**Bulletin of Environment, Pharmacology and Life Sciences**
Bull. Env. Pharmacol. Life Sci., Vol 3 [6] May 2014: 207-210

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD
Global Impact Factor 0.533
Universal Impact Factor 0.9804

**ORIGINAL ARTICLE**

# Study on Seed Vigor Deterioration in Hybrid corn (*Zea mays*) ,cv.single cross 704

**B.Oskouei[1], E.Majidi Hervan[2], A. Hamidi[3], F. Moradi[4], A. Moghadam[5]**
1- Department of agronomy, Science and Research Branch, Islamic Azad Universiti( SRBIAU)
2-Department of agronomy, Science and Research Branch, Islamic Azad Universiti( SRBIAU)
3-Seed and Plant Certification and Registration Institute- Karaj-Iran
4- Agricultural Biotechnology Research Institute of Iran- Karaj-Iran
5- Seed and Plant Improvement institute- Karaj-Iran
**Corresponding Author: e-majidi@yahoo.com**

**ABSTRACT**
*This experiment was conducted to study the reactions of different shapes of hybrid corn ( Zea mays) ,cv.single cross 704 to artificial aging. For separation and grading of round, flat and medium seeds, oblong (5.5 mm), round (7 mm) and round (6-6.25mm) sieves were used respectively. Seeds were objected to accelerate ageing by keeping them at 41$^{0}$C and 100% relative humidity for 144 h and analyzed after 72, 96, 120 and 144 h aging treatment. All the seeds of different shapes were incubated in a germinator maintained at a constant temperature of 25 $^{0}$C . Then percentage germination, MTG, SVIL and SVIW was calculated. Results showed acceleration time aging had significant effect on germination Mean time, The number of normal seedlings, seedling weight vigor index and seedling length vigor index. The results of data statistical analysis showed that there is not any significant effect among different shapes in number of normal seedlings, but round seeds had lower rate germination than medium and flat. Also The minimum and maximum Seedling weight vigor index was respectively related to round and medium seeds. In contrast the maximum Seedling length vigor index was related to medium and flat seeds and the minimum was referred to round seeds.*
*Key words: Maize, accelerated ageing time, normal seedling*

Received 20.04.2014 Revised 15.04.2014 Accepted 22.04. 2014

## INTRODUCTION
Maize (*Zea mays* L.) is the third most important crop after wheat and rice and is grown in more countries than any other crop in the world. It is cultivated virtually in all parts of the world except Antarctica. It has very specific water and climatic requirements in order to thrive. Most importantly, for the plant to germinate it needs a temperature ranging from 15 to 20ºC [6].
A large amount of quality corn seed is required for sowing to ensure successful crop establishment, but non availability of such seeds is a limiting factor in boosting Iranian's corn production. High seed and seedling vigor is required for a good stand establishment and successful crop performance in corn.
Corn seeds vary widely in shape and size depending upon the position on the cob. Seeds from the mid-cob position are flatter than seeds from either end, while seeds at the cob base are larger than seeds at the tip of the cob. The corn seed industry has utilized these differences in seed size and shape to establish grades ( 3 to 12) of flat and round (large, medium and small) seeds for many hybrids [22]. The seed was graded initially to aid in precision field planting with plated planters, however with the introduction of plate less planters, medium- flat and large – flat grades were still in demand, because these grades were thought to have higher quality than the small/round grades [2].
There is evidence that round seeds have lower initial germination, vigor and seedling performance than flat seeds, especially in the medium and small-round grades [20; 9; 18].
Graven and Carter (1990) reported field emergence of small/round seeds was 5 to 15 percentage points lower than small/flat seeds under stressful field conditions. Increased susceptibility to mechanical damage (seed breakage) has also been ass0Ciated with round rather than flat seeds [15; 18]. Thus, many

farmers and the seed industry have a general feeling that flat seeds are less susceptible to mechanical damage and have higher physiological quality than round seeds.

