

## INFLUENCE OF LOW TEMPERATURE AND FLUORESCENT LIGHT ON THE CEREAL SEEDS DURING THE GERMINATION TESTS

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**ABSTRACT** – Testing the capacity of the cereal seeds to produce plants in the fields, by germinating under the best laboratory conditions, had as goal to assess their quality for sowing, commercialization or long-time conservation. The experimental biologic material was represented by twelve oat genotypes, eighteen barley genotypes and twenty rye genotypes from the seed collection, stored in the Suceava Genebank. The germination tests were carried out in laboratory, on the artificial substrate made of filter paper, by the BP (between paper) method, under two experiencing conditions. The scientific grounding of results was done through the correlation between the germination capacity of the cereal seeds at dark and the germination capacity under fluorescent light and low temperature, before incubation. The differences found in the germination percents of each species pointed out the role of fluorescent light and low temperature, a significant correlation between viability seed and the two factors in barley being found, as compared to the other tested species. In the routine tests from seed control laboratories, they may successfully use the low temperature treatment in barley, before incubation, and the exposure at fluorescent light, during incubation, even if this species is no longer found at germination repose. Percent increases in the germinating capacity were registered.

**Key words:** genotype, germination, seeds, fluorescent light, filter paper

**REZUMAT** - Influența temperaturii scăzute și a luminii fluorescente asupra semințelor de cereale păioase în timpul testelor de germinație. Testarea capacității semințelor de cereale păioase de a produce plante în câmp, prin efectuarea germinației în condiții optime de laborator, are drept scop aprecierea calității acestora pentru semănat, comercializare sau conservare de lungă durată. Materialul biologic ales pentru experimentare a fost reprezentat de 12 genotipuri de ovăz, 18 genotipuri de orz și 20 de genotipuri de secară din colecția de

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semințe conservată la Banca de Resurse Genetice Vegetale Suceava. Testele de germinație s-au realizat în laborator pe substrat artificial prin metoda BP (between paper), în două condiții de experimentare. Fundamentarea științifică a rezultatelor s-a realizat prin corelația între facultatea germinativă a semințelor de cereale păioase în condiții de întuneric și facultatea germinativă în condiții de lumină fluorescentă și temperatură scăzută o perioadă de timp înainte de incubare. Prin apariția unor diferențieri în procente de germinație la fiecare specie s-a urmărit rolul luminii și al temperaturii scăzute, constatându-se existența unei corelații destul de strânse între viabilitatea seminței și cei doi factori la orz, comparativ cu celelalte specii testate. În analizele de rutină din laboratoarele de control al semințelor, în testele de germinație se poate folosi cu succes tratamentul cu temperaturi scăzute la orz, înainte de incubare o perioadă de timp, și expunerea la lumină fluorescentă în timpul incubării, chiar dacă specia nu mai este în repaus germinativ, înregistrându-se creșteri procentuale ale facultății germinative.

**Cuvinte cheie:** genotip, germinație, semințe, lumină fluorescentă, hârtie de filtru

## **INTRODUCTION**

Testing the capacity of cereal seeds to produce plants in the fields, by germinating under the best laboratory conditions, has as goal to assess the seed quality for sowing, commercialization or long-term conservation.

The economic importance of the studied species and their cultivation on great areas in farms and on small areas in households requires the knowledge of the seed efficiency for determining the sowing norms. During the germination time, the low temperature is the main means of activating gibberellins for the interruption of the germination repose and the stimulation of rising, by the action on seed covers, thus increasing their permeability to gases (Shepley and Varner, 1973; Evernary, 1965). In addition, our research had as goal testing the factors involved in the stimulation of the germination capacity, by establishing the correlation between the results of germination tests and the action of these factors.

## **MATERIALS AND METHODS**

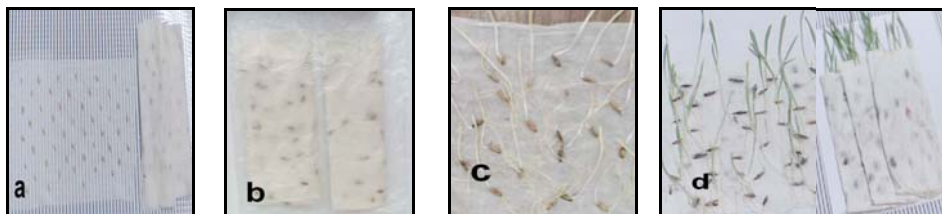
The experimental biologic material was represented by twelve oat genotypes, eighteen barley genotypes and twenty rye genotypes from the seed collection, stored in the Suceava Genebank. These genotypes were regenerated and multiplied in the experimental field, under the climatic conditions of the year 2007.

