TESTING *FESTUCA ARUNDINACEA* SEEDS DURING STORAGE

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Abstract: *Changes in cellular metabolism, whether caused by nutrition deficiencies or improper storage conditions, result in inefficient germination physiology (BUSTAMANTE L. et al., 1984., MIRDAD Z. et al., 2006, STANISAVLJEVIC R. et al. 2010). The aim of the present study was to examine the relation among the parameters that influence seed storability in the granary, for variety Palma of Festuca arundinacea. The seed for this variety was produced under the conditions characteristic for Banat area, in the west of Romania. The samples we analysed were taken from the granary where tall fescue seeds are kept. We took samples five months after harvest, during three consecutive years, namely: 2009, 2010 and 2011. For the analysis, we took several samples from the granary; these samples were combined and we extracted the lab sample for determining the purity, germination and the moisture sample. Germination testing was made in compliance with the current ISTA rules (International Seed Testing Association (ISTA)-2002) and Order SR 1634. We determined the following: germination (%/number), pure seeds (%weight) and moisture content (%). In order to determine the germination of Festuca arundinacea seeds, we used the TP-top of paper method. The following categories were highlighted on the germination layer: normal seedlings; abnormal seedlings; dead seeds. The results obtained while testing germination in the three consecutive years led us to the conclusion that improper storage conditions, i.e. increased moisture, influence germination percentage for variety Palma of Festuca arundinacea. Moisture content and dead seeds influence abnormal seedlings in a direct way. The poorest results from the point of view of the parameters we studied were recorded in 2009, while the best results were recorded in 2011. The relay index shows the similarities between years 2010 and 2011 (relay index for 2010 was 1.8183 and for 2011 it was 2), when the germination percentage was the highest. The assessment of germination, moisture and purity for variety Palma of Festuca arundinacea, grown in the conditions present in România, by the firm SC.Zanandreea Sementi, brings more information on the behaviour of this variety during storage.*

Key words: *Germination, purity, moisture, storage, Festuca arundinacea.*

INTRODUCTION

Changes in cellular metabolism, determined by nutrition deficiencies or by improper storage conditions, lead to inefficient germination physiology (BUSTAMANTE L. et al., 1984, COOKSON W.R. et al. 2001).

This characteristic includes two aspects: ripening degree at harvest and damage that occurs during storage. It is common knowledge that the more ripe seeds are at harvest, the stronger they are and the faster their sprouts grow (MIRDAD Z. et al., 2006., HONGFEI LU. et al. 2008, ZAMAN K. A. et al., 2010).

Ripening is a complex enzymatic and biochemical process resulting in the breakage of non-deep physiological dormancy. For tall fescue, ripening continues during storage and germination reaches the maximum values three months after the seeds were harvested. (STANISAVLJEVIC R. et al. 2010).

The seeds under study, coming from plants of *Festuca arundinacea* (Palma variety) were analysed five months after harvest, therefore the ripening was complete. In this situation, the weak germination is caused by improper storage conditions.

MATERIAL AND METHODS

The biologic material we used included seeds of *Festuca arundinacea* (Palma variety) obtained under the climate and soil conditions of Banat- România. Seed samples were taken from the granary, five months after harvest, in three consecutive years: 2009, 2010 and 2011.

The research conducted at the Inspectorate for Quality Seed and Seedlings Timis (ITCSMS) implied a large number of determinations and observations using state-of-the-art equipment. The method used (TP-top of paper) for making the determinations complies with the rules of the International Seed testing Association (ISTA), to which ITCSMS is affiliated.

For the analysis, we took several samples from the granary; these samples were combined and we extracted the lab sample for determining the purity, germination and the moisture sample.

For the laboratory analysis we used 250g seeds of *Festuca arundinacea* (Palma variety). The humidity sample was obtained by combining the elementary samples.

In order to assess the initial quality of the samples under study, we made the following determinations: moisture (%), germination on filter paper (germination energy, germination faculty) (%). We also determined seed vigour (normal seedlings, seedling weight, dry matter, after the final evaluation) (% and gravimetric). It is worth noting that the present paper does not present all of these aspects.

