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GENOTYPE AND CONDITIONING METHOD INFLUENCE ON SOWING MATERIAL QUALITY FOR SUNFLOWER

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Abstract

The syntagm ''quality seed'' is ever often used, relative notion which, on the one hand is defined by the ever growing demands of the seed final consumers, and on the other hand by laws and standards development, these ones establishing the minimum requests to be accomplished, ever higher and more restrictive once with every year, concept which supposes that this one to belong to some performant varieties and hybrids whose identity should be defined by: authenticity and variety purity, specific morphological characteristics and by phisiological and physic characteristics which will certify an adequate cultural value. Conditioning, stocking and preserving seeds are totally compulsory processes which interfere during the seed existence until the consumption. These processes are continuous concerns since the oldest times till nowadays. The continuous character of these processes involves their undissociated study, these ones carrying influences one upon the other. Hence, the attention which is transferred to them, ever higher to improve the seeds quality which is genetically determined.
All techniques and technologies of conditioning and stocking carry at their basis a complex of various origins phenomena (biological, physiological, biochemical, physic-chemical etc.) which take place in the seeds mass.
These concerns appeared as a consequence of the necessity to elongate the using period of seeds, long after they are produced, as the yield is seasonal and after the harvesting till the use, the seeds mass is submitted to some stressing factors which can lead to seeds quality indexes deterioration.
The most effective variant of conditioning has proved to be the one that used complex machinery consisting of separating - screening - gravitators, complex image which is indispensable when choosing a seed of the highest quality, the success of the next crop directly depending on the values of seeds quality indicators. The hybrid Paraiso 1000 CL P is remarkable, this one registering the highest values of the quality indicators, the differences observed having very significant positive statistical ensurance compared to the other three analyzed hybrids.

Key words*: conditioning (packaging), genotype, sunflower, quality physical indexes, quality biological indexes.*

INTRODUCTION

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 cereal crops mass, if possible, in a total amount (Buricescu, 2014). Practically, all impurities can't be eliminated and technical measures, which are taken, aim at their minimum reduction in the grains mass.
In fact, by conditioning method, removal of unknown light matters is foreseen (powders, dust), foreign bodyes larger than seeds (fragments of vegetal remains, pieces of wood, string, paper, stones, lumps of soil etc.) and unknown matters smaller than seeds (sand, weeds seeds, small particles of soil) (Borcean and Imbrea, 2005).
In order to elaborate this work, the following objectives were aimed at:

a- testing the behavior of 4 sunflower genotypes in terms of physical and biological indicators in different systems;
b- establishment of the most valuable sunflower genotype in terms of behaviour conditioning method.

MATERIALS AND METHODS

For sunflower, the studied factors were the following:

A Factor – the analysed sunflower hybrid, with 4 degree:

- **a_1 –** *FAVORIT hybrid*;
- **a_2 –** *SUPERSOL hybrid*;
- **a_3 –** *PARAISO 102 CL hybrid*;
- **a_4 –** *PARAISO1000 CL P hybrid*.

B Factor – the conditioning method with four degrees:

- **b_1** - unconditioned;
- **b_2** - conditioned with the selecting device;
- **b_3** - conditioned with the selecting and screening devices;
- **b_4** - conditioned with the selecting, screening and gravitator devices.

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 Lenuţa Iuliana and all, 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 50 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 physical purity of sunflower sowing material

The mixed effect of the two studied factors is rendered in Table 1.

The mixed influence of experimental factors (Table 1) highlights the fact that, following the determination of the sunflower seed natural purity, the successive growth of this indicator is observed both between the studied hybrids and between variants of the conditioning test.

Thus, in the case of the unconditioned value, the physical purity value was of 84.10% for the *Favorit hybrid* and 88.36% for *Supersol hybrid*, maximum values being derived from hybrids *Paraiso 102 hybrid* and *Paraiso 1000 hybrid* where physical purity was 89.44% and 90.55% respectively.

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

EXPERIMENTAL VARIANT		*PURITY (%)*	*DIF. (%)*	*SIGN.*
a_1 ***FAVORIT***	b_1 - unconditioned	**84.10**	**-**	**Mt.$_1$**
	b_2 - selecting machine	96.45	12.35	***
	b_3 - selecting and screening machiness	98.64	14.54	***
	b_4 - selecting, screening and gravitator machines	99.00	14.90	***
a_2 ***SUPERSOL***	b_1 - unconditioned	**88.36**	-	**Mt.$_2$**
	b_2 - selecting machine	97.56	9.20	***
	b_3 - selecting and screening machines	98.93	10.57	***
	b_4 - selecting, screening and gravitator machines	99.67	11.31	***
a_3 ***PARAISO 102 CL***	b_1 - unconditioned	**89.44**	-	**Mt.$_3$**
	b_2 - selecting	97.36	7.92	***
	b_3 - selecting and screening machines	98.75	9.31	***
	b_4 - selecting, screening and gravitator machines	99.87	10.43	***
a_4 ***PARAISO 1000 CL P***	b_1 - unconditioned	**90.55**	-	**Mt.$_4$**
	b_2 - selecting	98.97	8.42	***
	b_3 - selecting and screening machines	99.46	8.91	***
	b_4 - selecting, screening and gravitator machines	99.86	9.31	***

