

THE TEST OF ACCELERATED AGEING TO ESTABLISH THE VIGOUR POTENTIAL IN MAIZE AND SUNFLOWER HYBRID SEED

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ABSTRACT

Temperature and humidity represent important factors that could affect the seed vigour. This study was carried out to reproduce those temperature and humidity conditions that could influence, after harvest, the seed vigour and would estimate the unfavourable effect of these factors using the accelerated ageing method at maize and sunflower hybrid seeds. The results obtained made evident that the aged seed germination suffered significant alterations compared to control sample variant. It has also been established a different response both from the hybrids and the lots within the same hybrid under the unfavourable effect of treatment. The increase of seed humidity and temperature in the seed lot caused by respiration process led to the loss of germination capacity and the decrease of their vigour. Using the accelerated ageing method with the purpose of simulating the storage of harvested maize and sunflower seeds at a high moisture content permitted the selection of biological material from the view point of its resistance to stress conditions.

Key words: sunflower, maize, germination, vigour, accelerated ageing.

INTRODUCTION

Temperature and humidity represent important factors that could affect the seed vigour.

The deterioration rhythm of the seed could be slow or rapid and it depends both on the genetic structure of the material and the treatments applied to the seed, but mostly, on the environmental factors during the storage.

Thus, a seed can have an accelerated ageing at a few days or weeks only, but it can be still young enough after a few years of storage.

Delouche and Baskin (1971, 1973) demonstrated that seed ageing process can be accelerated by temperature and humidity increase and elaborated consequently a method to test the storage capacity of the seeds.

The ageing method led to many other researches such as: estimation of seed vigour according to certain techniques of seed yield (Atta and Gaspar, 1984); prediction the plant emergence in the field (Mathews, 1980); prevention of some essential components of germination from destruction (Harrington, 1973);

the unfavourable influence of the storage conditions of wheat and rye harvested seeds (Slusanschi and colab., 1978; Cseresnyes and Băleanu, 1986; Cienska and Schneider, 1973).

This study was carried out to reproduce those temperature and humidity conditions that could influence, after harvest, the vigour of the seed and would estimate the unfavourable effect of these factors using the accelerated ageing method.

MATERIALS AND METHODS

Maize and sunflower hybrid seed samples taken from two different lots produced by RICIC Fundulea were used in this study.

Starting from Delouche and Baskin's method (1971, 1973) amended by Mathews (1980) and adapted to our environmental conditions by Cseresnyes (1985), the samples were submitted to ageing process by an increase of seed humidity at different levels and by keeping them afterwards in thermostats at 40^o temperature for 1 to 4 days.

During the treatment the seeds were closed in corked glass jars to avoid the humidity content variation.

The Romanian maize hybrids Şoim and Fundulea 365 and sunflower hybrids Favorit and Turbo were used in this experiment.

The ageing variants were the followings:

A. Seed humidity: 15%; 20%; 25%.

B. Ageing temperature: 40^oC.

C. Ageing time: one day; two days; three days; four days.

RESULTS AND DISCUSSIONS

The results obtained and processed by monofactorial analysis made evident the fact that aged seed germination suffered significant alterations compared to control sample variant.

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Also a different response of the hybrids and lots within the same hybrid under the unfavourable effect of the treatment was established. The seed germination didn't suffer significant alterations at Şoim hybrid, lot 1 with 15% and 20% humidity in a space of 0-96 hours.

A significant decrease of 5% of the seed germination was noticed at a humidity of 25% after a 0-96 hours interval (Figure 1).

