

INTERDEPENDENCE OF SUNFLOWER SEED QUALITY PARAMETERS

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SUMMARY

Sunflower is an important source of oil and proteins necessary for development of healthy humans. By producing sunflower seeds, the main gains a possibility to use oil and proteins in different forms. The content of the observed parameters varies and depends on numerous factors. Environmental factors, the choice of genotypes and measures that apply during the production of seed all influence the content of oil and proteins in sunflower seed, as well as seed germination, one of the most important seed characteristics.

Based on the results obtained by comparing the observed parameters, further interdependence (correlation) of the observed parameters of sunflower seed quality is established.

Significant differences were determined between localities in which sunflower seed was produced. During the research, significant positive and negative correlations were found between the observed parameters of sunflower seed quality.

Key words: oil content, protein content, seed, seed germination, sunflower

INTRODUCTION

The basic goal of sunflower breeding is the production of seed (Škorić, 1997). Sunflower is produced at approximately 23 million hectares in 40 countries of the world (Seiler, 2008). The growth of competition with the aim of taking up a bigger part of the market is quite understandable if we take into consideration the sunflower acreage in the world, the profit realized from hybrid seed sales and the number of companies engaged in the production and marketing of sunflower seeds.

Germination is an important seed characteristic. A number of factors influences it, from environmental factors during growing season, good or poor agrotechnical measures applied to seed crop, to seed cleaning, bagging and delivery to clients (disease and insect attacks, inadequate seed drying, seed breaking during

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cleaning, inadequate treatment with protection agents, poor storage conditions, etc.). Kastori (1984) stated that environmental factors (climate factors: temperature, light, water) which activate inner factors (hormones and enzymes) are essential for germination. Mirić *et al.* (2002) state that a man can influence seed germination only during the seed cleaning and storage. The same authors further state that during the production a man can only partially lessen the influence of unfavorable factors.

According to Egly (1998), Vega *et al.* (2001) germination is conditioned by a number of factors which appear in the after-flowering period. The same authors further claimed that germination depends solely on the genotype. Conversely, Bullard *et al.* (1996) stated that germination of sugar beet depends not only on the genotype but on environmental factors as well. These factors affect certain physiological processes within the seed during seed formation and filling.

Common argument of seed companies when animating producers is chemical composition of seed and its purpose. Sunflower seed contains a number of different organic compounds, but for sunflower, oil and protein content in seed are most important (Marinković *et al.*, 2003).

In their papers, Škorić *et al.* (1990, 1996) and Dušanić (1998) mention variations of oil content in sunflower seed in different years and localities. Studying sunflower production in many localities, Kovačik *et al.* (1988) determined that environmental factors significantly affect oil content in seed. Robertson *et al.* (1979) disagreed with this. They maintained that latitude and temperature do not have significant effects on oil content in seed after the stage of flowering. The increase of oil content in sunflower seed can be achieved by gaining knowledge of environmental factors, application of adequate agrotechnical measures and correct choice of sunflower hybrids (Marinković *et al.*, 2003).

Besides oil, sunflower seed is a significant source of proteins. A number of authors have studied correlations between the protein content and other seed characteristics (Pačenko and Djakov, 1968; Ivanov and Stoyanova, 1978; Jovanović, 1995; Joksimović, 1999). Protein content has been correlated with seed yield, 1000-seed weight, dry matter mass, oil content, kernel yield and other qualitative and quantitative characteristics. Different results have been obtained on the level and strength of the established correlations. Pustavoit and Djakov (1972) and Djakov (1980) claimed that there is a certain degree of antagonism between oil and protein biosynthesis. In further research, Djakov (1986) did not confirm the existence of this antagonism. In a research of optimum time for desiccation of sunflower inbred lines, Radić (2006) found that in the process of maturing, protein biosynthesis stabilizes earlier than oil biosynthesis in sunflower seed. Kovačević (1986), Merrien *et al.* (1988) and Dušanić (1994) determined that in addition to the genotype, environmental factors exert a high effect on protein content in sunflower seed.

