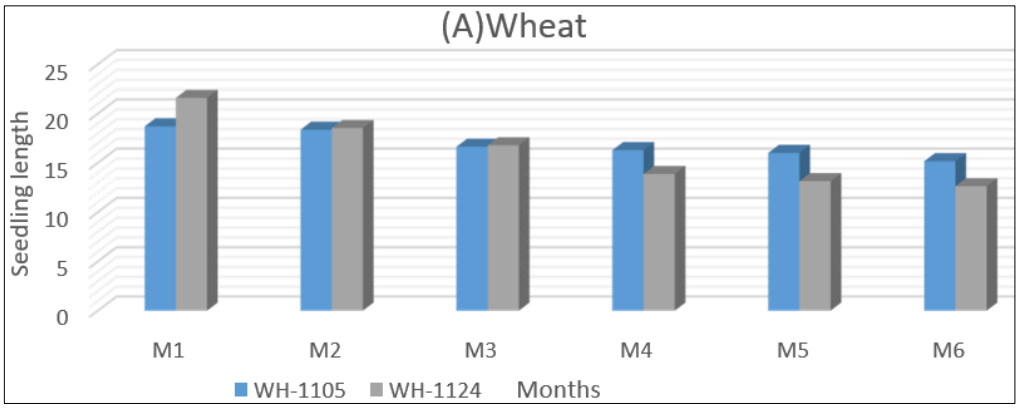


**Fig 3:** Effect of storage period on seedling length (cm) of wheat

Data presented in table 3 & Fig. 3 reveal seedling length decreased as period of storage increase in both the varieties. Longest seedling length was recorded in wheat varieties WH-1105 (20.14 cm)) in the month of July and shortest (13.90 cm) in month of December. In both the variety longest seedling length was observed in WH-1105 (16.85 cm) while shortest was observed in WH-1124 (16.09 cm). Similar trend was found in table 4 & Fig. 4 reveal seedling dry weight decreased as period of storage increase in both the varieties. Maximum seedling dry weight was recorded in wheat varieties WH-1105 (0.16 g) in the month of July and minimum (0.08 g)) in month of December. In both the variety maximum seedling dry weight was observed in WH- 1105 (0.13 g) while minimum was observed in WH-1124 (0.11). Similar results were reported by Baldaniya *et al*. (2018) [4] in onion seeds the plastic bag maintained the germination potential above the Indian minimum seed certification standard (70%) even after 9 months of storage. Similar results were found by Kartoori and Biradar Patil (2018) [8].

**Table 4:** Effect of storage period on seedling dry weight (g) of wheat

| **Variety** | **Storage period** | | | | | | **Mean** |
|---|---|---|---|---|---|---|---|
| **Wheat** | **M1** | **M2** | **M3** | **M4** | **M5** | **M6** | |
| WH-1105 | 0.16 | 0.13 | 0.12 | 0.11 | 0.10 | 0.08 | 0.13 |
| WH-1124 | 0.17 | 0.15 | 0.14 | 0.12 | 0.11 | 0.09 | 0.11 |
| Mean | 0.16 | 0.14 | 0.13 | 0.11 | 0.10 | 0.08 | |
| | **Factor A (Variety)** | | **Factor M (Month)** | | **Interaction AxM** | | |
| C.D | 0.007 | | 0.013 | | N.S. | | |
| S.E.(d) | 0.004 | | 0.006 | | 0.009 | | |
| S.E.(m) | 0.003 | | 0.004 | | 0.006 | | |

**Table 5:** Effect of storage period on seed vigour index- I of wheat

| **Variety** | **Storage period** | | | | | | Mean |
|---|---|---|---|---|---|---|---|
| Wheat | M1 | M2 | M3 | M4 | M5 | M6 | |
| WH-1105 | 1720.40 | 1689.12 | 1480.07 | 1438.00 | 1386.56 | 1288.60 | 1500.45 |
| WH-1124 | 1964.69 | 1667.70 | 1498.06 | 1220.49 | 1134.27 | 1069.25 | 1425.74 |
| Mean | 1842.54 | 1678.41 | 1489.06 | 1329.24 | 1260.41 | 1178.92 | |
| | **Factor A (Variety)** | | **Factor M (Month)** | | **Interaction AxM** | | |
| C.D | 7.956 | | 13.780 | | 19.488 | | |
| S.E.(d) | 3.854 | | 6.675 | | 9.440 | | |
| S.E.(m) | 2.725 | | 4.720 | | 6.675 | | |