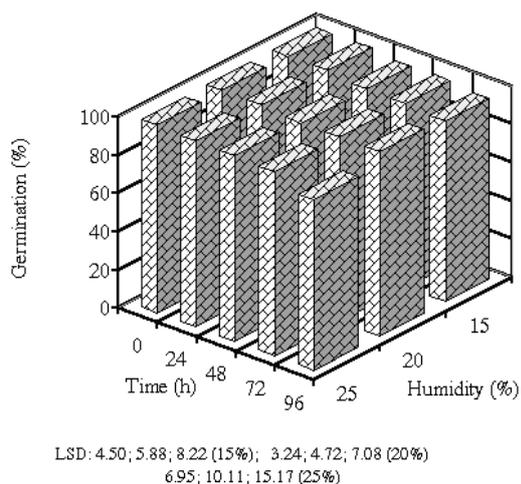


Figure 1. Vigour potential of maize hybrid seeds determined by accelerated ageing method (Şoim - Lot 1). Fundulea, 1997

The result obtained entitles us to advance the idea that seed vigour potential for this hybrid and its lot is quite high as the seeds tolerate a 25% humidity for 72 hours.

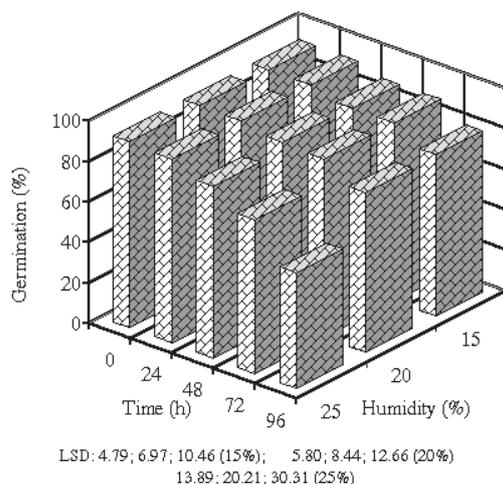


Figure 2. Vigour potential of maize hybrid seeds determined by accelerated ageing method (Şoim - Lot 2). Fundulea, 1997

As for lot 2 of the same hybrid distinct significant decreases were noticed starting with 15% humidity after 96 hours interval. At 25% humidity the germination was seriously affected beginning with the 72 hours interval (Figure 2).

Comparing the results of the two lots within the same hybrid one should say that they do have different vigour potentials; the stronger reaction to the unfavourable effect of the accelerated ageing treatment in the second lot is partially due to initial germination level (92% in comparison with 98% in the first lot).

The hybrid Fundulea 365, in lot 1, had a negative reaction beginning with 15% humidity after 96 hours of deterioration; these factors determined significant 6% decrease of the germination.

The germination is lower while the humidity is higher, the highest point being reached at a 25% humidity and 96 hours interval when the decrease is distinctly significant (53%) (Figure 3).

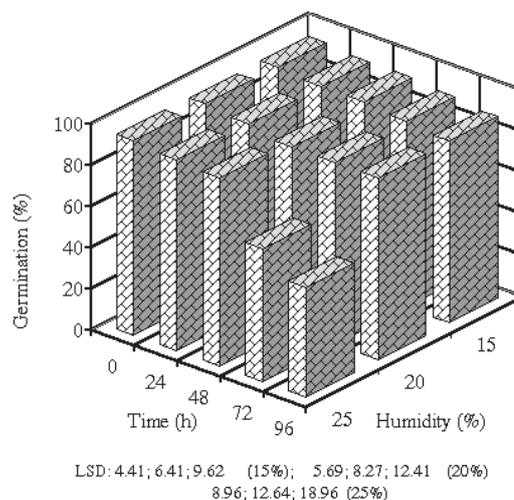


Figure 3. Vigour potential of maize hybrid seeds determined by accelerated ageing method (F 365 - Lot 1). Fundulea, 1997

In lot number 2 of the hybrid Fundulea 365 distinct significant decreases of the germination were noticed during the 72-96 hours interval at a 25% humidity only; this proves that this seed has a higher vigour potential (Figure 4).

