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THE INFLUENCE OF THE CULTIVAR ON THE MAIN BIOCHEMICAL INDICATORS ON PEA SEEDS

INFLUENȚA CULTIVARULUI ASUPRA PRINCIPALILOR INDICI BIOCHIMICI ÎN SEMINȚELE DE MAZĂRE

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Abstract: *The main biochemical quality indices of seeds for the cultivated plants are influenced by a series of factors, such as: gentic, technological, abiotic or biotic factors. The storage period, the germination capacity and seed vigor are in direct correclation with the seeds' biochemical indices, which vary depending on the cultivar. The present work presents a study regarding the influence of the cultivar and storage period on the main biochemical indices of the garden pea seeds. The ash content varied in the case of pea seeds between 1.4% for the Skinado cultivar and 2.4% for the Television cultivar. The crude protein varied in the case of the cultivar selection under study between 20.20% for the Television cultivar and 27.40% for the Skinado cultivar, and the total lipids varied between 5.10% (Ambrosia cultivar) and 6.50% (Ran 1 round-seed and Kelvedon Wonder cultivars). The reducing sugars varied between quite large limits, from 10.20% in the case of the Television cultivar, up to 18.30% in the case of the Ran 1 wrinkled-seed cultivar.*
Key words: *Pisum sativum*, moisture, dry matter, proteins, sugars, lipids

Rezumat: *Principalii indici biochimici de calitate ai semințelor la plantele cultivate sunt influențați de o serie de factori, precum: factori genetici, factori tehnologici, abiotici sau biotici. Durata de păstrare, capacitatea de germinație şi vigoarea semințelor sunt în corelație directă cu indicatorii biochimici ai semințelor, care sunt variabili în funcție de cultivar.*
Lucrarea de fata prezintă un studiu cu privire la influența cultivarului şi a duratei de păstrare asupra principalilor indici biochimici ai semințelor la mazărea de grădină. Conținutul de cenuşă a variat la mazăre între 1,4% la Skinado până la 2,4% la cultivarul Television. Proteina brută a variat în cazul sortimentului studiat între 20,20% la Television până la 27,40% la cultivarul Skinadoiar lipidele totale au variat între 5,10% (Ambrosia) şi 6,50% (Ran 1 bob neted şi Kelvedon Wonder). Glucide reducătoare au variat în limite destul de largi, de la 10,20% în cazul cultivarului Television, până la 18,30% în cazul soiului Ran 1 bob zbârcit.
Cuvinte cheie: *Pisum sativum*, umiditate, substanță uscată, proteine, glucide, lipide

INTRODUCTION

It is well known that the main physical and biological quality indices of seeds are directly and clearly determined by the cultivation technology and,

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especially, by the harvesting and conditioning work and operations (Ciofu *et al.,* 2004).

These quality indices of seeds determined upon reception for storage are the phenotypic expression of each cultivar, an expression that sums up the influence of the genotype and the environment (the environmental conditions).

The seeds' physical and biological characteristics, expressed by moisture, germination, physical purity, health state, etc., are to a great extent the expression of the metabolic processes that have as a substrate the chemical and biochemical composition of seeds (Butnariu and Butu, 2014).

The chemical composition of pea seeds varies a lot depending on the maturation state of the seeds, the crop, as well as on the nutrition-related conditions (Dogaru *et al.,* 2006; Marin and Burada, 2007). The dry matter contained in the seeds varies a lot between 11,6 and 33,1%, depending on the cultivar. The proteins may vary between 2.48 and 9.12%, and the sugars content may rise from 8.1% to 20,1% out of the dry matter content (Enăchescu, 1984). The total nitrogen content varies within reduced limits in the case of pea seeds (15.08-15.80 g/100 g protein), depending on the crop (Atanasiu and Atanasiu, 2000). The total aminoacid quantities in the pea grains, from the same variety, have highlighted the fact that that the crop localization and the soil type determines a great variability of the chemical composition (Păcurar *et al.*, 2007).

