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Variation of maize (*Zea mays* L.) hybrids on the decline of germination

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Abstract Corn seed has a chemical composition that defines it as a valuable food for humans and a basic animal feed. The seed, by its attributes, makes the success of any agricultural crop conditional, being an essential lever in the dimensioning of the level and quality of agricultural produce. It implies identity and quality, as well as the existence of a genetic load that ensures adaptability to determined purposes and areas. As with any living organism, reproduction, aging and then death is a complex phenomenon developed throughout life within the seed, which includes not only her life but also hereditary properties of the plant that are of particular importance in the production potential. Seed quality is a complex of attributes influenced by genetic factors, factors during the development of the mother plant, factors during harvesting, conditioning, preservation, as well as those regarding the physical and sanitary health of the seed. Turda Favorit has an initial average germination of 95.5% and Turda 201 with an initial average germination of 97%. Assessed by the magnitude of the damage rate, the Turda 201 hybrid, has a rate ($5.3x10^{-4}$), higher than the Turda Favorit ($4.5x10^{-4}$), which is clearly visible after the slope of the two plotted dependencies. A good behavior of the Turda 200 hybrid in this environment, with a low rate of only $2.7x10^{-4}$.

Key words

maize, seed, germination, decline, damage rate

Seed quality is a complex of attributes influenced by genetic factors, factors during the development of the mother plant, factors during harvesting, conditioning, preservation, as well as those regarding the physical and sanitary health of the seed.

In the literature, the first document that makes observations about seed quality is that of NOBBLE (1876) who proposed a procedure for the determination of germination [5]. Numerous studies have documented genetic variability composition traits in maize [3, 1].but breed- ing progress has been limited by an apparent inverse genetic relationship between grain yield and protein concentration in the cereals [2].

The chemical components are spread unevenly in the grain. In the endosperm, 80% of the crude protein of the bean is found, although the endosperm represents 84% of the bean mass, while the embryo is 16.9% of the total protein, although the embryo accounts for only 10% of the grain mass. Also found in the embryo are 68.6% of maize oil and 62.5% of mineral salts.

Glucids, which account for about 75% of the grain, are mostly made up of 80% starch, which is 98% in the endosperm. The other ingredients are sugars and dextrins (3%), pentozans (6%) and cellulose (3%). Sugars are: 70% embryo, 28% endosperm and 2% tegument [8].

Maize has a higher fat content than other grains. Most of the lipids are found in the embryo (about 80% of the total). By degerminating the beans used in the spirits industry or for the production of fine grain, the embryos from which the maize is extracted [7].are separated.

Corn kernels for consumption after drying for good preservation avoiding the possibility of contamination with mycotoxins must have a moisture content below 14.5% and maize seed intended for sowing in order to preserve seminal qualities should be dried at moisture below 12% [6].

The accelerated aging test has been shown to correlate with seedling emergence [4].The accelerated aging and leachate conductivity tests detected low vigor resulting from immature seeds in sweet corn [9].). Wilson et al. (1992) suggested combining the accelerated aging, leachate conductivity, and other vigor tests to develop a multiple regression model for prediction of final stand in sweet corn

Material and Method

The hybrids under study were produced on a soil with a clay-loam texture, with a neutral pH on 0-20 cm and a poor acidity on 20-40 cm of depth, good and very good supply of NPK and microelements soil humus content being medium, according to analyses carried out by the specialized laboratory. In order to better outline the differences between hybrids and a more accurate assessment of them after a certain retention time, we will use the graphical method.

Results and Discussions

Initial germinations of the hybrids are different in the "before sowing" phase, considered as the initial moment. This classifies the hybrids from the start as being different in terms of quality, judged only by the germination indicator. From the representation of the regression lines describing the decline of germination for each hybrid, during storage, there are different reactions of them, which means that the decline of germination of the seed lots does not develop with the same intensity for all hybrids.

Example Turda Favorit has an initial average germination of 95.5% and Turda 201 with an initial average germination of 97%.

Depending on the magnitude of the damage rate, the Turda 201 hybrid, has a rate ($5.3x10^{-4}$), higher than Turda Favorit ($4.5x10^{-4}$), which is clearly visible after the slope of the two plotted dependencies (Figure 1).