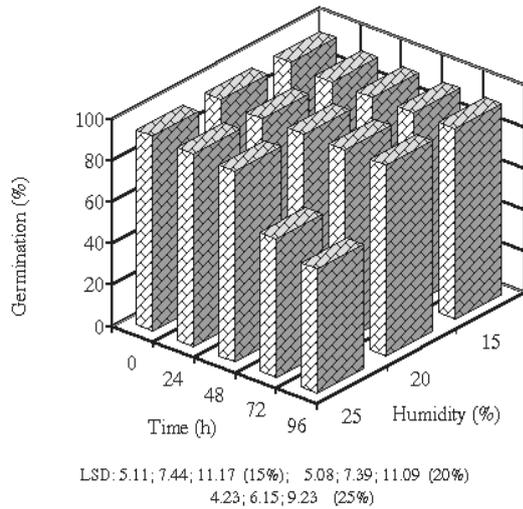


Figure 4. Vigour potential of maize hybrid seeds determined by accelerated ageing method (F 365 - Lot 2). Fundulea, 1997

The application of accelerated ageing method for sunflower hybrid seeds pointed out the genotype and lot with the lowest resistance under unfavourable conditions of temperature and humidity.

Within Favorit hybrid the highest limit of resistance is that of 15% humidity only, for a 0-24 hours interval; after 48 hours the decreases are clearly significant with all the variants of humidity reaching a decrease of germination of 44% (Figures 5 and 6).

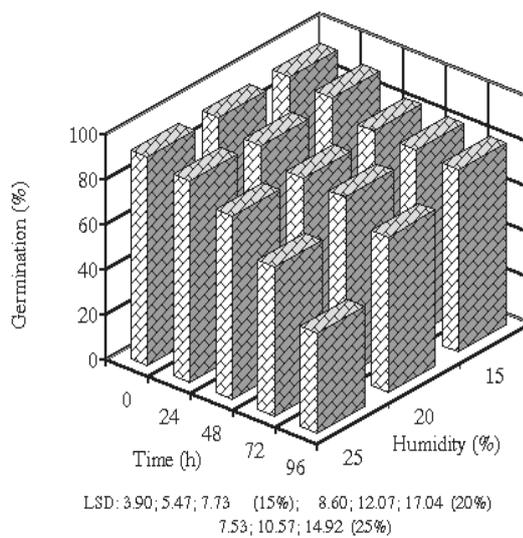


Figure 5. Vigour potential of sunflower hybrid seeds determined by accelerated ageing method (Favorit - Lot 1). Fundulea, 1997

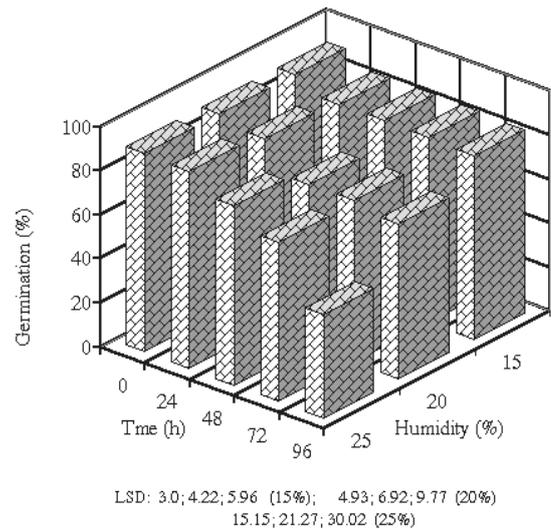


Figure 6. Vigour potential of sunflower hybrid seeds determined by accelerated ageing method (Favorit - Lot 2). Fundulea, 1997

The germination decrease for Turbo in both lots is quite significant beginning with a 24-96 hours interval and 15% and 20% humidity, reaching a 26-23% value of germination at the humidity of 25% and after 96 hours interval (figures 7 and 8).

Comparing the two genotypes of sunflower as well as maize we notice that the lowest vigour potential was recorded for the lot and hybrid with the lowest initial germination.