The germination tests were conducted in laboratory on the artificial substrate, made of filter paper, by the BP (between paper) method (STAS 1634-82).

We have sampled 150 seeds, which were germinated in three replicates, between two layers of paper moistened with distilled water. These were packed as rollers, which were introduced in plastic bags (*Picture 1 a, b*).

## TESTING THE CAPACITY OF CEREALS SEEDS

The germinating seed samples were incubated in two ways: seven days at  $T = 20^{\circ}\text{C}$ , at dark, without a low temperature-period before incubation (Picture c); seven days at  $T = 20^{\circ}\text{C}$ , with fluorescent light and a low temperature-period of five days at  $T = 10^{\circ}\text{C}$ , before incubation (Picture d).



**Picture 1** - a- seeds on moistened substrate; b- rolls with seeds introduced in plastic bags; c- seeds germinated at dark and d- seeds germinated at the fluorescent light

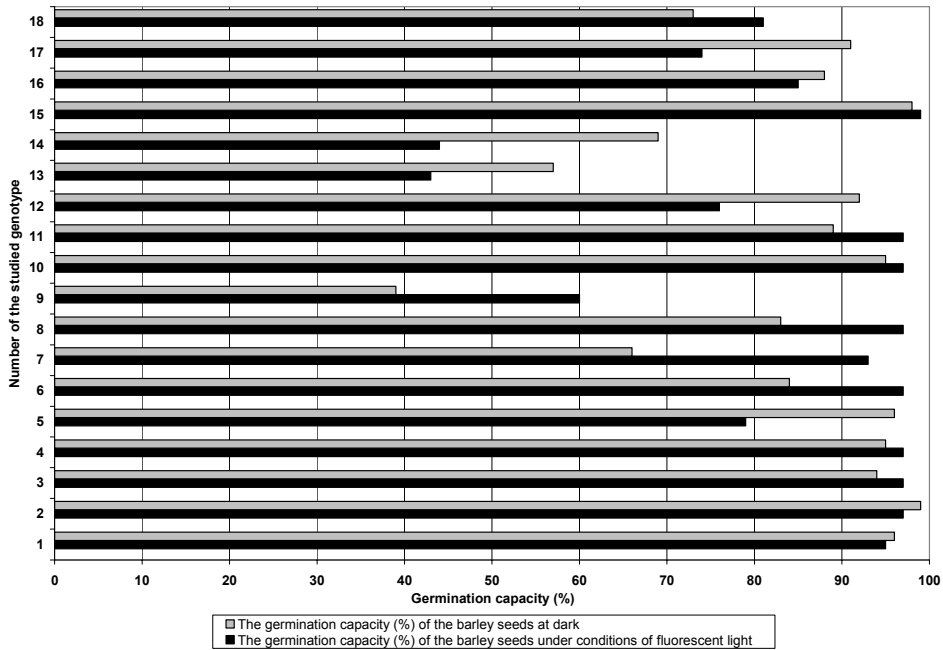
After the incubation period, the germs, developed enough to be accurately estimated, were counted and removed from the substrate, thus, the percent of germinated seeds being determined for each species, under the two testing conditions.

The capitalization of data was done according to the statistics methods (Ceapoiu, 1968), adequate for the proposed goal.

## RESULTS AND DISCUSSION

The scientific grounding of the results, concerning the correlation between the germination capacity of the cereals seeds, at dark, and the germination capacity, under conditions of fluorescent light and low temperature, before incubation, was conditioned by the germination behaviour of oats, barley and rye seeds, as influenced by the above-mentioned factors. *Table 1* shows the germination percents on species and genotypes, which resulted from the two experimental ways, under the best laboratory conditions.

The differences between the germination percents in the three studied species pointed out a significant development of germination in barley seeds, incubated at fluorescent light and kept at  $T = 10^{\circ}\text{C}$  for five days before incubation, under the best conditions, as compared to the other species, where the differences were the lowest (*Figure 1*).