Generally, in the case of the wrinkled-seed varieties, the dry matter content is more reduced, compared with the round-seed varieties. The sugars and reducing sugars content is greater in the case of the wrinkled-seed varieties, compared with the round-seed varieties, but from a qualitative perspective, the wrinkled-seed varieties are far superior (4.82% proteic matter in round-seed varieties and 2.74% proteic matter in wrinkled-seed varieties). The reducing sugars content depending on the crop varies from 2.41%, in round-seed varieties, up to 4.28%, in wrinkled-seed varieties.

Under these circumstances, the aim of the research was to establish to what extent the cultivar determines the quality of the seeds' metabolic substrate, namely their chemical and biochemical composition.

The present experiment offers solutions regarding the way in which the chemical and biochemical composition influences the seeds' quality, specifically their germination, as a main factor on which the seeds depend for their reception for storage, circulation and use in establishing new crops.

MATERIAL AND METHOD

The pea seeds from the 2015 harvest, from six cultivars, were used as a biological material: the Ambrosia, Television, Ran 1- non-wrinkle grain, Skinado, Ran 1- wrinkle-grain and Kelvedon Wonder cultivars.

The moisture determination was done according to AOAC 1999. Approximately 5 g from a sample in ampoules containing a known dry mass, previously numbered. After weighing them, they are introduced in the drying oven, previously set at a 105ºC temperature. After the drying time is up, the ampoules are taken out of the drying oven and the mass is recorded.

This process is repeated until a constant mass is reached. For the majority of products, they are considered to have reached a constant mass when the difference between two successive weighings does not surpass 0.005 g.

The mineral substances (ash) determination was done according to AOAC 942.05 (Thiex *et al*., 2012).

The ash content was determined after the samples were calcinated in the calciner, at a 525 ± 25ºC temperature, until reaching a constant weight.

The total fibers content determination was done according to AOAC 973.18.

The method employs cationic detergents in order to remove the carbohydrates, the proteins uncomplexed by Maillard reactions and fats, leaving a fibrous residue made for the most part from cellulose and lignin or from insoluble protein complexes. After weighing the reflux tubes, the sample used for analysis is homogenized and then some quantities between 0.9 and 1.1 g are added in the tubes.

The weighed and noted tubes are introduced in the device fuelled with sulphuric acid and the cationic detergent, where the washing process begins. After this process ends, the reflux tubes are dried over night (100ºC).

The crude protein determination was done according to AOAC 955.04, the Kjeldahl method of determinig the total nitrogen (Butnariu and Butu, 2014).

The total lipids determination was done according to AOAC 963.15, the Soxhlet method of determining the total fats.

The reducing sugars determination is done by preparing the carbohydrate extract starting from a part of the quantity from the material to be analyzed, so that the sample would contain a certain amount of carbohydrates, which in turn would lead to obtaining a final extract with a sugar content below 1% (Stan *et al.,* 2003). The samples were treated with acetic acid (the precipitation with lead acetate is done in a weak acetic solution, because this way, the precipitate formed retains the carbohydrates). The excess of lead acetate is precipitated in turn with a saturated solution of sodium sulphate and it is filtered again. The solution is made up to volume with distilled water, in a volumetric flask of 250 ml capacity. In the case in which the materials used are dried fruits and vegetables, the necessary quantity needed to work with is around 5 – 10 g dried plant material.

RESULTS AND DISCUSSION

The results obtained show the fact that the cultivar factor may have a certain influence on the seeds' chemical and biochemical composition, which practically translates into the characteristics that determine the germination, as main characteristics depending on which the seed vigor and the quality that would ensure the production of an appropriate crop are assessed.

The cultivar, as a main production factor for any agricultural crop, proves its influence starting from the seed stage (table 1).

The seed moisture varied within the cultivar selection from 9.7% (in the case of the Television cultivar) to 13.4% (in the case of the Skinado cultivar), with an experimental avarage of 10.8%.

The moisture level for most cultivars falls within the limit of the experimental avarage, except for the Skinado cultivar, for which the moisture was of 13.4%. This value also has a positive correlation with a higher moisture retention capacity in the case of this specific cultivar.