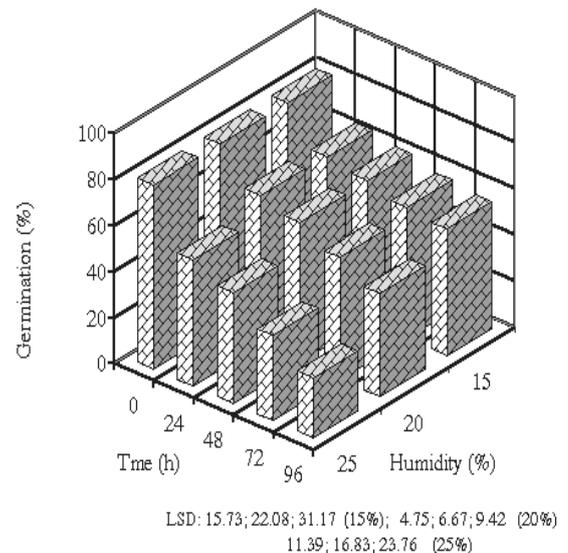


Figure 7. Vigour potential of sunflower hybrid seeds determined by accelerated ageing method (Turbo - Lot 1). Fundulea, 1997

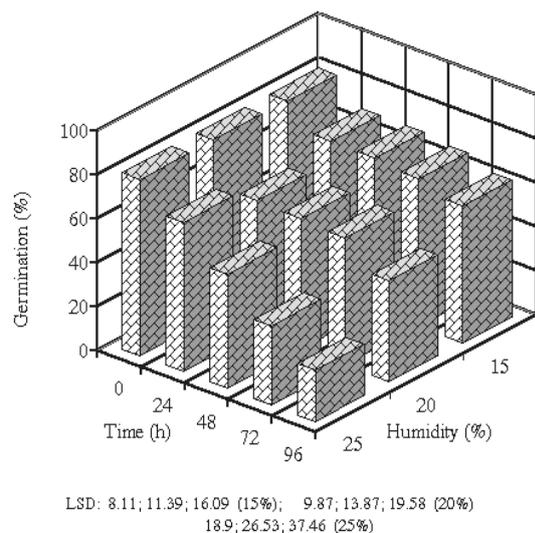


Figure 8. Vigour potential of sunflower hybrid seeds determined by accelerated ageing method (Turbo - Lot 2). Fundulea, 1997

CONCLUSIONS

The increase of seed humidity and temperature in the seed lots caused by respiration process led to the loss of germination capacity and the decrease of seed vigour.

Using the accelerated ageing method with the purpose of simulating the storage of harvested maize and sunflower seeds at a high moisture content permitted a selection of bio-

logical material from the point of view of its resistance to stress conditions.

By means of the test, the upper limit of hybrid resistance was pointed out and the treatment and storage priorities could be properly classified.

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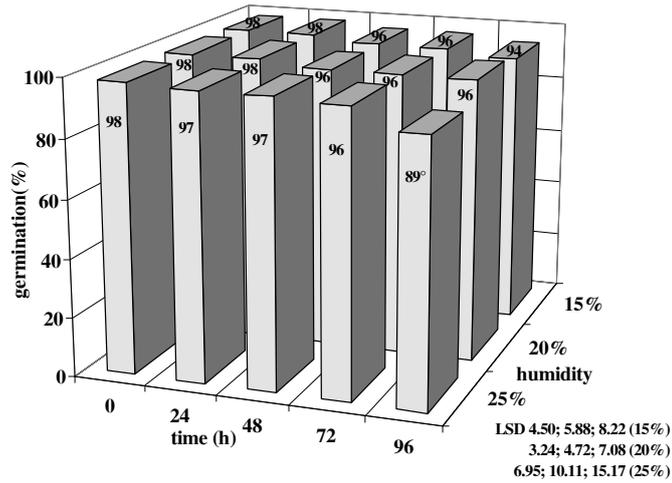


Figure 1. Vigour potential of maize hybrid seeds determined by accelerated ageing method Şoim - Lot 1 - Fundulea, 1997.

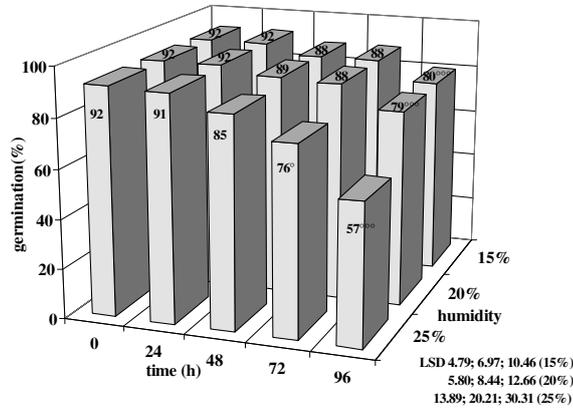


Figure 2. Vigour of maize hybrid seeds determined by accelerated ageing method Şoim - Lot 2 - Fundulea, 1997.