The goal of this research was to determine whether the locality influences certain parameters of seed quality, what effects it extends and whether there exist correlations between the observed parameters of sunflower seed quality.

MATERIAL AND METHOD

Samples of seed produced in two different localities in 2007 were examined. Two inbred lines were used in this study, L-2 and L-4. All analyses were performed at Institute of Field and Vegetable Crops in Novi Sad, in a laboratory of Oil Crops Department. The following parameters were analyzed.

1. Germination -Germination of both genotypes was tested at 6 dates. Fifty seeds were used in each stage. Germination was determined after 10 days. Only straight plumules were taken into account for determination of this parameter. Germination was expressed in relative values.
2. Oil content -Oil content was determined by the conventional method by Ruskovski and expressed in relative values.
3. Protein content -Protein content was determined by the standard method of Kjeldahl using a VAP-50-Gerhardt apparatus. This parameter too was expressed in relative values.

A GENSTAT computer program (two-way ANOVA) was used for the analysis of variance and interdependence of the observed parameters.

RESULTS

Seed germination of the observed lines (L-2 and L-4) was 64% and 71%, respectively, in locality 1, and 97% and 96%, respectively, in locality 2 (Table 1).

Table 1: Results from different localities

Genotype	Locality 1					
	Seed germination (%)	Oil content (%)	Protein content (%)			
L-2	64	31.34	26.74			
L-4	71	36.82	23.61			
Genotype	Locality 2					
	Seed germination (%)	Oil content (%)	Protein content (%)			
L-2	97	36.42	24.28			
L-4	96	48.90	15.07			
LSD	Seed germination		Oil content		Protein content	
	Genotype	Locality	Genotype	Locality	Genotype	Locality
1%	5.78	5.17	0.75	1.61	0.49	0.87
5%	9.58	11.93	1.25	3.72	0.81	2.01

Regarding oil content in seed, lower values were determined on the first than in the second locality, similarly to seed germination values. The line L-2 had the oil

contents of 31.34% and 36.42% in the first locality and second locality, respectively. The line L-4 had the oil contents of 36.82% and in the first and second locality, respectively (Table 1).

Regarding protein content in seed, higher percentages were obtained in the first locality than in the second locality. The line L-2 had the protein contents of 26.74% and 24.28% in the first and second locality, respectively. The respective values for the line L-4 were 23.61% and 15.07% (Table 1).

When the results for seed germination were compared, highly significant differences were determined between the localities but not between the lines.

Regarding the oil content in seed, highly significant differences were determined between the localities, just like for seed germination.

Highly significant differences were also determined for the protein content. The observed sunflower lines differed significantly between in this parameter.

A significant positive correlation was determined between seed germination and oil content in seed. A significant negative correlation was determined between seed germination and protein content in seed. A highly significant negative correlation was determined between oil and protein contents in seed (Table 2).

Table 2: Coefficients of correlation of the observed parameters

	Oil content	Protein content
Seed germination	0.675*	-0.633*
Oil content		-0.994**

DISCUSSION

Based on the results for seed germination, it can be concluded that seed production of one hybrid/variety should be organizer in a number of different localities, in order to obtain enough seed of high quality. It is obvious that the first locality produced poorer results, except in the case of protein content. These results allowed us to find highly significant effects of environmental factors on sunflower seed germination. Miklič (2001) claimed that favorable environmental factors in a locality tended to reduce the occurrence of certain diseases which otherwise would have affected seed yield and quality. Conversely, Balalić *et al.* (2006) found no significant difference for the interaction of hybrids and the year, while significant differences existed for all other sources of variations (relation of oil content and yield, locality, year, deadline of sowing and the plant density). Rondanini *et al.* (2006) believed that germination is a specific attribute, characteristic for each individual genotype.