Vigorous seeds will produce excellent emergence and stand in proper soil environment. It can improve the chances for satisfactory emergence. Vigor is often implied when discussing seed quality and most growers have to use the terms and quality and vigor interchangeably. Seeds vigor comprises those properties, which determine the potential for rapid uniform emergence and development of normal seedlings under a wide range of field conditions [3]. The rapid and synchronous germination rate as well as good field establishment will be characteristic of vigorous seeds.

The deterioration of stored seed is a natural phenomenon and the seeds tend to lose viability and vigor even under ideal storage conditions [4]. The rate of seed deterioration varies greatly from one species to another and even among varieties of the same species. The performance capabilities of many seeds deteriorate due to variations in temperature, relative humidity and moisture content in storage [1].

Seed ageing is an important parameter to assess/estimate the seed vigor. Accelerated ageing is a good vigor test for various crop seeds including corn [23]. Seeds subjected to accelerated ageing lost vigor sooner than viability [8]. The accelerated ageing test is rapid, inexpensive, simple and useful for many species. It has also shown a good correlation with stand establishment in corn.

## MATERIALS AND METHODS

This study was conducted in 2013 in the central seed analysis laboratory of seed and plant certification &registration institute of Karaj-Iran. Seed germination and vigor tests were conducted as a completely randomized design with four replications. For separation and grading of round, flat and medium seeds, oblong (5.5 mm), round (7 mm) and round (6-6.25mm) sieves were used respectively. In order to ensure precise separation of the seeds, this work was done two times manually with related screens.

Seeds were objected to accelerated ageing by keeping them at $41^{0}$C and 100% relative humidity for 144 h and analyzed after 72, 96, 120 and 144 h aging treatment. All the seeds of different shapes were incubated in a germinator maintained at a constant temperature of 25 $^{0}$C The germination tests were evaluated after 7 days from planting.

***Standard germination test:***

Standard germination test was conducted for all samples according to the between paper (BP) method of the ISTA rules (11). Four hundred seeds were randomly chosen from various flat, round and medium and under sieve seeds and were placed on moist germination paper (containing 4 sheets of germination paper and 1 sheet of paper towel) equidistant apart. Paper towels were rolled up and placed individually in plastic bags. The bags were sealed with an elastic band. They were incubated in an upright position at 25 ± 1°C.

Percentage germination was determined after seven days and rating for normal/abnormal seedlings was done at eleven days. Seeds were visually assessed according to the ISTA rules [11]. Results were presented as the percentage seedlings that had germinated at the end of the test period. Finally ten normal seedlings were selected randomly and seedling, root and shoot length and dry weight were calculated. By daily counting of germinated seeds, seed germination and seedling vigor indices was calculated as following:

***Mean time to germination (MTG)***

Mean time to germination is an index of seed germination speed and velocity [5], and calculated by:

$$MTG = \frac{\Sigma (nd)}{\Sigma n}$$

n = number of germinated seed during d days

d = number of days

Σn = total number of germinated seeds

Seedling vigor index length (SVIL)=LP*nor

LP: length of seedling; 10 seedlings of each treatment and replication were selected and length measurements were taken nor; number of normal seedlings

Seedling vigor index weight (SVIW) =WDP*nor

WDP=total weight of seedlings nor: number of normal seedlings [5].

The objective of this research was then to distinguish reaction of different shapes of hybrid maize (*Zea mays* L. Cv. Single Cross 704) to deterioration by using of several times of artificial aging.

***Statistical analysis***

Analysis of variance was conducted using SAS version9 software, and means were compared by LSD multiple range test at 1% and 5% probability levels.

**RESULTS AND DISCUSSION**

variance analysis) showed (table 1) that acceleration time aging had significant effect on germination Mean time, The number of normal seedlings, seedling weight vigor index and seedling length vigor traits index. The results of the Means comparison showed (table 2) that The maximum and minimum germination Mean time in 72 and 144 h were 1.6and 2.3respectively. It is noteworthy that The number of normal seedling in 72 h was the highest rate( 24.7) and in 144 h was the lowest rate( 23.2)and there were not any significant difference between 72 and 96 also between 96 and 120 h. Martin et al [14, 15] and Peterson et al [18] believe that round seeds are more susceptible of mechanical damage than flat and medium seeds ,so round seeds deteriorated faster than others.