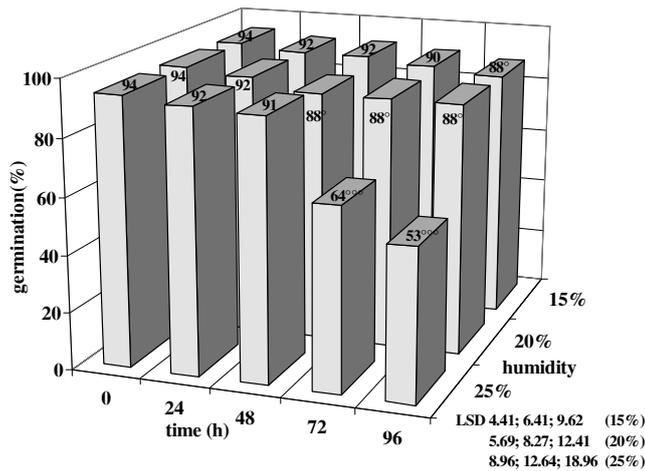


Figure 3. Vigour potential of maize hybrid seeds determined by accelerated ageing method F 365 - Lot 1 - Fundulea, 1997

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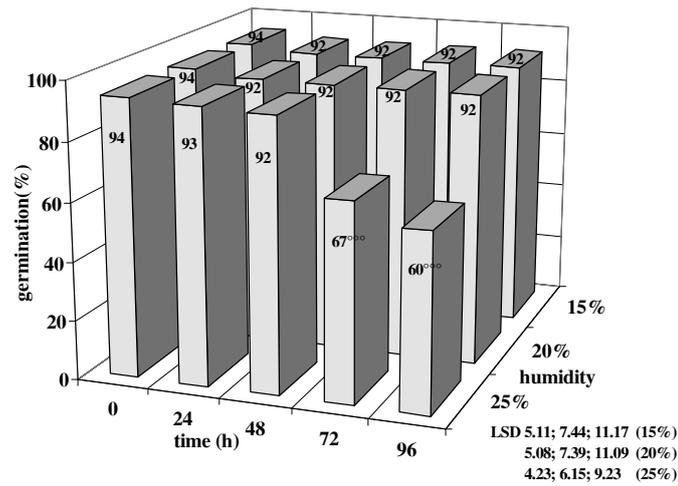


Figure 4. Vigour potential of maize hybrid seeds determined by accelerated ageing method F 365 - Lot 2 - Fundulea, 1997

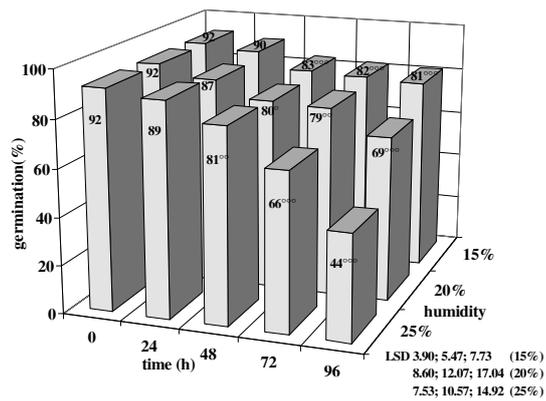


Figure 5. Vigour potential of maize hybrid seeds determined by accelerated ageing method Favorit - Lot 1 - Fundulea, 1997