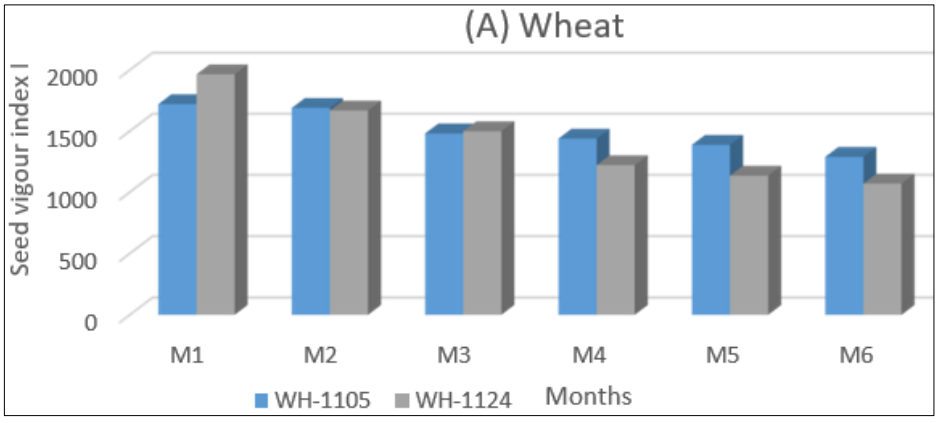


**Fig 4:** Effect of storage period on seed vigour index- I of wheat

Data presented in table 5 & Fig. 5 reveal seed vigour index I decrease as period of storage increase in both the varieties. Maximum seed vigour Index-I was recorded in wheat varieties WH-1105 (1842.54) in the month of July and minimum (1178.92)) in month of December. In both the variety maximum vigour index I was observed in WH-1105 (1500.45) while minimum was observed in WH-1124 (1425.74). Similar trend in table 6 & Fig. 5 reveal seed vigour index - II decrease as period of storage increase in both the varieties. Maximum seed vigour index-II was recorded in wheat varieties WH-1105 (15.09) in the month of July and minimum (7.20) in month of December.

In both the variety maximum vigour index-II was observed in WH-1105 (11.52) while minimum was observed in WH-1124 (10.56). Similar results was reported by Kumar *et al*., (2019) [11] 9 in brinjal seed polythene bag 700 gauge recorded significantly higher germination and vigour index than the paper bag at the end of 12 months of storage in brinjal. Similar results were reported by Quais *et al*., (2013) [13] 11 in radish seeds.

**Table 6:** Effect of storage period on seed vigour index II of wheat

| Variety | Storage period | | | | | | Mean |
|---|---|---|---|---|---|---|---|
| **Wheat** | **M1** | **M2** | **M3** | **M4** | **M5** | **M6** | |
| WH-1105 | 14.72 | 11.96 | 10.68 | 10.59 | 8.66 | 6.80 | 11.52 |
| WH-1124 | 15.47 | 13.50 | 12.50 | 10.56 | 9.49 | 7.61 | 10.56 |
| Mean | 15.09 | 12.73 | 11.59 | 10.57 | 9.07 | 7.20 | |
| | **Factor A (Variety)** | | **Factor M (Month)** | | **Interaction AxM** | | |
| C.D | 0.242 | | 0.420 | | 0.594 | | |
| S.E.(d) | 0.117 | | 0.203 | | 0.288 | | |
| S.E.(m) | 0.083 | | 0.144 | | 0.203 | | |

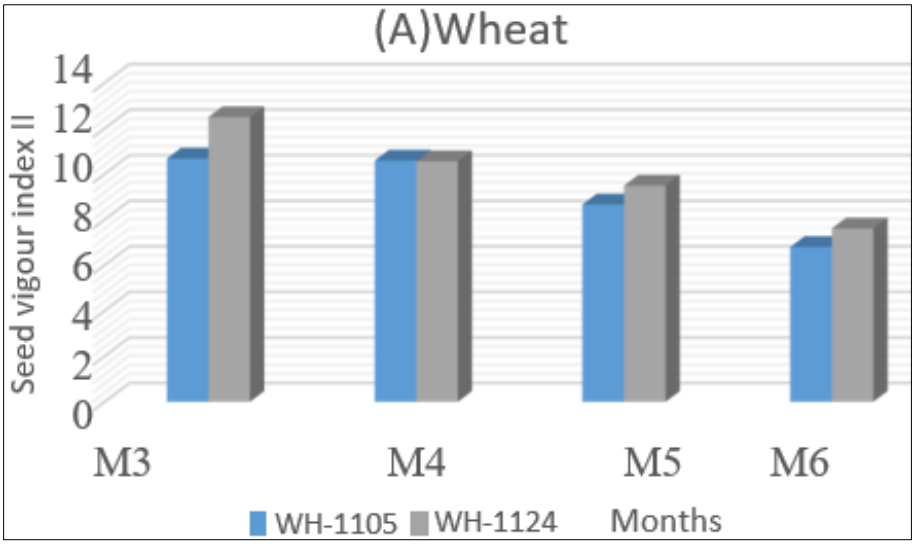


**Fig 5:** Effect of storage period on seed vigour index II of wheat

## Conclusion

During natural ageing, standard germination, seedling length, seedling dry weight, and vigour indices, decreased significantly with an increase in the ageing period. Conclusion that comparing the result obtained in the months of July WH-1105 recorded better performance and WH-1124 recorded moderate and poor performance in maximum vigour test in wheat.

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