In the first locality, both oil content in sunflower seed and seed germination were lower than in the second locality. These results indicate that the locality does affect oil content in sunflower seed. Based on their research, Marinković *et al.* (2003) concluded that oil content in seed is a quantitative attribute and that its for-

mation is conditioned by both, genetic and environmental factors. Škorić and Marinković (1990) concluded that this attribute varies in dependence of the year. Miklič (2001) maintained that environmental factors do not have a high effect on oil content in seeds and that the effect of genotype prevails.

A highly significant effect of locality on protein content in sunflower seed was also found, as in the case of the previously observed parameters. Contrary to the previous parameters, protein content was higher in the first locality than in the second observed. Kurnik (1979), Merrien *et al.* (1988) and Dušanić (1994) stated that environmental factors affect not only total protein content but the synthesis of proteins in sunflower seed as well.

The obtained correlations are in compliance with the results of other researchers from this region. Alba *et al.* (1979) and Dušanić (1998) produced similar results. When comparing certain parameters of seed quality with environmental factors, Radić (2008) found a positive correlation between seed germination and oil content in sunflower seed. Canvin (1965) asserted that unfavorable conditions for oil synthesis lead to the increase of protein content in sunflower seed. Based on their research, Marinković *et al.* (2003) concluded that in addition to the study of physiological aspect of protein synthesis in sunflower, attention should be devoted to the study of genetic and individual environmental factors that increase the protein content in sunflower seed.

It was concluded on the basis of the obtained results that further research should be aimed at observation of relationships between certain parameters of seed quality, with the objective of obtaining high-quality sunflower seed.

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INTERDEPENDENCIA DE CIERTOS PARÁMETROS DE CALIDAD DE LA SEMILLA DE GIRASOL

RESUMEN

Girasol es la fuente importante de aceite y proteínas necesarias para el desarrollo regular del hombre. Produciendo la semilla de girasol, el hombre crea la posibilidad de utilizar el aceite y proteínas en formas diferentes. El contenido de los parámetros observados varía dependiendo de numerosos factores. Los factores del medio, elección de genotipo y las medidas agrotécnicas aplicadas durante la producción de semilla, influyen en el contenido de aceite y proteínas en la semilla de girasol, tanto como en la germinación de semilla. La germinación es una de las propiedades de semilla más importantes.

En base a los resultados obtenidos por comparación de los parámetros observados, fueron establecidas las interdependencias (correlaciones) de los parámetros observados que definen la calidad del aceite de girasol.

Fueron definidas las diferencias significantes entre las localidades en las cuales se producía la semilla de girasol. A lo largo de las investigaciones fueron encontradas correlaciones positivas y negativas significantes entre los parámetros observados que definen la calidad de aceite de girasol.

INTERDÉPENDANCE DE CERTAINS PARAMÈTRES DE QUALITÉ DE LA GRAINE DE TOURNESOL

RÉSUMÉ

Le tournesol est une importante source d'huile et de protéines nécessaires au développement normal de l'homme. En produisant des graines de tournesol, on crée la possibilité d'utiliser l'huile et les protéines sous différentes formes. La teneur des paramètres observés variait selon un grand nombre de facteurs. Les facteurs du milieu, le choix des génotypes et des mesures agrotechniques appliquées au cours de la production de la graine agissent sur la teneur en huile et en protéines dans la graine de tournesol ainsi que sur sa faculté germinative. La faculté germinative est l'une des caractéristiques les plus importantes de la graine.

Les résultats obtenus en comparant les paramètres observés ont permis de confirmer l'interdépendance (corrélation) des paramètres observés définissant la qualité de l'huile de tournesol.

Des différences importantes entre les localités où est produite la graine de tournesol ont été confirmées. Au cours de la recherche on a trouvé d'importantes corrélations positives et négatives entre les paramètres observés définissant la qualité de l'huile de tournesol.