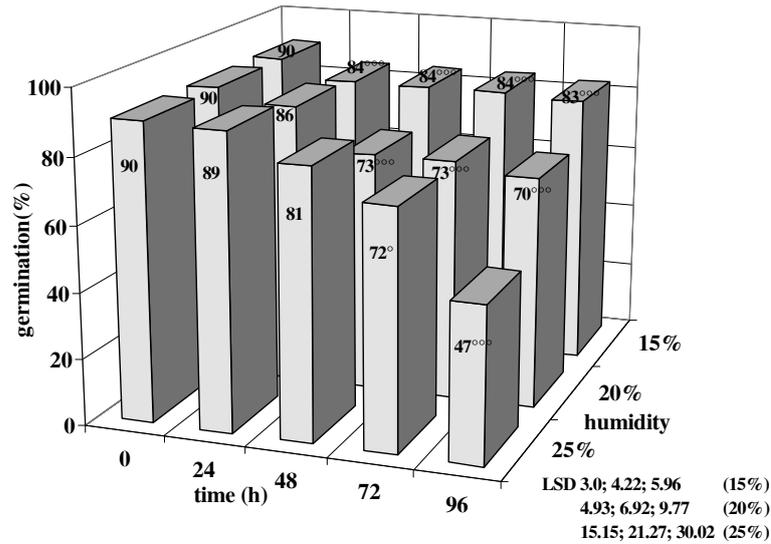


Figure 6. Vigour potential of maize hybrid seeds determined by accelerated ageing method Favorit - Lot 2 - Fundulea, 1997

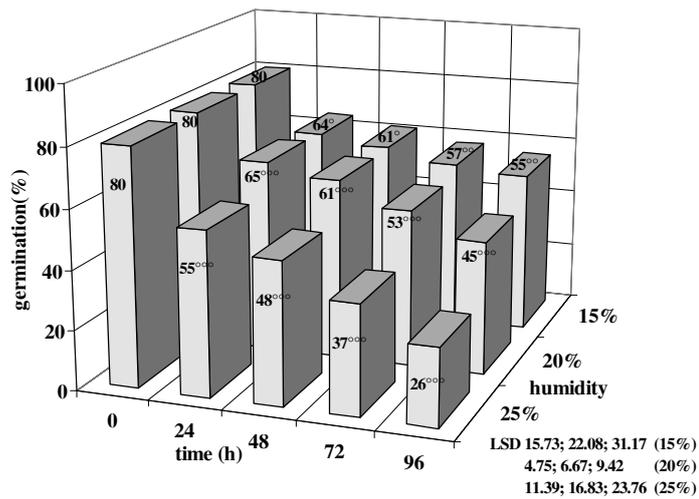


Figure 7. Vigour potential of maize hybrid seeds determined by accelerated ageing method Turbo - Lot 1 - Fundulea, 1997

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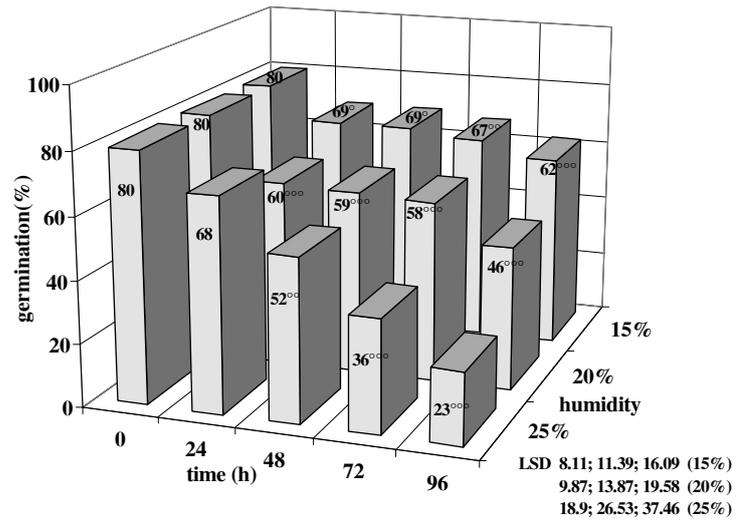


Figure 8. Vigour potential of maize hybrid seeds determined by accelerated ageing method Turbo - Lot 2 - Fundulea, 1997