$DL_{5\%} = 0.17$; $DL_{1\%} = 0.23$; $DL_{0.1\%} = 0.30$

The wrapping with the selecting device, the first place is taken by *Paraiso hybrid* 1000 with 98.97% purity, followed by the 97.56% for *Supersol* and 102 for *Paraiso* but also 97.36% and the *Favorit hybrid* with 96.45%.

Compared to the unconditional variant, the differences recorded by this physical quality indicator have very significant positive statistical assurance for all analyzed hybrids, for all the variations of conditioning, maximum values being recorded in the case of *Paraiso 1000 hybrid*.

The most effective conditioning variant has proved to be the one where it has been used complex machinery consisting of selecting, screening and gravitator devices, complex which is indispensable when wanting to obtain highest quality sowing material, next crops success directly depending on the purity of seeds.

Conditioning method influence determination on 1000 seeds mass of sunflower sowing seeds

It results out of this table that by getting out the light bodies of the seeds mass by their conditioning, 1000 grains mass improves significantly in comparison with the unconditioned control element, this parameter values increasing successively once with the increase of the number of used machines in the conditioning process (Table 2).

This time too, *Paraiso 1000 hybrid* has proven to be significantly superior to the other hybrids, the 1000 seeds mass recorded values being the following: 68.37 g for the unconditioned variant, 69.97 g, when within the conditioning process the selecting device was used, 70.12 g when using selecting and screening machines and 70.43 g when within the conditioning flow the gravitator is used too (Table 2).

The recorded differences among the experimental variants in comparison with the control variants are, in all cases, statistically ensured, being comprised between 0.40-1.10 g for *Favorit*, *hybrid*, 0.20 with unsignificant

statistical ensurance (-) for selecting device variant and 2.60 g in the case of *Supersol hybrid*, 1.52-2.73 g for *Paraiso 102* şi 1.60-2.06 for *Paraiso 1000 hybrid*, being very significantly statistically ensured (***).

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

EXPERIMENTAL VARIANT		*1000 SEEDS MASS (g)*	*DIF. (g)*	*SIGN.*
a_1	b_1 - unconditioned	**67.00**	**-**	**Mt.$_1$**
	b_2 - selecting machine	67.40	0.40	***
FAVORIT	b_3 - selecting and screening machines	67.80	0.80	***
	b_4 - selecting, screening and gravitator machines	68.10	1.10	***
a_2	b_1 - unconditioned	**67.50**	-	**Mt.$_2$**
	b_2 - selecting machine	67.70	0.20	-
SUPERSOL	b_3 - selecting and screening machines	69.60	2.10	***
	b_4 - selecting, screening and gravitator machines	70.10	2.60	***
a_3	b_1 - unconditioned	**67.35**	-	**Mt.$_3$**
	b_2 - selecting	68.87	1.52	***
PARAISO 102 CL	b_3 - selecting and screening machines	69.94	2.59	***
	b_4 - selecting, screening and gravitator machines	70.08	2.73	***
a_4	b_1 - unconditioned	**68.37**	-	**Mt.$_4$**
	b_2 - selecting	69.97	1.60	***
PARAISO 1000 CL P	b_3 - selecting and screening machines	70.12	1.75	***
	b_4 - selecting, screening and gravitator machines	70.43	2.06	***

$DL_{5\%} = 0.22$; $DL_{1\%} = 0.30$; $DL_{0.1\%} = 0.40$

Conditioning method influence on absolute mass of sunflower sowing material

Within the conditioning process of sunflower seeds, as a consequence of the mixed effect of the two tested experimental factors within the research, the absolute mass records significant positive values (*), in the case of *Favorit* and *Supersol hybrids* within the conditioning variant which uses the selecting device and very significant positive (***), for all studied hybrids, when when within the conditioning process there are used selecting + screening devices, respectively selecting + screening + gravitator devices, with differences of this parameter comprised between 4.54-4.66 g for *Favorit hybrid*, 1.74-3.10 g for *Supersol hybrid*, 2.01-3.68 g for *Paraiso 102*, respectively 1.18-1.16 g for *Paraiso 1000*, in comparison with the unconditioned control variants specific to each tested hybrid (Table 3).

Conditioning method influence on specific mass of sunflower sowing material

Results achieved as a consequence of the determination of sunflower seeds specific mass, as an effect of the combined action of the studied factors taken into the research study are summarized in Table 4.