Table 1

The chemical composition of pea seeds regarding moisture, ash (mineral salts) and fibers

No.	Cultivar	Moisture (%)	Ash (%)	Total fibers (%)	Observations
1	**Ambrosia**	10,1	2,2	7,2	-
2	**Television**	9,7	2,4	5,8	Pea-weevil samples
3	**Ran 1 wrinkle-grain**	10,2	1,8	8,7	-
4	**Skinado**	13,4	1,4	7,6	-
5	**Ran 1 non-wrinkle grain**	10,8	1,6	7,4	-
6	**Kelvedon Wonder**	10,6	1,6	7,0	-
7	**x□ (Average)**	10,8	1,8	7,25	-

The ash content varied within the cultivar selection between 1.4% for the Skinado cultivar, and 2.4%, for the Television cultivar, with an experimental avarage of 1.8%. In the case of the Television cultivar, the greater ash content was also determined by the fact that the seeds were damaged by *Bruchus pisorum*.

In the case of the wrinkled-seed variety (Ran 1), the ash content was greater then the one found in the Ran 1 round-seed variety, with a growth of 0.2%.

The fibers content varied within wide limits, from 5.8% in the case of the Television cultivar, up to 8,7% in the case of the Ran 1 wrinkled-seed variety, with an average within the cultivar selection of 7.25%.

The crude protein, percentually determined, varied in the case of the cultivar selection under study between 20.20% in the case of the Television cultivar, up to 27.40% in the case of the Skinado cultivar, with an average recorded at the level of the entire experiment of 23,10%. For the majority of cultivars, the crude protein content varied between 22% and 23%, which is also shown in the literature on the matter (Enăchesu, 1984; Păcurar *et al.,* 2007; Butnariu and Butu, 2014).

A greater protein content indicates the fact that the variety is more stable for industrialization and it is positively correlated with a more reduced starch content, which makes it better for preservation.

In the case of the Ran 1 cultivars, the total protein varied within small limits, from 23.20% to 23.70% (table 2).

The total lipids varied between 5.10% (Ambrosia) and 6.50% (Ran 1 round-seed and Kelvedon Wonder), with an experimental average of 5,95%. Higher values of the total lipids content were also obtained in the case of the Skinado cultivar (6.40%).

The reducing sugars content varied within wide limits, from 10.20% in the case of the Television cultivar, up to 18.30% in the case of the Ran 1 wrinkled-seed cultivar, with an experimental average of 14.60%.

Values that were close to the experimental average were obtained in the case of the Skinado and Ran 1 round-seed varieties. Values that exceeded the experimental average were obtained in the case of the Kelvedon Wonder cultivar.

The starch content varied within wide limits, from 30.65% (Skinado) up to 48.30% (Television), with an experimental average of 38.29%. Values that were close to the experimental average were obtained in the case of the Ran 1 round-seed (36.70%) and Kelvedon Wonder varieties (36.59%). The high values of the starch content are correlated with low values of the lipids and proteins content.

Table 2

The chemical composition of pea seeds regarding the crude proteins, total lipids and reducing sugars

No.	Cultivar	Crude proteins (%)	Total lipids (%)	Reducing sugars (%)	Starch (%)
1	**Ambrosia**	21,80	5,10	12,20	43,80
2	**Television**	20,20	5,80	10,20	48,30
3	**Ran 1 wrinkled-grain**	23,70	5,40	18,30	33,70
4	**Skinado**	27,40	6,40	14,50	30,65
5	**Ran 1 non-wrinkled grain**	23,20	6,50	15,40	36,70
6	**Kelvedon Wonder**	22,31	6,50	17,00	36,59
7	**$\bar{x}$ (Average)**	23,10	5,95	14,60	38,29

CONCLUSIONS

In all cases, the value of the seeds' moisture level is under the maximum limit accepted by the standard, which should be under 14%, and this fact shows that the pea seeds were kept under optimal conditions.

In the majority of the cases, the average fibes content falls within the average limit. Lower levels of the fibes content are due especially to the degree of pea-weevil infestation.

The data presented highlight the fact that the Kelvedon Wonder cultivar is more equilibrated from a biochemical perspective, which made this variety to be highly appreciated by consumers, for over five decades.

The reducing sugars content varied within wide limits, from 10.20% in the case of the Television cultivar, up to 18.30% in the case of the Ran 1 wrinkled-seed variety, and the starch content varied within very wide limits, from 30.65% (Skinado) up to 48.30% (Television).

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