Moisture determination was performed in the drying chamber, in 8 cm diameter capsules. Two subsamples were analysed. The weighing, before and after drying, had a precision of three decimals, and the final result was reported in compliance with ISTA (International Seed Testing Association) regulation

The drying temperature was 130 ^{0}C, it was left to dry for 1 hour and the cooling time in the desiccator was 45 minutes.

Moisture value was calculated with the formula:

$$U(\%) = (M2-M3)*100/(M2-M1)$$

Where:

- M1 = the weight of the capsule with the lid, in grams;
- M2 = the weight of the capsule with the lid and the content before drying, in grams;
- M3 = the weight of the capsule with the lid and the content after drying, in grams.

In order to determine seed germination for *Festuca arundinacea* (Palma variety), we used the TP-top of paper method (International Seed Testing Association (ISTA)-2002, SR 1624, 2003).

In this method, the seeds are placed on the surface of the industrial filter paper in Petri dishes. The paper layer is moistened at first at maximum capacity and the dishes are covered with a glass lid after each repetition, to reduce evaporation.

The samples are introduced in the germination device at alternant temperature, 20-30 °C. Higher temperatures alternate with a lower temperature. The seeds placed for germination are kept at the lower temperature (20°C) for 16 hours, and another 8 hours at the higher temperature, 30°C. Temperatures are changed gradually, in 3 hours.

For each variant, the determination was performed in four repetitions of 100 seeds each.

Germination testing was made in compliance with the current ISTA rules (International Seed Testing Association (ISTA)-2002) and Order SR 1634. We determined the following: germination (%/number), pure seeds (%/weight) and moisture content (%).

In order to determine the germination of *Festuca arundinacea* seeds, we used the TP-

top of paper method.

The following categories were highlighted on the germination layer: normal seedlings; abnormal seedlings; dead seeds. The evaluation of normal seedlings was performed 11 days after the seeds had been placed in the germination device.

Statistical analysis:

The statistical evaluation of the experimental data was made using MVSP 3.1 and PAST 2.14.

The analyses were done using two models: cluster analysis and correspondence analysis – relay plot.

Cluster Analysis is a statistical method that groups data objects based on information found in the data that describes the objects and their relationship (http://www-users.cs.umn.edu/~kumar/dmbook/ch8.pdf).

The cluster analysis was performed using two-way clustering, based on the average distance between all members in the two groups (Hammer et all, 2001).

Relay plot is a composite diagram with one plot per column. The plots are ordered according to Correspondence Analysis column scores.

Each data point is plotted with CA first-axis row scores on the vertical axis, and the original data point value (abundance) in the given column on the horizontal axis (Hammer et all, 2001).

RESULTS AND DISCUSSION

The present paper assesses eight seed parameters (Pure seeds, Inert matter, Other crop seeds, Total Germination, Normal seedlings, Abnormal seedlings, Dead seeds, Moisture content) and the way in which they influence seed storability for Palma variety of *Festuca arundinacea*. Figure 1 presents these seed parameters grouped according to their similitude.

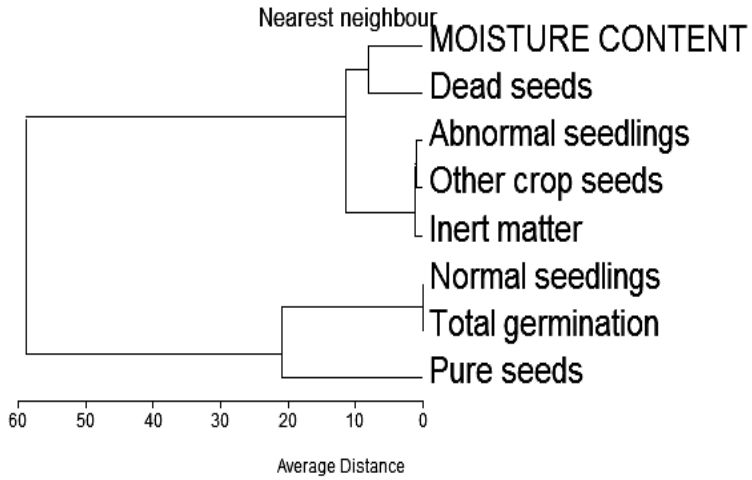

Figure 1. Cluster analysis of the parameters under study

Studying the clusters presented in figure 1 we can state that Normal seedlings is the parameter which that has the greatest influence on total germination. At the same time, moisture content and dead seeds influence directly the abnormal matter as well as total

germination and pure seeds parameter.