Following the conditional operations, it can be said that the specific weight of sunflower seeds improve significantly by eliminating light factions, since the first variant of conditioning with the selecting device together with the wind, remove light mass bodies from the seed (Table 4).

The highest values of this indicator have been physically registered with the *Favorit hybrid*, followed by *Supersol*, *Paraiso 102* and *Paraiso 1000 hybrids*, each genotype exceeding the values recorded in the case of conditional variants.

Differences recorded compared with the control unconditioned variants recorded respect for each tested hybrid were between 0.20 and 0.34 g/cm3 for *Favorit hybrid*, 0.20 and 0.07 g/cm^3 for *Supersol hybrid* 0.07 and 0.17 g/cm^3 for *Paraiso 102 hybrid* and 0.04-0.18 g/cm^3 for hybrid *Paraiso 1000*, the differences statistically assured being significantly positive (*).

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

EXPERIMENTAL VARIANT		*ABSOLUTE MASS (g)*	*DIF. (g)*	*SIGN.*
a_1 *FAVORIT*	b_1 - unconditioned	**52.87**	**-**	**$Mt._1$**
	b_2 - selecting machine	53.70	0.83	*
	b_3 - selecting and screening machines	57.41	4.54	***
	b_4 - selecting, screening and gravitator machines	57.53	4.66	***
a_2 *SUPERSOL*	b_1 - unconditioned	**54.67**	-	**$Mt._2$**
	b_2 - selecting machine	54.70	0.03	*
	b_3 - selecting and screening machines	56.41	1.74	***
	b_4 - selecting, screening and gravitator machines	57.77	3.10	***
a_3 *PARAISO 102 CL*	b_1 - unconditioned	**54.65**	-	**$Mt._3$**
	b_2 - selecting	55.43	0.78	***
	b_3 - selecting and screening machines	56.66	2.01	***
	b_4 - selecting, screening and gravitator machines	58.33	3.68	***
a_4 *PARAISO 1000 CL P*	b_1 - unconditioned	**56.78**	-	**$Mt._4$**
	b_2 - selecting	56.87	0.09	***
	b_3 - selecting and screening machines	57.96	1.18	***
	b_4 - selecting, screening and gravitator machines	57.94	1.16	***

$DL_{5\%} = 0.03$; $DL_{1\%} = 0.04$; $DL_{0.1\%} = 0.06$

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

EXPERIMENTAL VARIANT		*SPECIFIC MASS (g/cm^3)*	*DIF. (g/cm^3)*	*SIGN.*
a_1 *FAVORIT*	b_1 - unconditioned	**0.86**	**-**	**$Mt._1$**
	b_2 - selecting machine	1.06	0.20	***
	b_3 - Selecting and screening machines	1.14	0.28	***
	b_4 - Selecting, screening and gravitators	1.20	0.34	***
a_2 *SUPERSOL*	b_1 - unconditioned	**0.98**	-	**$Mt._2$**
	b_2 - selecting machine	1.18	0.20	***
	b_3 - Selecting and screening machine	1.22	0.24	***
	b_4 - selecting, screening and gravitators	1.05	0.07	***
a_3 *PARAISO 102 CL*	b_1 - unconditioned	**1.09**	-	**$Mt._3$**
	b_2 - Selecting	1.16	0.07	***
	b_3 - Selecting and screening machine	1.23	0.14	***
	b_4 - Selecting, screening and gravitators	1.26	0.17	***
a_4 *PARAISO 1000 CL P*	b_1 - unconditioned	**1.10**	-	**$Mt._4$**
	b_2 - Selecting	1.14	0.04	***
	b_3 - Selecting and screening machines	1.23	0.13	***
	b_4 - Selecting, screening and gravitators	1.28	0.18	***

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

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

EXPERIMENTAL VARIANT		*HECTOLITRICAL MASS (kg/hl)*	*DIF. (kg/hl)*	*SIGN.*
a_1 *FAVORIT*	b_1 - unconditioned	**38.96**	**-**	**$Mt._1$**
	b_2 - selecting machine	39.13	0.17	***
	b_3 - selecting and screening machines	40.12	1.16	***
	b_4 - selecting, screening and gravitator machines	40.86	1.90	***
a_2 *SUPERSOL*	b_1 - unconditioned	**40.11**	-	**$Mt._2$**
	b_2 - selecting machine	40.87	0.76	***
	b_3 - selecting and screening machines	40.95	0.84	***
	b_4 - selecting, screening and gravitator machines	41.11	1.00	***
a_3 *PARAISO 102 CL*	b_1 - unconditioned	**40.56**	-	**$Mt._3$**
	b_2 - selecting	40.89	0.33	***
	b_3 - selecting and screening machines	41.32	0.76	***
	b_4 - selecting, screening and gravitator machines	41.44	0.88	***
a_4 *PARAISO 1000 CL P*	b_1 - unconditioned	**40.73**	-	**$Mt._4$**
	b_2 - selecting	40.87	0.14	***
	b_3 - selecting and screening machines	41.47	0.74	***
	b_4 - selecting, screening and gravitator machines	41.62	0.89	***

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

Conditioning method influence on hectolitrical mass of sunflower sowing material

Table 5 centralized experimental results which are obtained from the hectolitrical standard mass determination of sunflower seed material, the effect of the combined action of the two factors being tested in the research.