The maximum Seedling weight vigor index and Seedling length vigor index were seen in 72 h (1.9 and 779 respectively), while the minimum was related to 144 h (1.2 and 495 respectively).Totally acceleration aging could decrease vigorous seedlings. Also according to the some of researcher's reports, time aging had significant effect on seed vigor and could decrease it [12].So when seeds were produced in area with high temperature and humidity, for storing, they immediately must be carried to the suitable store with low relative humidity and temperature.

Table 1: Analysis of variance vigor indices of various maize seed shapes under several time aging

| S.O.V | df | Mean time to germination | Normal seedling | Seedling weight vigor index | Seedling length vigor index |
|---|---|---|---|---|---|
| Time aging | 3 | 0.809143528** | 4.10185185** | 0.64389156** | 129990.7410** |
| Different shapes | 2 | 1.44324444** | 1.86111111 ns | 0.13407000** | 19562.9733** |
| Time aging*Size | 6 | 0.01398519ns | 0.15740741 ns | 0.01390029 ns | 3639.4141 ns |
| C.V | | 5.312586 | 3.984668 | 7.876784 | 9.603786 |

ns: non significant ; ** significant at 1% level

Table 2: Means comparison of vigor indices of seed maize under several time aging

| Time aging | Mean time to germination | Normal seedling | Seedling weight vigor index | Seedling length vigor index |
|---|---|---|---|---|
| 72 h | 1.67444 d | 24.7778 a | 1.91968 a | 778.98 a |
| 96 h | 1.85556 c | 24.3333 ab | 1.79001 b | 704.59 b |
| 120 h | 2.15889 b | 23.7778 bc | 1.67078 b | 651.47 b |
| 144 h | 2.34333 a | 23.2222 c | 1.29867 c | 495.27 c |
| LSD | 0.1038 | 0.9315 | 0.128 | 61.443 |

Means with the same letter are not significantly different.

Table 3: Means comparison of vigor indices of various maize seed shapes

| Seed shape | Mean time to germination | Normal seedling | Seedling weight vigor index | Seedling length vigor index |
|---|---|---|---|---|
| Round | 2.40583 a | 24.3333 a | 1.77543 a | 612.31b |
| Medium | 1.76917 b | 24.1667 a | 1.66990 b | 689.88 a |
| Flat | 1.84917 b | 23.3333 a | 1.56403 ab | 670.54 a |
| LSD | 0.0899 | 0.8067 | 0.1108 | 53.211 |

Means with the same letter are not significantly different.

The results of data statistical analysis showed that there are not any significant effect among seed shapes in number of normal seedlings, but round seeds had lower rate (2.4 days)germination than medium and flat (1.7 and 1.8 respectively). The minimum and maximum Seedling weight vigor index was respectively related to round (1.7) and medium (1.6) seeds. In contrast the maximum Seedling length vigor index was related to medium and flat seeds (689.8 and 670.5 respectively) and the minimum was referred to small seeds (612.3).

Seed size has a direct and positive relevance with percent and rate of germination and primary seedling growth, possibly due to more storage of large seeds in comparison to small ones (10). In contrast Lafond and baker (1986) believed that small seeds in comparison to larger ones, not only germinate faster, but also their seedlings establish more quickly [13]. Although some researchers believe that seed size does not have any significant effect on germination rate and seedling establishment [17; 19]. Ghorbani, et al [7] observed that seed size does not have any significant effect on germination rate, so that germination rate of small seed was more than larger ones [7].

Variations of seed shapes between genotypes are affected by various environmental factors (such as nutrition of maternal plants) and genetic resources [21]. In a mutant genotype, larger seeds owing to more storage produce vigorous seedlings. In favorite seed germination and seedling establishment conditions larger seeds usually produce larger seedling in comparison to small seeds that may results in increasing of final yield [16].

