THE INFLUENCE OF THE STORAGE PERIOD OF PEA SEEDS ON THEIR GERMINATION CAPACITY

INFLUENȚA DURATEI DE PĂSTRARE A SEMINȚELOR DE MAZĂRE ASUPRA CAPACITĂȚII DE GERMINARE

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Abstract: *The present paper presents a study regarding the influence of the storage period on the germination capacity of garden peas seeds. The germination capacity of the garden peas seeds was done according to the Romanian standard SR 1634/1999, during a period of three years, between 2012-2014. The number of germs resulted naturally has constantly declined starting from 2012 up until 2014, in all cultivars, but the biggest decline was recorded in the Skinado (11.80 %) and Television (12,32 %) cultivars. The final value of the total germination in the case of the Television cultivar was of 76.5%, being below the acceptable limit for germination, that is of 80%.*
Key words*: Pisum sativum,* storage conditions, total germination

Rezumat: *Lucrarea de față prezintă un studiu cu privire la influența duratei de păstrare asupra capacității de germinare a semințelor la mazărea de grădină. Determinarea capacității de germinare a semințelor de mazăre s-a efectuat în conformitate cu SR 1634/1999, pe parcursul a trei ani, în perioada 2012-2014. Numărul germenilor dezvoltați normal s-a redus constant din anul 2012 până în 2014, la toate cultivarele, însă, cea mai mare scădere s-a înregistrat la cultivarele Skinado (11,80 %) şi Television (12,32 %). Valoarea finală a germinației totale în cazul cultivarului Television a fost de 76,5 %, fiind sub limita acceptabilă pentru germinare, respectiv 80%.*
Cuvinte cheie: *Pisum sativum,* condiții de păstrare, germinație totală

INTRODUCTION

In the past years, the expression "quality seeds" has been increasingly used, and it is a relative concept, defined, on the one hand, by the tougher requirements of the final seed users, and on the other hand by the evolution of the legislation and standards in the field, which establish the minimum requirements to be met, higher and more restrictive with each passing year, a concept which supposes that the seed should derive from some efficiend varieties and hybrids whose identity should be defined by: authenticity and varietal purity, specific morphological characteristics, as well as physical and physiological characteristics that would attest an appropriate cultural value.

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In order to identify the species and varieties, as well as to employ the correct approach to the conditioning, packaging and processing processes, there are some important characteristics that influence the seeds' behaviour in the mentioned processes, related to *shape and size*, *colour and sheen*, *chemical composition*, which may influence the storage conditions, through the different affinity that these have on the external factors that produce the deterioration of the quality, as well as related to the ratio between the carbohydrates, proteins, lipids, water and mineral salts (Butnariu and Butu, 2014).

Beside the biological value of seeds, that attests their belonging to a variety with proven productivity and quality characteristics, a great importance is placed on the seeds' physical characteristics, represented by: the percentage content of pure seed from that particular species compared to the total mass of the analyzed sample (*physical purity*), the ratio of seeds belonging to other species present in the basic seed, respectively, of seeds of other crop species and weed seeds, represented either in a numerical or gravimetric way (*botanical composition*), the seed moisture content, that should not surpass a certain critical level, depending on the species (*moisture*), as well as the physiological characteristics that define the quality of the seed, standardised through specific norms: the *germination faculty*, which shows the number of pure seeds, expressed in percentages, capable of producing normal germs in the laboratory, in the period and in the temperature, moisture and light conditions established as being optimal for each species, and which can be improved to a lesser extent than the physical purity and decides if the seed lot keeps or loses the value of seed fit for sowing; the *germination energy*, which expresses the germination speed of seeds in optimal conditions in which the germination faculty is determined, being for a long time considered as a valuable indicator, being correlated with a better power germination, with a faster and more uniform plant emergence, with a better resistance of plants to the unfavourable conditions from the first period of growth; the *vigor*, which is considered to be the sum of the characteristics that determine the seeds' level of activity and performance during the germination and emergence of the germs in the field, the seeds that emerge well in the field conditions, not always optimal, being the seeds with high vigor, and the seeds that have a weak emergence have a reduced vigor; the *viability* expresses the percentage of viable germs specific to a certain lot, allowing an orientation towards the germination faculty and it is determined when a quick orientation is needed regarding a seed lot or when the seeds are in a germinantion stand-by, and the *phytosanitary condition*, when thinking about the contamination of seeds with diseases or pest infestation, is very important in the characterization of the seeds' quality, the presence of quarantine organisms being banned, and the attack of harmful organisms being limited, in order to ensure a proper emergence and growth of the seeds, during the first stages of development, being recommended and necessary to treat the seeds in order to improve their resistance to the attack of harmful organisms.