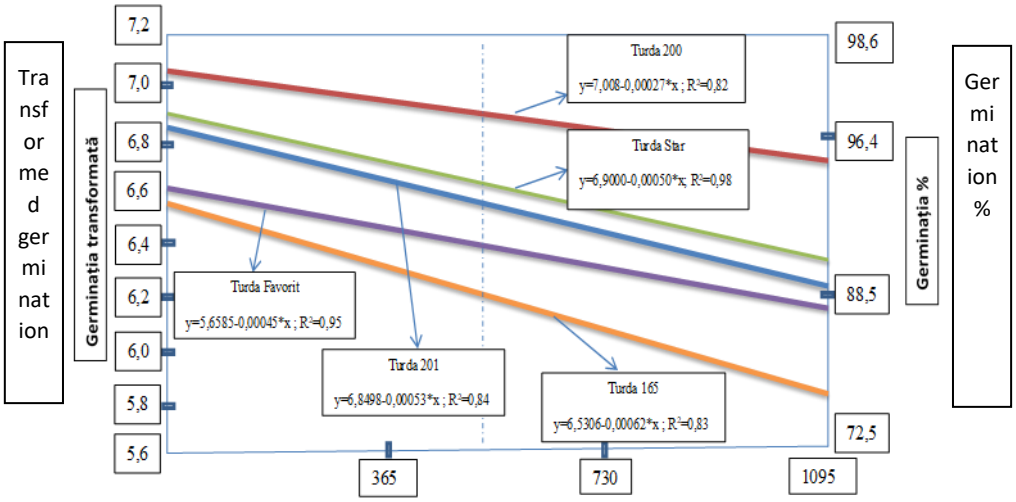

Fig. 1. Slope (rate) of damage to untreated seed lots of studied hybrids, stored in open space

Graphics show good behavior of the Turda 200 hybrid in this environment, with a low rate of only $2.7x10^{-4}$.

The graphic profile was plotted in an experimental version where the seed was treated with a fungicide+insecticide, which proved to be a variant with external stress. From the graph (Figure 2) you can easily see the different reactions of the behavior of these hybrids.

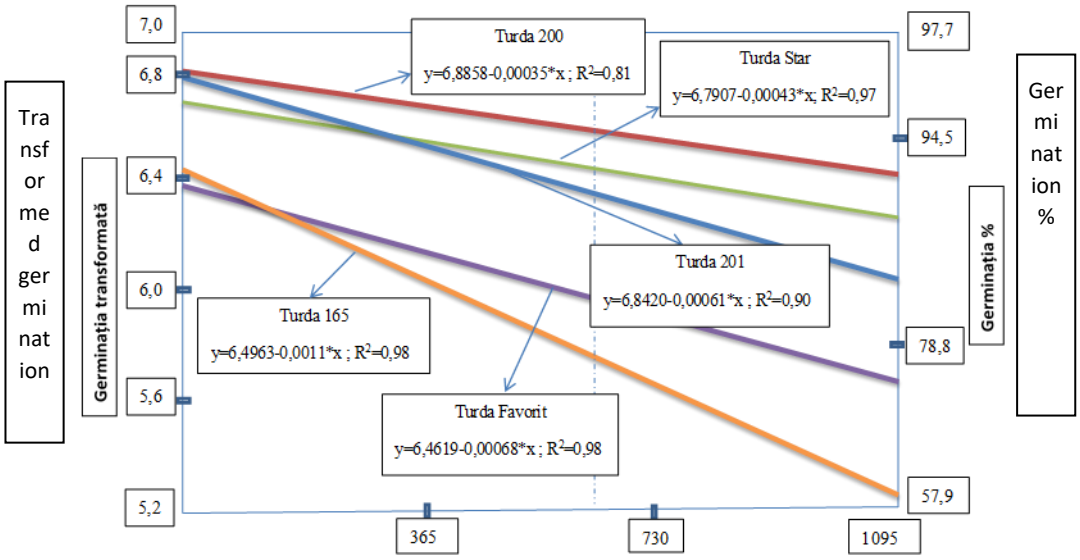

Fig. 2. The rate of deterioration of seed lots treated with fungicid + insecticid from studied hybrids, stored in open space

For example, in a comparative study of Turda-200 with initial germination Gi = 97.5% in this variant and Turda-201 with initial germination Gi = 96%, appreciated by deterioration rates, there is a very large difference. The low rate of $3.5x10^{-4}$ for Turda-200 describes it as a stress-resistant hybrid against Turda 201 with a damage rate of $6.3x10^{-4}$.