It is well-known that moisture is a very important factor for maintaining the quality of a batch of seeds during storage (WANG Y.R., 2001, PALADA FLORINA, 2009).

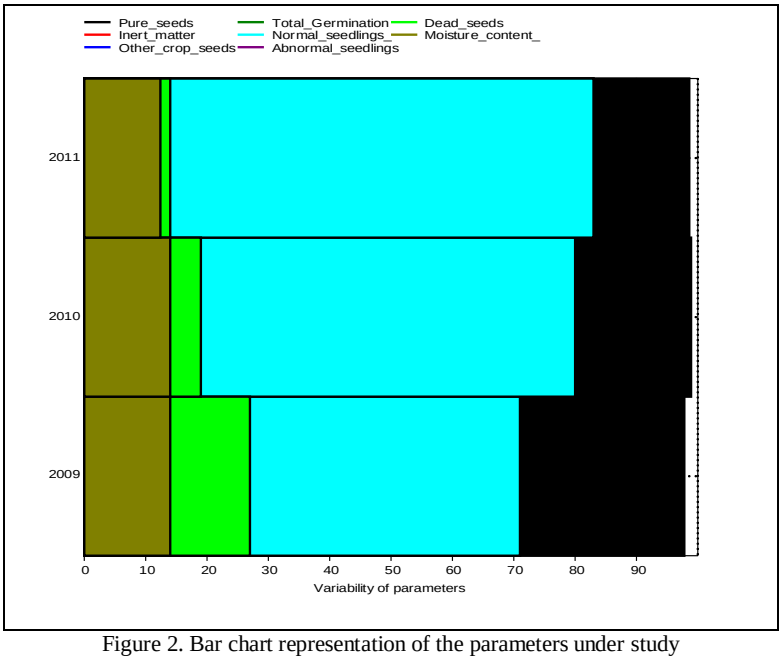

Figure 2. Bar chart representation of the parameters under study

Designation: 2009: high number of dead seeds, low number of normal seedlings, few pure seeds

2010: medium high number of death seeds, medium low number of normal seedlings, but high number of pure seeds

2011: lowest number of dead seeds, highest number of normal seedlings.

Figure 2 show that the moisture parameter has small variation amplitude from one year to another in 2009 - 2011 experimental cycles. However, germination faculty, expressed in percentage of normal seedlings, presents higher variation amplitude from one year to the other, in relation with storage conditions. The same holds good for dead seeds, the percentage of which drops when the percentage of normal seedlings is increased.

According to figure 3, moisture content influences the number of dead seeds; the number of normal seedlings seems to be influenced by the number of pure seeds.

In 2009, the purity of tall fescue seeds was 97.8%, while inert matter represented 0.10% and seeds of other species represented 2.1% of the total. Five months after harvest, under storage conditions that were not assessed in the granary, seed germination reached 71%, with 14% moisture.

In 2010, seed purity was 98.90%, which proves the fact that in that particular year, seed crops were better organized. Upon germination analysis of the samples taken from the granary, we noticed that, five months after harvest, seed germination was 80%.

The highest germination values (83%) and the lowest moisture values (12.4%) were recorded in 2011.

