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GENOTYPE AND CONDITIONING METHOD INFLUENCE ON SOWING MATERIAL QUALITY FOR WINTER WHEAT

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Abstract

Within modern agriculture, the yearly use of some seeds and sowing material with superior biological traits represents one of the basic conditions to obtain an important and constant production, adequate to the genetic potential of cropped hybrids and varieties.
In this context, an important part in getting crops at the foreseen level, as well as their surpassing, is performed by the action of yielding, control and supervision of the seeds meant to be sowed.
If this action isn't coordinated and adequately achieved, taking into account principles, the decrease of biologic potential production is rapid and unavoidable, being joined by less valuable quality and quantity crops.
Before valorizing seeds in different areas, these ones are submitted to some conditioning operations such as unknown matters cleaning, moisturizing etc. In order to obtain superior quality products, it is necessary to eliminate unknown matters from the cereals mass if possible, in a total amount. Practically, all impurities can't be eliminated and technical measures which are taken aim at their minimum reduction in the grains mass.
The research results carried out on samples of 4 of winter wheat seed genotypes have shown that the three types of conditionality have a positive influence on the physical and biological properties of the seed.
The effect of each machine is cumulative and very significantly higher than previous equipment, thus among the 4 analysed genotypes Mulan variety proved to be superior in terms of quality indices in all variants of conditioning, compared to other studied varieties of winter wheat.

Key words*: conditioning, sowing material, quality physical indexes, quality biological index, winter wheat.*

INTRODUCTION

Seeds conditioning, stocking and preserving are absolutely compulsory processes which interfere during seed's existence until final consumption. These processes are continuous concerns since the oldest times till present. The continuous characteristics of these processes request their non-dissociated study and influence upon each other. That's why they receive a particular attention, in order to improve the seeds quality genetically determined (Borcean and Imbrea, 2005).
All conditioning and stocking techniques and technologies have at their basis a complex of different phenomena (biological, physiological, biochemical, physico-chemical etc.) which take place in the seeds mass (Bucurescu et al., 1992). These concerns have appeared out of the necessity of elongating the seeds use period long time, after the period they were produced in, because agricultural production lasts only for one season and after harvesting till use, the seeds mass is submitted to some stressful factors which can determine seeds quality indexes deterioration (Buricescu, 2014).

MATERIALS AND METHODS

For winter wheat we effected a bi-factorial trial, the studied factors being the following:
A Factor – the analysed winter wheat with four levels:
- a_1 – DROPIA variety;
- a_2 – GLOSA variety;
- a_3 – GK PETUR variety;
- a_4 – MULAN variety.

B Factor – conditioning method with four levels:

- b_1 – unconditioned;
- b_2 – conditioned with the selecting device;
- b_3 – conditioned with the selecting and screening machines;
- b_4 – conditioned with the selecting and gravitator machines.

Out of the two tested factors combination, there resulted 16 experimental variants, the results registered within each variant being statistically interpreted by variability method analysis according to bi-factorial trials.

Laboratory analysis effected within research

Quality analysis (physic purity, weight of 1000 grains, total mass, specific mass, hectolitrical mass, germination) for experimental variants proper to the trial were effected for the crops harvested during 2010-2012 in four replicates over one year.

Statistical interpretation and calculus by variance analysis method the moment when the mixed effect of experimental analysis was effected for the unconditioned variant proper to each winter wheat genotype tested during research.

Measurement technique

Weight of 1000 grains determinations are effected only for the pure seed obtained by the early physical purity analysis.

In order to determine the weight of 1000 grains, in the research there was used the method of determining the weight of 1000 grains by counting all the samples to be analysed, which involves counting sample of pure seed resulting from the determination of physical purity or passing the sample through the included seeds. After counting them, samples are weighed and the results are to be expressed in grams, with the same number of decimal places in the determination of physical purity weight of 1000 grains is calculated by comparing the result to 1,000 grains.

Absolute mass determinations were effected on the mass of 1000 seeds dry matter content according to the relationship (Epure et al., 2011):

$$M_a = 100 – U/100 \times M_r$$

Where:

M_a –1.000 seeds mass (g);
M_r – 1.000 seeds relative mass (g);
U – seeds present moisture (%).