One acknowledges, as a result of the determination of the sunflower seeds volumetric weight that the values of this indicator increases very significantly (***) for all experimental variants considered in the study (Table 5), compared with the unconditional hybrid-specific tested control variants, the increases are due to the way of setting seed in bulk, which make up a large and inter-granular space of dry seeds.

Compared with unconditional control variant, research results have shown that hybrids of sunflower taken into study were of a different behavior, increasing the standard mass values together with the increase in the number of machines used in the conditioning process.

Conditioning method influence on the germination capacity of sunflower sowing material

The results obtained following the determination of sunflower seeds germination capacity, as a result of the combined action of the two factors which are tested in the research are summarized in table 6.

Analyzing the results obtained as a consequence of the determination of germination capacity of sunflower seeds, as a result of the combined action of two experimental tested factors in the research, it is found that the entry values are growing once with the increase in the number of machines that are used in the process of conditioning, maximum values being recorded in the case of using a complex selecting device formed of selecting, screening and gravitator devices, no matter the tested genotype. Thus, in the case of this conditioning method for *Favorit hybrid* was recorded a germination of 85%, 91% for *Supersol hybrid*, while for *Paraiso 102* and *Paraiso 1000 hybrid*, the germination values were of 90 and respectively 93%, with very significant positive ensurance (***) in the variant selecting + screening + gravitator devices, in comparison with unconditioned control variants, where seeds germination percent was of 78% for *Favorit hybrid* and 86% *Supersol*, *Paraiso 102* and *Paraiso 1000 hybrids*.

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

EXPERIMENTAL VARIANT		*GERMINATION (%)*	*DIF. (%)*	*SIGN.*
a_1 ***FAVORIT***	b_1 - unconditioned	**78**	-	**Mt.$_1$**
	b_2 - selecting machine	79	1.0	-
	b_3 - selecting and screening machines	82	4.0	**
	b_4 - selecting, screening and gravitator machines	85	7.0	***
a_2 ***SUPERSOL***	b_1 - unconditioned	**86**	-	**Mt.$_2$**
	b_2 - selecting machine	87	1.0	-
	b_3 - selecting and screening machines	88	2.0	-
	b_4 - selecting, screening and gravitator machines	91	5.0	***
a_3 ***PARAISO 102 CL***	b_1 - unconditioned	**86**	-	**Mt.$_3$**
	b_2 – selecting machine	87	1.0	-
	b_3 - selecting and screening machines	88	2.0	-
	b_4 - selecting, screening and gravitator machines	90	4.0	**
a_4 ***PARAISO 1000 CL P***	b_1 - unconditioned	**86**	-	**Mt.$_4$**
	b_2 – selecting machine	89	3.0	*
	b_3 - selecting and screening machines	90	4.0	**
	b_4 - selecting, screening and gravitator machines	93	7.0	***

$DL_{5\%} = 2.33$; $DL_{1\%} = 3.13$; $DL_{0.1\%} = 4.13$

CONCLUSIONS

The most effective variant of conditioning has proved to be the one that used complex machinery consisting of separator - screening – gravitator machines, complex image which is indispensable when chasing a seed of the highest quality, the success of the next crop directly depending on the values of seeds quality indicators.

The *Paraiso 1000 CL P hybrid* is remarked, this one registered the highest values of the quality indicators, the differences observed having very significant positive statistical assurance (***) compared to the other three analyzed hybrids.

For cleaning, appropriate preservation and long term storage, conditioning of seeds is absolutely mandatory, in this respect the use of the complex machines consisting of separator, screening machine and gravitator being recommended.

REFERENCES

Borcean I., Imbrea F., 2005. Condiţionarea şi păstrarea produselor agricole. Ed. Eurobit Timişoara.

Buricescu Gh.L., 2014. Influenţa tehnologiei de procesare asupra calităţii materialului semincer de grâu şi floarea - soarelui. Teză de doctorat. US.A.M.V. Bucureşti.

Epure L.I., Toader M., Ion V., 2011. Controlul calităţii seminţelor destinate semănatului. Manual de lucrări practice – Fitotehnie. Ed. Universitară, Bucureşti.

Roman Gh. V. et al., 2012. Condiţionarea şi păstrarea produselor agricole. Editura Universitară, Bucureşti.