Another example is that between Turda Favorit with the initial average germination in this experimental variant of 94% close to that of Turda 165 with the initial germination of 93.25%. So insignificant differences between germination but with very significant differences in the rate of deterioration, for the Turda Favorit of $6.8x10^{-4}$ versus $11x10^{-4}$ for Turda 165.

Further, the change in the rate of decline with the retention time for two corn hybrids, Turda 200 (Figure 3) and the Turda Favorit hybrid (Figure 4), the newest hybrid created, was studied. Both hybrids show good preservation of the initial germinations, in the fungicide-treated version, with a low rate of almost equal decline for both hybrids ($\approx 2x10^{-4}$).

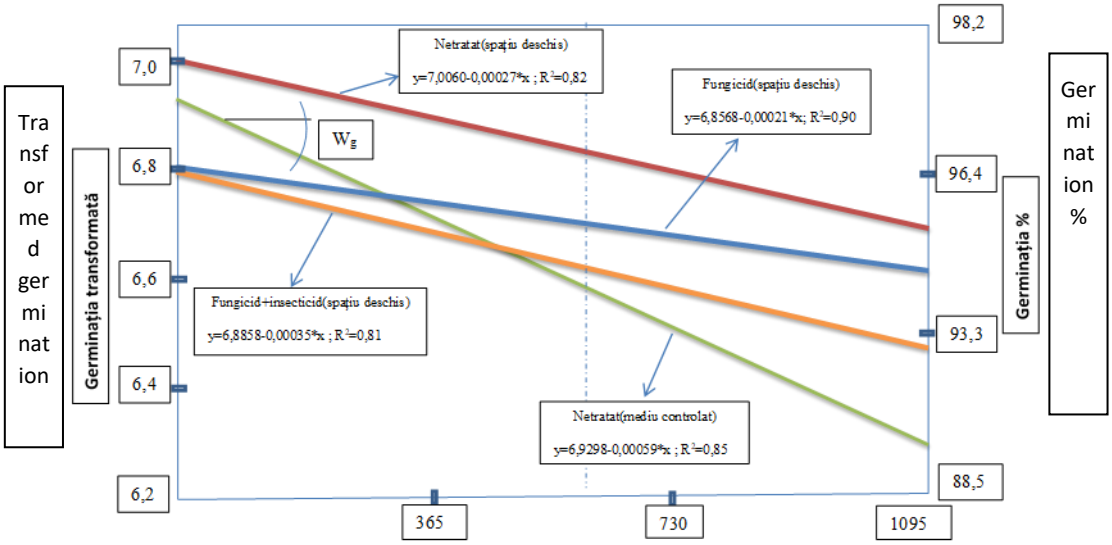

Fig. 3. Decline slope (rate) of treated and untreated seeds, lots stored in different environments

In the controlled environment variant, considered as a variant of stress, as well as in the fungicide + insecticide version, proved to be ultimately a variant of external stress, the Turda Favorit hybrid registered almost double

the rate of decline germination versus standard (untreated storage in open space).
Small decreases in the decline rate are recorded for Turda 200 corn. In the untreated seed stored in open space, the rate of decline during storage is $2.7x10^{-4}$ and in the controlled environment increase to $3,5x10^{-4}$.
In the case of Turda Favorit maize, there is an intensification of the deterioration process in these two variants considered as external stress variants, judged by the increase in the rate of decline of $6.8x10^{-4}$ in the controlled environment and $8.4x10^{-4}$ in the variant treated with fungicide + insecticide, compared to the relatively low rate of decline recorded in the standard version of $2x10^{-4}$.