In order to calculate the specific mass, there was determined 1000 seeds mass (MMB) and their volume (Vs)

The volume was determined by the introduction of 500 seeds in a graded cylindre which contains 500 cm^3 oil. The difference between the liquid level from the cylindre, obtained after seeds introduction and their initial level, represents the seeds volume.The result was recalculated for 1000 grains according to the formula (Roman et al., 2012):

$$d = MMB/V_S$$

Where:

MMB – 1.000 seeds mass (g);
V_S – seeds volume (cm^3).

In order to determine the volume weight of winter wheat and sun-flower seeds meant to be sowed, the hectolitrical balance was used, having 0.25 l volume. For statistical analysis, there were effected every four parallel determinations for the same seeds sample. In order to determine the germinative capacity of winter wheat sowing material, there were taken at random four samples (replicates) of 100 seeds, seeds which were to germinate, using as a vegetal bed filtring folded paper (BP method) and watered until receiving no more, seeds being arranged as uniformous as possible on the vegetal bed. Samples, prepared this way were introduced into a thermostat, then we followed constantly the temperature and moisture degree of the vegetal bed.

For the calculation of germination there was done the arithmetic average of the 4 repetitions results after extracting from the table differences between rehearsals, admitted to the germination percentage and calculated depending on the average percentage obtained rounded to the nearest whole number.

RESULTS AND DISCUSSIONS

Conditioning method influence on phisical purity for winter wheat sowing material

After determining wheat grains physical purity (Table 1), it is acknowledged that this quality physical index is significantly improving in comparison with the control unconditioned variant due to the fact that after every conditioning stage, machines used in this process specifically remove the foreign bodies present in the seeds mass.

Table 1. Conditioning method influence over winter wheat sowing material purity (2010 – 2012 average)

EXPERIMENTAL VARIANT		*PURITY (%)*	*DIF. (%)*	*SIGN.*
a_1	b_1 - unconditioned	**84.30**	**-**	**Mt.$_1$**
	b_2 - selecting machine	88.80	4.5	***
DROPIA	b_3 - selecting and screening machines	93.60	9.3	***
	b_4 - selecting, screening and gravitator machines	97.30	13.0	***
a_2	b_1 - unconditioned	**88.40**	-	**Mt.$_2$**
	b_2 - selecting machine	95.70	7.3	***
GLOSA	b_3 - selecting and screening machine	98.90	10.5	***
	b_4 - selecting, screening and gravitator machines	99.80	11.4	***
a_3	b_1 - unconditioned	**89.90**	-	**Mt.$_3$**
	b_2 - selecting	97.60	7.7	***
PETUR	b_3 - selecting and screening machine	98.70	8.8	***
	b_4 - selecting, screening and gravitator machines	99.90	10.0	***
a_4	b_1 - unconditioned	**88.75**	-	**Mt.$_4$**
	b_2 - selecting	97.60	8.85	***
MULAN	b_3 - selecting and screening machines	98.70	9.95	***
	b_4 - selecting, screening and gravitator machines	99.90	11.15	***

$DL_{5\%} = 0.45$; $DL_{1\%} = 0.60$; $DL_{0.1\%} = 0.79$

Differences in comparison with the control variant recorded values comprised 4.5-13.0% for *Dropia variety*, 7.3-11.4% for *Glosa variety*, 7.7 - 10,0% for *Petur variety* and 8.85 – 11.15% for *Mulan variety*, being statistically ensured as significantly positive (***) for all four varieties of winter wheat, when within the conditioning process appear adequate machines, the biggest values of physical purity being recorded the moment when for seeds conditioning was used the complex machine formed of selecting, screening and gravitator machines *Glosa*, *Petur* and *Mulan* varieties are to be remarked, where the value of physical purity after using the three conditionning machines reached 99.8% for *Glosa* variety and 99.9% for *Petur* and *Mulan* varieties being statistically ensured as significantly positive (***).

Conditioning method influence determination on 1000 seeds mass for winter wheat sowing material

In Table 2 there are gathered the experimental results after having determined 1000 seeds mass for winter wheat sowing material.