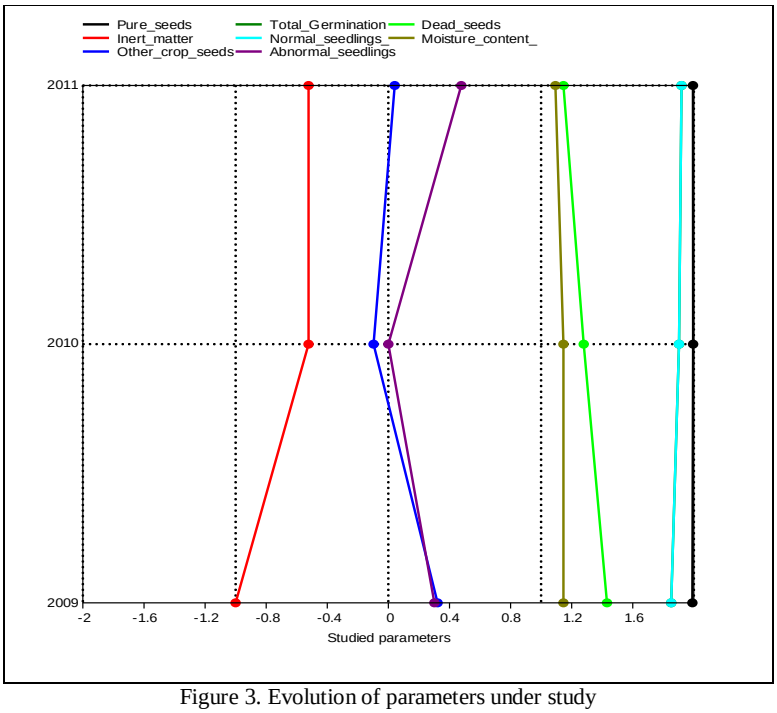

Figure 3. Evolution of parameters under study

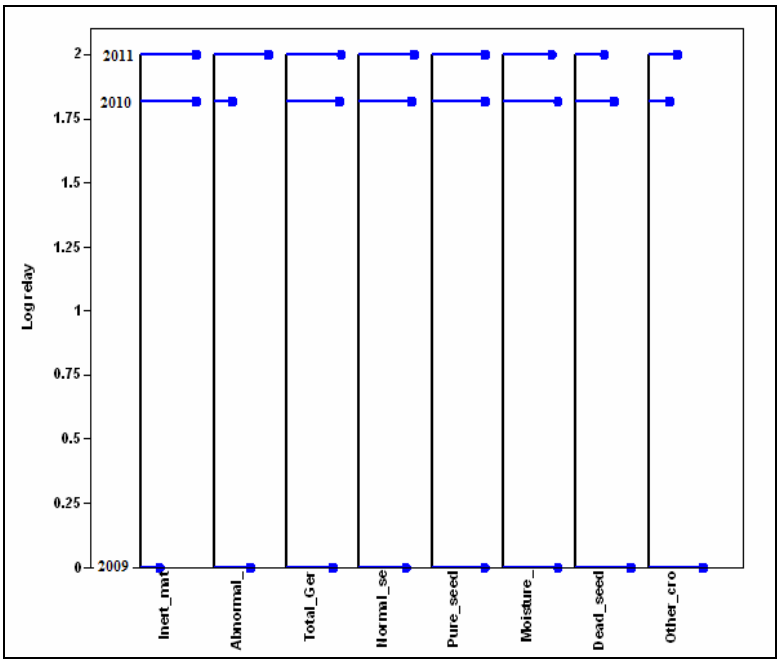

Figure 4. The correlation correspondence using relay index

The correspondence analysis (Figure 4) presents 85.569 % of the total on the first axis distribution. The relay index reveals the similarities between years 2010 and 2011 (relay index for 2010: 1.8183 and for 2011: 2), years that were represented by higher germination rate.

These poor results can be explained by poor storage conditions, and in our particular case this materialized in failure of the air system, which happened in 2009. Other studies in the same field (BUSTAMANTE L. et al., 1984, MIRDAD Z. et al., 2006, HAN J.G. et al., 1995) lead to the same idea, namely that unsuitable storage conditions cause seed damage and thus to poor germination.

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CONCLUSIONS

The assessment of germination, moisture and purity for Palma variety of *Festuca arundinacea*, cultivated under the conditions in Banat, România, by SC. Zanandreea Sementi, brings more information regarding the behaviour of this variety during storage.

The results obtained upon germination testing in the three years of study leads us to the following conclusions:

- unsuitable storage conditions, particularly increased moisture, affect the germination percentage for Palma variety of *Festuca arundinacea*. Thus, moisture content influences the number of dead seeds.
- moisture and dead seeds influence directly abnormal seedlings;
- the number of normal seedlings seems to be influenced by the number of pure seeds;
- the worst results in regard to the values of the parameters under study, were recorded in 2011. Relay index reveals the similarities between years 2010 and 2011 (relay index for 2010: 1.8183 and for 2011: 2). 2011 is the year when germination percentage was highest.

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