The seeds' germination is a succession of biological phenomenons that happen at a cellular level and that ultimately determine the transformation of the embryo into a germ, on the basis of some chemical and physical modifications.

There are many situations in which, under normal environmental conditions and at the same germination percentage, the growth vigor of young seedlings varies a lot.

The main aim of the present paper was to highlight the germination capacity of six pea cultivars in two years of experiments.

MATERIALS AND METHODS

The process of determining the germination takes into account at least two working standards, the one for sampling and the one for determining the germination, coupled with the determination of the seeds' vigor and the standard for determining the seeds' viability.

Out of the total mass of pure seeds well-homogenized, 400 seeds are randomly counted – 8 repetitions of 50 seeds each, placed at a sufficient distance in order to ensure the necessary space needed for the germs' growth and nutrition, as well as for the protection of the seeds that are not contaminated by diseases. In the case in which the seeds are strongly infected, it is necessary for the paper substrate to be changed, at an intermediate count.

As a method of germination, the germination between-paper (BP) was used.

The seeds are placed to germinate between strips of paper, rolled and uniformly distributed (fig. 1). The placement of the seeds on the paper is done manually because the pea seeds are big enough to allow the proper development of the germs. The repetitions of placing the seeds in between stripes of paper are rolled and put into plastic bags, in order to maintain a constant level of moisture, and then they are placed in the germinator (Sanyo MLR), in a horizontal position.

Fig. 1. Germination pea seeds stage

Taking into account that the germination analysis is applied to a great number of species, in order to render uniform the methods used, the standard SR 1634/1999 establishes the requirements of each species in relation to the environmental factors, which are mandatory to be respected in any official accredited or authorized laboratory.

For the pea, the optimal germination temperature is around 20^{o}C and the readings for recording the values are done 5 days and 10 days respectively after the seeds are put in the germinator.

The seeds from the six cultivars have been analyzed in dynamic between 2012-2014.

After determining the physical purity, which was between 99.6 and 99.9%, the seeds were prepared in order to determine the germination, for the seeds obtained in 2011.

According to standard SR 1634/1999, the minimal germination for the pea seeds must be of 80%.

RESULTS AND DISCUSSION

The germ considered to be normal has the following normal essential structures:

- the radicular system is intact;
- the main root is intact or with slight defects, discolored or with necrotic stains, scars of cracks or fissures, superficial tears and cracks.

The germs that have a defective main root are classified as normal if they have enough well-developed secondary roots.

The data regarding the influence of the storage period on the germination of the pea seeds are presented in table 1. The data are presented for each cultivar and year of storage, as follows: the normally developed germs, the abnormal germs, the dead seeds and the value of the germination energy.

It is important to mention the fact that after germination, there have been no hard seeds or fresh seeds non - germinated.

In 2012, the seeds' germination has varied between 87.3%, in the case of the Television cultivar, and 98.5% in the case of the Kelvedon wonder variety, in 2013, the germination has varied between 81.5 % (Television cultivar) and 97.3% (Kelvedon wonder variety) and in 2014 the germination has varied between 76.5% (Televison cultivar) and 91.3 % in the Ambrosia cultivar.

In the case of the Ambrosia cultivar, we can say that the number of germs normally developed has decreased from 391 (2012) to 365 (2014), the germination percentage being reduced with 6.65 % during three years of storage.

In the case of the Television cultivar, we can say that the number of germs normally developed has decreased from 349 (2012) to 306 (2014), the germination percentage being reduced with 12.32 % during three years of storage.