The differences are statistically recorded and were between 0.4-3.3 g for *Dropia variety*, being statistically ensured as significantly positive (-) in conditional variants with selecting device, selecting device + screening machine very significant positive (***) for screening machine, 1.2-2.1 g for *Glosa variety* being statistically ensured as distinct significantly positive (**) in the selector and very significant (***) in the case of variants conditioning with the screening machine, 0.3 to 3.8 g to ensure statistical insignificant with *Petur* (-) in the selector and very significant (***) in the case of variants selecting and screening machines and selecting, screening and gravitator machines and 1.8-4.3 g, with very significant statistical assurance (***) in all variants of wrapping, the variety of winter wheat *Mulan variety*, which values are superior to other varieties tested.

Increasing the values of this indicator of quality is due in particular to eliminate light fixtures and mass residues of seed grain by using the selecting, screening and gravitator devices.

Conditioning method influence on absolute mass of winter wheat sowing material

In Table 3 absolute mass evolution is presented as a result of the combined action of the two factors are (genotype x method of conditioning).

Absolute mass is a parameter of quality of wheat seeds which vary significantly throughout the process of conditioning.

This is due to the increase in the share of the mass of seeds, seed-filled with high value. Thus, the higher values of this parameter are recorded in the selecting, screening and gravitator machines at all 4 wheat cultivars tested.

Absolute mass is a parameter of quality of wheat seeds that varies very significantly positive (***) in a manner (***) throughout the process of conditioning.

Table 2. Conditioning method influence determination on 1000 seeds mass for winter wheat sowing material (average 2010 – 2012)

EXPERIMENTAL VARIANT		*1000 Seeds Mass (g)*	*DIF. (g)*	*SIGN.*
a_1 ***DROPIA***	b_1 - unconditioned	**34.5**	-	**Mt.$_1$**
	b_2 - selecting machine	34.9	0.4	-
	b_3 - selecting and screening machines	35.2	0.7	-
	b_4 - selecting, screening and gravitator machines	37.8	3.3	***
a_2 ***GLOSA***	b_1 - unconditioned	**37.6**	-	**Mt.$_2$**
	b_2 - selecting machine	38.8	1.2	**
	b_3 - selecting and screening machine	39.3	1.7	***
	b_4 - selecting, screening and gravitator machines	39.7	2.1	***
a_3 ***PETUR***	b_1 - unconditioned	**38.9**	-	**Mt.$_3$**
	b_2 - selecting	39.2	0.3	-
	b_3 - selecting and screening machine	40.5	1.6	***
	b_4 - Selecting, screening and gravitator machines	42.7	3.8	***
a_4 ***MULAN***	b_1 - unconditioned	**39.8**	-	**Mt.$_4$**
	b_2 - selecting	41.6	1.8	***
	b_3 - selecting and screening machines	43.8	4.0	***
	b_4 - selecting, screening and gravitator machines	44.1	4.3	***

$DL_{5\%} = 0.74$; $DL_{1\%} = 0.99$; $DL_{0.1\%} = 1.31$

This is due to the increase in the share of the seeds mass, seed-filled with high value. Thus, the highest values of this parameter are recorded in selecting, screening and gravitator machines at all 4 wheat cultivars tested.

Conditioning method influence on specific mass of winter wheat sowing material

In table 4 centralized experimental results are obtained as a result of the determination of specific mass based on the combined action of the two factors which are tested in the research. In all variants of the mass-specific, conditioning has provided statistically significant positive values (*) and very significantly positive (***) compared to the control.

This variation is due to light fixtures, high volume, mass of seeds. As a result, the increases in this parameter compared with 0.02-0.04 g/cm^3 selecting device usage, 0.05-0.06 g/cm^3 after using the selecting, screening machines and 0.06-0.08 g/cm^3 using complex machines consisting of selecting, screening and gravitator machines (Table 4).

Analyzing separately the four wheat cultivars under study, it is observed that the maximum value of the specific mass is obtained after using the selecting, screening and gravitator machines in the case of the variety of *Mulan.*

Conditioning method influence on hectolitrical mass for winter wheat sowing material

The combined influence of factors are tested as part of the research is summarized in table 5.