The graphs shown in Figures 3 and 4 reveal a phenomenon difficult to highlight by other procedures. In the case of the Turda 200 hybrid with the fungicide treatment of stored seeds, the normal aging process was very poorly influenced, quantified by the magnitude of the coefficient measuring the rate of decline. From the graph, it can be seen that by treating the Turda 200 hybrid seed the germination rate decreases very little from $d = 2.7x10^{-4}$ to $d = 2.1x10^{-4}$. Instead, in the case of the Turda Favorit hybrid by treating the seeds with fungicide, the decline rate decreases more than doubled, from $d = 4.5x10^{-4}$ to $2x10^{-4}$.

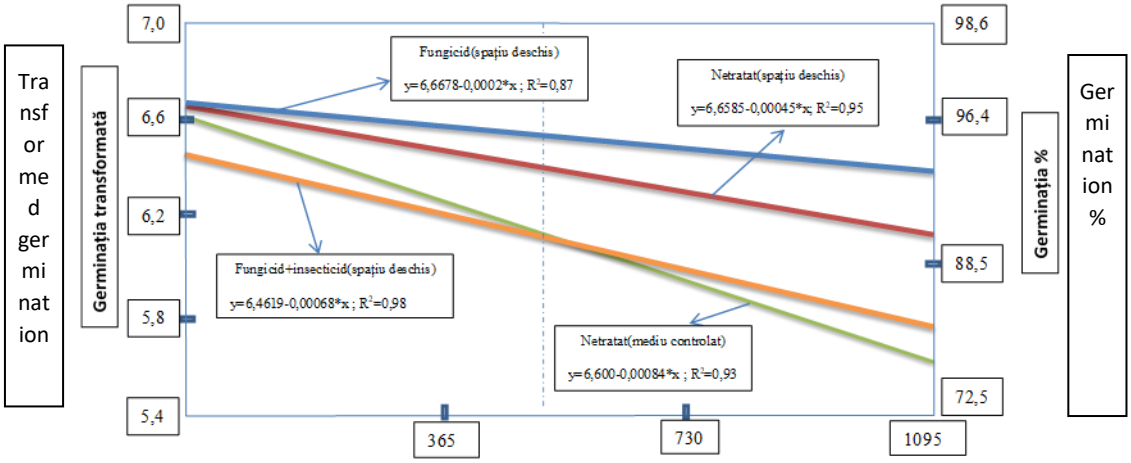

Fig. 4. The rate of deterioration of treated and untreated Turda Favorit seed lots stored in different environment

Following the determination for each hybrid and the experimental condition of the equivalences of viability and assessing the size of the decline of seed belonging to the hybrids through the deterioration rate, it can be said that:
- Seed deflection is a natural process involving chemical, biochemical and physiological changes with consequences on its viability.
-developing a complex equation of seed viability makes it possible to predict the seed germination of the hybrids studied at any given time, after a retention period, useful information for the seed industry, avoiding the downgrading of lots as a result of the decrease in germination below the permissible limit, with consequences in terms of economic and production safety.
- considering the slope of the regression line of the viability equations with the rate of germination decline (d = tg w), during the retention period, the hybrids could be classified and ordered according to their size, revealing different reactions regarding the conservation of the original qualities regarding storage conditions.
- the "d" indicator - the damage, highlights a difficult aspect to be found by other methods, namely genotypes with a higher initial germination in certain environments, but records during storage decay rates much higher than those with a germination initially inferior.
For example, we show that Turda 201 has a 96% initial germination in controlled medium versus Turda 165 with 92% initial germination, but the Turda 201 hybrid seed conservation rate is $d = 12.6x10^{-4}$, much higher than calculated for the Turda 165 hybrid where the rate is $d = 8.1x10^{-4}$.

Conclusions

The aging process of seeds does not flow with the same intensity for all hybrids. By evaluating and calculating the decline rate d = tg w, appreciated by the slope of the regression line, it is demonstrated that by controlling and guiding the storage environment factors the longevity of the seed lots can be increased.
For example, in the case of Turda Favorit, the low value recorded for the decline rate for fungicide-treated seeds ($d = 2x10^{-4}$) compared to the variant where the seed was not treated ($d = 4.5x10^{-4}$).

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