**Fig. 1 – Values of the germinating capacity in barley seeds, tested at dark and fluorescent light with low temperature, before incubation**

**Table 1- The germinating values of the cereals seeds, tested at dark and fluorescent light with low temperature**

| Genotypes | Oats             |        |                                   | Barley           |        |                                   | Rye              |        |                                   |
|-----------|------------------|--------|-----------------------------------|------------------|--------|-----------------------------------|------------------|--------|-----------------------------------|
|           | Accession number | Fg (%) |                                   | Accession number | Fg (%) |                                   | Accession number | Fg (%) |                                   |
|           |                  | Dark   | Fluorescent light Low temperature |                  | Dark   | Fluorescent light Low temperature |                  | Dark   | Fluorescent light Low temperature |
| 1         | 14208            | 94     | 91                                | 13476            | 96     | 95                                | 5301             | 80     | 60                                |
| 2         | 14994            | 66     | 60                                | 13472            | 99     | 97                                | 10264            | 96     | 60                                |
| 3         | 14031            | 81     | 59                                | 13446            | 94     | 97                                | 11007            | 92     | 100                               |
| 4         | 13745            | 73     | 87                                | 13474            | 95     | 97                                | 5358             | 84     | 64                                |
| 5         | 5194             | 82     | 71                                | 13467            | 96     | 79                                | 15069            | 88     | 96                                |
| 6         | 13791            | 72     | 70                                | 13459            | 84     | 97                                | 5268             | 88     | 80                                |
| 7         | 14038            | 77     | 67                                | 13448            | 66     | 93                                | 5111             | 88     | 64                                |
| 8         | 415              | 62     | 83                                | 13473            | 83     | 97                                | 5453             | 88     | 60                                |
| 9         | 14129            | 88     | 85                                | 13466            | 39     | 60                                | 7442             | 96     | 88                                |
| 10        | 13809            | 94     | 80                                | 13470            | 95     | 97                                | 10266            | 88     | 72                                |
| 11        | 15406            | 84     | 92                                | 13463            | 89     | 97                                | 10263            | 92     | 76                                |

# TESTING THE CAPACITY OF CEREALS SEEDS

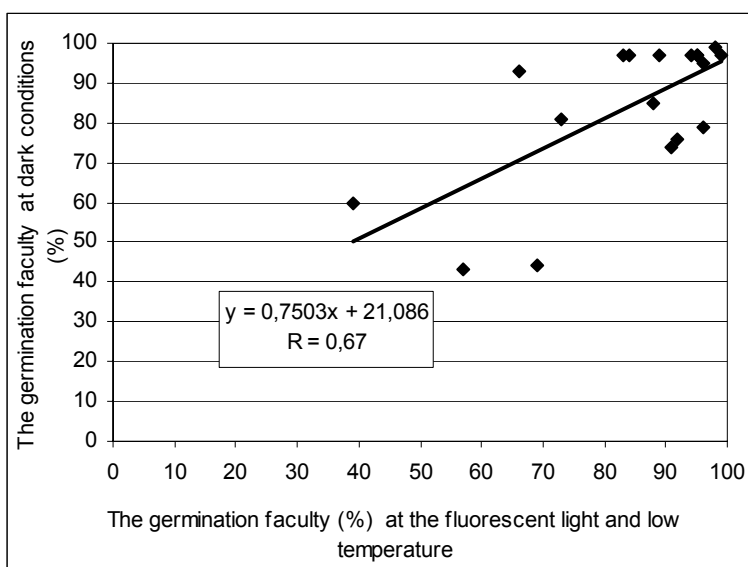
| Genotypes | Oats             |        |                   |                 | Barley           |        |                   |                 | Rye              |        |                   |                 |
|-----------|------------------|--------|-------------------|-----------------|------------------|--------|-------------------|-----------------|------------------|--------|-------------------|-----------------|
|           | Accession number | Fg (%) |                   |                 | Accession number | Fg (%) |                   |                 | Accession number | Fg (%) |                   |                 |
|           |                  | Dark   | Fluorescent light | Low temperature |                  | Dark   | Fluorescent light | Low temperature |                  | Dark   | Fluorescent light | Low temperature |
| 12        | 16657            | 59     | 70                |                 | 13452            | 92     | 76                |                 | 5112             | 88     | 84                |                 |
| 13        | -                | -      | -                 |                 | 13461            | 57     | 43                |                 | 5105             | 76     | 100               |                 |
| 14        | -                | -      | -                 |                 | 13462            | 69     | 44                |                 | 5652             | 100    | 52                |                 |
| 15        | -                | -      | -                 |                 | 13477            | 98     | 99                |                 | 5651             | 100    | 76                |                 |
| 16        | -                | -      | -                 |                 | 13479            | 88     | 85                |                 | 10407            | 96     | 56                |                 |
| 17        | -                | -      | -                 |                 | 13464            | 91     | 74                |                 | 10265            | 100    | 44                |                 |
| 18        | -                | -      | -                 |                 | 13426            | 73     | 81                |                 | 5638             | 100    | 56                |                 |
| 19        | -                | -      | -                 |                 | -                | -      | -                 |                 | 7477             | 100    | 96                |                 |
| 20        | -                | -      | -                 |                 | -                | -      | -                 |                 | 10262            | 96     | 56                |                 |
| Mean      |                  | 77.6   | 76.2              | -               |                  | 83.5   | 83.7              | -               |                  | 87.4   | 72.0              |                 |