During the conditioning process, the value of MH ranged between 74.12 and 78.24 kg/hl after the first variant of conditioning 74.34 kg/hl 78.44 and after the second variant, namely 75.54 and 78.63 kg/hl after the third variant of conditioning (Table 5), the highest values were recorded in the case of *Mulan variety*.

Thus, we can say with certainty, that from the point of view of the seeds volumetric weight, *Mulan* winter wheat variety is superior the other three analysed varieties differences recorded in comparison to unconditioned variant between 0.71 and 1.10 kg/hl reaching very significantly positive (***).

Conditioning method influence on germination capacity of winter wheat sowing material

In Table 6 there are summarized the results achieved as a result of the determination of seed germination, as a result of the combination of those two factors.

Determinations relating to the winter wheat seeds germination have revealed that this quality indicator of the recorded variations depend on the grown genotype and depend on the used conditioning method.

Table 3. Conditioning method influence over the absolute mass of winter wheat sowing material (average 2010 – 2012)

EXPERIMENTAL VARIANT		*ABSOLUTE MASS (g)*	*DIF. (g)*	*SIGN.*
a_1	b_1 - unconditioned	**30.5**	**-**	**Mt.$_1$**
	b_2 - selecting machine	30.9	0.4	-
DROPIA	b_3 - selecting and screening machines	31.2	0.7	**
	b_4 - selecting, screening and gravitator machines	33.8	3.3	***
a_2	b_1 - unconditioned	**33.6**	-	**Mt.$_2$**
	b_2 - selecting machine	34.8	1.2	***
GLOSA	b_3 - selecting and screening machines	35.3	1.7	***
	b_4 - selecting, screening and gravitator machines	36.2	2.6	***
a_3	b_1 - unconditioned	**34.9**	-	**Mt.$_3$**
	b_2 - selecting	35.2	0.3	-
PETUR	b_3 - selecting and screening machines	36.5	1.6	***
	b_4 - selecting, screening and gravitator machines	37.8	2.9	***
a_4	b_1 - unconditioned	**35.8**	-	**Mt.$_4$**
	b_2 - selecting	36.6	0.8	**
MULAN	b_3 - selecting and screening machines	37.8	2.0	***
	b_4 - selecting, screening and gravitator machines	39.1	3.3	***

$DL_{5\%} = 0.50$; $DL_{1\%} = 0.67$; $DL_{0.1\%} = 0.89$

Table 4. Conditioning method influence over wheat sowing material specific mass (average 2010 – 2012)

EXPERIMENTAL VARIANT		*SPECIFIC MASS (g/cm^3)*	*DIF. (g/cm^3)*	*SIGN.*
a_1	b_1 - unconditioned	**1.34**	**-**	**Mt.$_1$**
	b_2 - selecting machine	1.36	0.02	*
DROPIA	b_3 - selecting and screening machines	1.39	0.05	***
	b_4 - selecting, screening and gravitator machines	1.40	0.06	***
a_2	b_1 - unconditioned	**1.41**	-	**Mt.$_2$**
	b_2 - selecting machine	1.43	0.02	*
GLOSA	b_3 - selecting and screening machines	1.46	0.05	***
	b_4 - selecting, screening and gravitator machines	1.49	0.08	***
a_3	b_1 - unconditioned	**1.43**	-	**Mt.$_3$**
	b_2 - selecting	1.47	0.04	***
PETUR	b_3 - selecting and screening machines	1.49	0.06	***
	b_4 - selecting, screening and gravitator machines	1.50	0.07	***
a_4	b_1 - unconditioned	**1.44**	-	**Mt.$_4$**
	b_2 - selecting	1.48	0.04	***
MULAN	b_3 - selecting and screening machines	1.50	0.06	***
	b_4 - selecting, screening and gravitator machines	1.52	0.08	***

$DL_{5\%} = 0.02$; $DL_{1\%} = 0.03$; $DL_{0.1\%} = 0.04$

Table 5. Conditioning method influence over wheat sowing material hectolitric mass (average 2010 – 2012)