## REFERENCES


1. Abdul-Baki A.A. (1980). BioChemical aspects of seed vigor. Hort.Sci., 15, 765-771.
2. Agronomic spotlight, (2011). Seed size issues in corn. Available at: http://reahybrids. com/ assets/files /agronomy/Ag_Spotlight- Seed_Sizes_of_Corn
3. ASPB.2003. Regulations on the sale of planting seed in Arkansas-72203.
4. Bhatti, M.S. and Sato, H. (1997). Viability testing. Annual report, Plant Genetic resources Institute, Nat. Agric. Res. Center, Islamabad Pakistan.
5. Ellis, R. H. and Roberts, E. H. (1981). The quantification of ageing and survival in orthodox seeds. Seed Science and Technology. 9: 377-409
6. Fairfood, (2012). Fairfood international: corn. Available at: http://www.fairfood.org/research/production-chains/maize.
7. Ghorbani, M.H., Soltani, A., Amiri, S. (2007). The effect of salinity and seed size on germination and seedling growth of wheat. J.Agric. Sci. and Natural Res.. 14(6):44-52.
8. Gorecki, R.J., Midhalczyk, D.J. and Esashi, Y.(1992). Comparative studies on the anaerobic reparation in differently aged pea and c0Cklebur seeds. Acta Physiol. Plant, 14: 19-27.
9. Graven, L.M. and Carter, P.R. (1990). Seed size/shape and tillage system effect on corn growth and grain yield. Journal of Production Agriculture, 3, 445-452.
10. Hampton, J.G. (1981). The extent and significant of seed size variation in Newsland wheats. N. Z. J. Exp. Agricultur. 9: 179- 183.
11. International Seed Testings Ass0Ciation (ISTA). (2008). International rules for seed testing. Seed Science and Technology. Basserdorf, Switzerland.
12. Kaya, M.D. (2014). Conformity of vigor tests to determine the seed quality of safflower ( Carthamus tinctorius L.) cultivars. Australian Journal of Crop Science.8 (3): 455-459.
13. Lafond, G.P., Baker, R. J.1986. Effects of temperature, moisture stress, and seed size on germination of nine spring wheat cultivars. Crop Sci. 26:563-567
14. Martin, B.A., Smith, O.S., Neil, M.O. (1988). Relationships between laboratory germination tests and field emergence of maize inbreds. Crop Science. 28: 801-805.
15. Martin, C.R., Converse, H.H., Czuchajowska, A., Lai, F.S. and Pomeranz, Y. (1987). Breakage susceptibility and hardness of corn kernels of various size and shapes. Applied Engineering in Agriculture, 3, 104-113.
16. Perry, D. A. (1977). A vigour test for seeds of barley (*Hordeum vulgare*). Based on measurement of plumule growth. Seed Sci. and Techno. 5: 709-719.
17. Petersen, W.L., J.M. Perkins, and D.G. White. (1989). Evaluation of Captan as a seed treatment for corn. Plant Disease. 70:45-49.
18. Peterson, J.M., Perdomo, J.A. and Burris, J.S.(1995). Influence of kernel position, mechanical damage and controlled deterioration on estimates of hybrid maize seed quality. Seed Science and Technology, 23, 647-657.
19. Randhawa, G.S., Bains, D. S., Gill, G.S. (1973). The effects of the size of seed on the growth and development of wheat. J. Res. Punjab Agric. Univ. 10:291-295.
20. Shieh, W.J. and McDonald, M.B.(1982). The influence of seed size, Shape and treatment on inbred seed corn quality. Seed Science and Technology, 10, 307-313.
21. Taylor, A. G. (1997). Seed storage, germination and quality. The physiology of vegetable crops" Edited by H.C .Wien., 1-36.
22. Tekrony, D.M., Shande, T., Rucker, M. and Egli, D.B.(2005). Effect of seed shape on corn germination and vigor during warehouse and controlled environmental storage. Seed Sci& Technol., 33, 158-197.
23. Tyagi, C.S.(1992). Evalution of storability of soybean seed. Seeds and farms, 18: 8-11.