The intensity of the relation between the obtained results, under the two experimental conditions, was pointed out by the correlation coefficients specific to each tested species (*Table 2*). Among the studied species, the value of the correlation coefficient was statistically assured only in barley, having a distinctive significance, which has shown the influence of low temperature and fluorescent light on increased germination percent in seeds, found on the germination substrate.

**Table 2 - The simple correlation coefficients between the analysed traits in the tested cereals seeds**

| Correlated traits                       | The germination capacity (%) of the tested seeds under conditions of fluorescent light and low temperature |              |
|-----------------------------------------|------------------------------------------------------------------------------------------------------------|--------------|
|                                         | r                                                                                                          | Significance |
| Germination (%) of tested seeds at dark | Oats                                                                                                       |              |
|                                         | 0.47                                                                                                       | -            |
|                                         | Barley                                                                                                     |              |
|                                         | 0.67                                                                                                       | **           |
|                                         | Rye                                                                                                        |              |
|                                         | -0.29                                                                                                      | -            |

The germination percents, calculated on the basis of the regression equation, and represented by the regression line in barley seeds, pointed out the presence of a positive relation between seed viability and special treatments (fluorescent light and low temperature, before incubation), applied during the germination tests (*Figure 2*).



**Fig. 2 - The regression line for the correlation between the germination capacity of barley seeds, tested under two experimental conditions**

## CONCLUSIONS

Investigations pointed out the mode of manifestation at germination of oat, barley and rye seeds, tested under the best conditions of laboratory, as influenced by some factors like dark, fluorescent light and low temperature, for a period of time, before incubation.

The differences of the germination percents in each species pointed out the role of fluorescent light and low temperature, a significant correlation being found between the seed viability and the two factors in barley, as compared to the other tested species.

The existence of some correlations without statistical assurance in rye and oats over barley has shown that the seed viability in these species was not influenced by the fluorescent light and low temperature, before incubation, under the best conditions.

In the routine tests from the seed control laboratories, they may successfully use the low temperature treatment in barley, before incubation, and the exposure at fluorescent light, during incubation, even if this species is no longer found at the germination rest, percent increases in viability being registered.

## TESTING THE CAPACITY OF CEREALS SEEDS

### REFERENCES

- Ceapoiu N., 1968** - *Metode statistice aplicate în experiențele agricole și silvice*, Edit. Agro-Silvică, București
- Evenary M., 1965** - *Effects of some internal and external conditions on seeds germination*. Bot. Rev., 15, 153
- Mureșan T., Pompei P.N., Cseresnyes Z., 1986** - *Producerea și controlul calității semințelor agricole* Cap.6 - Factorii care influențează repausul germinativ. Tratamente și procedee pentru stimularea germinației semințelor în stare de repaus, Shepley și Varner 1973, Evenary 1965, pp.328-329, Edit. Ceres, București
- Shepley S.C., 1973** - *Early actions of gibberellic acid on the embryo and on the endosperm of Avena fatua seeds*, Plant Physiology, 51(4)
- STAS 1634-82** - *Anexa A, Metode de lucru pentru determinarea germinației*
- Varner J.E., 1973** - *Studies on dormancy in wheat*. Proc. Int. Seed Test. Assoc. 26, 697-760