EXPERIMENTAL VARIANT		*HECTOLITRICAL MASS (kg/hl)*	*DIF. (kg/hl)*	*SIGN.*
a_1	b_1 - unconditioned	**73.00**	**-**	**Mt.$_1$**
	b_2 - selecting machine	74.12	1.12	***
DROPIA	b_3 - selecting and screening machines	74.34	1.34	***
	b_4 - selecting, screening and gravitator machines	75.54	2.54	***
a_2	b_1 - unconditioned	**76.25**	-	**Mt.$_2$**
	b_2 - selecting machine	76.78	0.53	***
GLOSA	b_3 - selecting and screening machines	76.83	0.58	***
	b_4 - selecting, screening and gravitator machines	77.32	1.07	***
a_3	b_1 - unconditioned	**77.47**	-	**Mt.$_3$**
	b_2 - selecting	77.87	0.40	***
PETUR	b_3 - selecting and screening machines	78.17	0.70	***
	b_4 - selecting, screening and gravitator machines	78.47	1.00	***
a_4	b_1 - unconditioned	**77.53**	-	**Mt.$_4$**
	b_2 - selecting	78.24	0.71	***
MULAN	b_3 - selecting and screening machines	78.44	0.91	***
	b_4 - selecting, screening and gravitator machines	78.63	1.10	***

$DL_{5\%} = 0.21$; $DL_{1\%} = 0.28$; $DL_{0.1\%} = 0.37$

It is found that, in all the studied genotypes the germination capacity increases with the complexity of the wrapping method, the highest values are recorded when the wrapping was used consisting of complex - selecting, screening and gravitator machines - in the case of *Dropia* and *Glosa* varieties the values are very significant positive (***) when using and testing winter wheat genotype.

Thus, in case of conditional variants, germination was recorded with 86% about 89% with *Glosa*, and *Dropia* varieties, 84% to 90% with *Petur* and *Mulan* varieties. Overall, it appears that this quality indicator of the recorded maximum value in conditional complex machine.

Mulan variety proved to be superior to the other tested varieties, the germination capacity increased by 2 percentage points in the case of compliance with the 5 percentage points of the selecting machine, respectively, in the case of compliance with the complex selecting, screening and gravitator machines, compared to the unconditioned control group.

Table 6. Conditioning method influence on germinated capacity for winter wheat sowing material (average 2010 – 2012)

EXPERIMENTAL VARIANT		*GERMINATION (%)*	*DIF. (%)*	*SIGN.*
a_1	b_1 - unconditioned	**86**	**-**	**$Mt._1$**
DROPIA	b_2 - selecting machine	88	2.0	**
	b_3 - selecting and screening machines	92	6.0	***
	b_4 - Selecting, screening and gravitator machines	92	6.0	***
a_2	b_1 - unconditioned	**89**	**-**	**$Mt._2$**
GLOSA	b_2 - selecting machine	90	1.0	-
	b_3 - selecting and screening machines	92	3.0	**
	b_4 - selecting, screening and gravitator machines	94	5.0	***
a_3	b_1 - unconditioned	**84**	**-**	**$Mt._3$**
PETUR	b_2 - selecting	85	1.0	-
	b_3 - selecting and screening machines	89	5.0	***
	b_4 - selecting, screening and gravitator machines	90	6.0	***
a_4	b_1 - unconditioned	**90**	**-**	**$Mt._4$**
MULAN	b_2 - selecting	92	2.0	*
	b_3 - selecting and screening machines	95	5.0	***
	b_4 - selecting, screening and gravitator machines	95	5.0	***

$DL_{5\%} = 1.75$; $DL_{1\%} = 2.35$; $DL_{0.1\%} = 3.10$

CONCLUSIONS

From the obtained results analysis, the conclusions drawn emphasized the most important aspects of winter wheat and sunflowers seeds conditioning and storage process in terms of qualitative parameters of seed.

The research results carried out on samples of 4 of winter wheat seed genotypes have shown that the three types of conditionality have a positive influence on the physical and biological properties of the seed.

It was found that a very significant improvement of all seed weight properties, purity, 1000 grains mass, absolute mass, specific mass, volumetric weight and germination capacity increase significantly improving properties since passing through the separator and the gradual increase of values to the complexes formed from separator - screening – gravitator machines, respectively.

The effect of each machine is cumulative and very significantly higher than previous equipment, thus among the 4 analysed genotypes *Mulan*, variety proved to be superior in terms of quality indices in all variants of conditioning, compared to other studied varieties of winter wheat.

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