In the case of the Ran -1 smooth seed cultivar, we can say that the number of germs normally developed has decreased from 384 (2012) to 343 (2014), the germination percentage being reduced with 10.68 % during three years of storage.

In the case of the Skinado cultivar, we can say that the number of germs normally developed has decreased from 373 (2012) to 329 (2014), the germination percentage being reduced with 11.80 % during three years of storage.

In the case of the Ran -1 wrinkled seed cultivar, we can say that the number of germs normally developed has decreased from 364 (2012) to 338 (2014), the germination percentage being reduced with 7.14 % during three years of storage.

In the case of the Kelvedon cultivar, we can say that the number of germs normally developed has decreased from 394 (2012) to 364 (2014), the germination percentage being reduced with 7.61 % during three years of storage.

The highest number of abnormal germs was recorded in the Televison cultivar, 32 (2012), which then grew up to 66 (2014).

From the data presented in figure 2, we can say that after three years of storage, the highest germination value was recorded in the Ambrosia cultivar (91.3) and Kelvedon wonder cultivar (91%), and the lowest value was recorded in the Television cultivar (76.5%).

Table 1

Results regarding the germination and plant emergence on paper substrate (2012-2014)

No. crt.	Cultivar	Values of germination indices*											
		2012				2013				2014			
		Normally developed germs (no.)	Abnormal germs (no.)	Dead seeds (no.)	Germination value (%)	Normally developed germs (no.)	Abnormal germs (no.)	Dead seeds (no.)	Germination value (%)	Normally developed germs (no.)	Abnormal germs (no.)	Dead seeds (no.)	Germination value (%)
1	Ambrosia	391	8	1	97.8	387	10	3	96.8	365	25	10	91.3
2	Television	349	32	19	87.3	326	41	33	81.5	306	66	28	76.5
3	Ran 1-bn	384	12	4	96.0	362	28	10	90.5	343	36	21	85.8
4	Skinado	373	23	4	93.3	354	33	13	88.5	329	51	20	82.3
5	Ran 1-bz	364	28	8	91.0	353	29	18	88.3	338	41	21	84.5
6	Kelvedon wonder	394	4	2	98.5	389	7	4	97.3	364	27	9	91.0

*with no hard or fresh ungerminated seeds

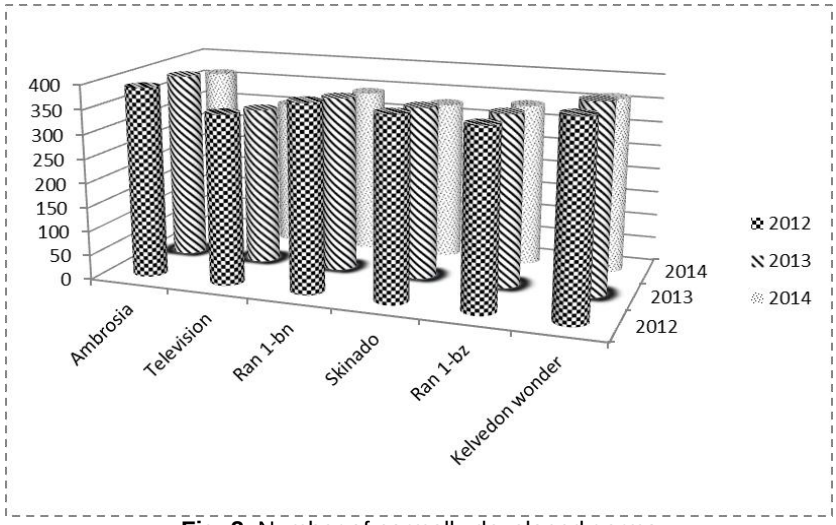

Fig. 2. Number of normally developed germs

CONCLUSIONS

The results presented in Table 1 highlight a direct correlation that exists between the pea cultivar and the seeds' germination percentage, which suggests that the storage process influences directly this process of germination.

The highest reduction of the germination percentage in the Television cultivar and the highest number of abnormal germs may be explained by the fact that in the seeds of this cultivar there has been identified the *Bruchus pisorum* pest, which results in the fact that after three years of storage, the seeds from this cultivar are unfit for sowing the crop.

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