

**VARIABILITY AND HERITABILITY COEFFICIENT OF AVERAGE DRY  
MATTER CONTENT IN ONION (*Allium cepa* L.) BULBS**

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In order to research the variability of average dry matter content  
in onion bulbs, the trial has been set up on the experimental plot in the  
Centre for Vegetable Crops in Smederevska Palanka during 2000. and  
2001. The trial has been performed by applying the method of random  
block design with five replicas. Ten cultivars of different geographical  
origin have been used. Examined characteristics were determined by  
applying the variance analysis of two-factorial trial – model 2.  
HADZIVUKOVIC, 1991. The components of phenotype variance, genotype  
and phenotype coefficient of variance and heritability in broader sense  
have been calculated according to SINGH and CHAUDHARY (1976).

The significant variability has been found for dry matter content  
in bulbs during both years of research. The researched trait had a greater  
genotype variance than out door conditions factor variance and the

coefficient of phenotype variation greater than genetic variance coefficient.

High percentage of genetic variability in total phenotype variability has been confirmed by high heritability.

*Key words:* onion, dry matter content, coefficient of variation, heritability

## INTRODUCTION

Only genotypes with high percentage of dry matter are used in food industry. Selection programs in many countries deal only with genotypes for drying with high percentage of dry matter. Main chemical characteristic of onion is its variability influenced weather, soil and agro-technique.

Dry matter percentage for some varieties shows the percentage of total bulb mass that can be used in food industry. Total yield of one variety per surface unit can be counted through dry matter content. Onion bulbs with high percentage of dry matter are better for storage.

## MATERIAL AND METHODS

In order to research the variability of dry matter content in onion bulbs, a trial has been set up on the experimental plot in the Centre for Vegetable Crops in Smederevska Palanka during 1997 and 1998. The trial has been performed by applying the method of random block design with five replications. Ten cultivars of different geographical origins have been used. Assessed characteristics were analysed by applying two-factorial trial variance– model 2 (HADZIVUKOVIC, 1991). Phenotype components, genotype and phenotype variation coefficient in broader sense, have been calculated according to SINGH and CHAUDHARY (1976).

## RESULTS AND DISCUSSION

The lowest dry matter content (9.61% and 10.20%) had variety Makoi bronzi. The highest dry matter content (18.64% and 18.09%) in both years of research had variety Bunkino beo, (Table 1).

The average dry matter content for researched varieties was 9.90% and 18.36%. These results are similar to those found by other authors: ARASIMOVIC and ISKOZ 1950; PAVLEK 1985; etc). These authors found that the dry matter content in onion bulb varies from 7.2% to 21.2% (average 15). According to their average dry matter content and Zeceva (1973) classification, the researched varieties can be sorted as: sweet (Makoi bonzi), mild (Holandski zuti, Piroški, Atteleo voroshaguma, Kupusinski jabucar and AC 101) and intense (Tetelji rubin,

Bunkino beo i Jasenički žuti) flavour, while Jasenički crveni varies between last two groups.

Table 1: Medium value, variation coefficient and standard deviations of dry matter content in 10 onion varieties

Varieties	Dry matter							
	1997			1998			8(%)	CV%
	8(%)	CV%	S	8(%)	CV%	S		
Holandski žuti.	12.82	12.91	1.38	12.02	13.77	1.55	12.42	4.26
Piroški	11.53	9.01	1.10	10.66	9.59	0.96	11.09	4.61
Atteleo vorosh.	13.43	10.79	0.44	13.23	10.29	1.42	13.33	1.05
Tetelji rubin	16.55	10.92	0.48	15.92	9.96	0.62	16.23	3.34
Bunkino beo	18.64	9.46	0.45	18.09	9.51	0.45	18.36	2.93
Jasnički crveni	14.03	10.20	1.42	13.13	10.13	1.33	13.58	4.76
Makoi bronzi	10.20	8.93	0.43	9.61	11.23	0.18	9.90	3.11
Jasenički žuti	14.57	10.09	0.31	14.08	9.13	1.42	14.32	2.70
Kupus. jabuč.	11.81	9.70	1.22	10.74	10.33	0.29	11.27	5.66
AC 101	13.56	9.37	1.35	12.36	9.98	0.30	12.96	6.34
8	13.04	7.44	0.86	13.04	6.59	0.85	13.35	3.87
CV%	17.20			20.61				
LSD 0.05			1.21					
LSD 0.01			1.59					

Variability of researched genotypes expressed in variation coefficient amounts 8.93% to 13.91%, which equals the variability found by AGIČ (1996). The cited author found the changing of variability for the researched genotypes from 7.26% to 20.55%. The lowest coefficient variance in 1997 had Makoi bronzi variety, and the lowest Holandski žuti (table 19). In 1998, the variety Bunkino beo had the lowest variation coefficient (9.13%), while the highest variation, like in previous years, had Holandski žuti (13.77%). Standard deviations are in accordance to variation coefficient values. Variability per years of research showed that the variety Atteleo voroshaguma had lowest variation while variety AC 101 varied the most. The variability among the researched genotypes in 1997 was 17.20% and in 1998 was 20.61%, (table 1).

The variance analysis showed highly significant variability, while the interaction of year and genotype was not found (table 2).

Table 2: Two-factorial analysis of dry matter content in 10 onion varieties

Trait	Variation source	freedom degree df	Sum square SS	Middle square MS	F (exp)	F (tab)	
						0,05	0,01
Dry matter	Variety	9	573.30	63.70	67.32**	2,04	2,72
	Year	1	9.58	9.58	10.13**	4,00	7,08
	S X G	9	5.68	0.63			
	Error	72	68.12	0.94			

Dry matter content for all researched genotypes was higher in 1997 (lower precipitation) and lower in 1998 (more precipitation). The influence of precipitation on dry matter content was confirmed by LAZIC (1993), ZECEVA and MANUELJAN (1967).

On basis of phenotype variability for dry matter content it was found that this trait is more controlled by heritage than by ecological impact. Part of genetic variance in total phenotype was 84% and 88%. According to results in table 3, the ecological variance in 1997 was 0.96, and in 1998, 0.94. Genetic variance per year of research was 5.33 and 7.04.

Table 3: Genetic ( $Sg^2$ ), ecologic ( $Se^2$ ) and phenotype ( $Se^2$ ) variance  
Genetic coefficient (GCV) and phenotype (FCV) variance  
Heritability coefficient from analysis of 10 onion varieties

Trait		$Sg^2$	$Se^2$	$Sf^2$	GCV (%)	FCV (%)	$h^2$
Dry matter	1997	5.33	0.96	6.28	16.89	18.35	0.85
	1998	7.04	0.94	7.97	20.34	21.65	0.88

Coefficient of genetic variance was 16.89% and 20.34%, while coefficient of phenotype variation was higher: 8.35% and 21.65%. Heritability in broader sense was 0.85% and 0.88% and that shows that genetic is the most important in inheriting dry matter content (table 3). Our results are in accordance with ZECEVA et al. (1993) and LAZIC and DJUROVKA (1985).

According to our researches Bunkino beo and Tetelji rubin could be recommended for dehydration. Our researches are in accordance with BAJAJA et al (1980), who found that white onion bulbs are best for dehydration.

## CONCLUSION

The results show that there is a significant variability of average dry matter content in onion bulbs. In both years of research, genetic variance was higher than the ecological and the coefficient of phenotype variation were higher

than genetic variance coefficient. Values of phenotype variability and heritability in broader sense show that this trait is controlled more by genetic than ecology conditions.

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**VARIJABILNOST I KOEFICIENT HERITABILNOSTI PROSEČNOG  
SADRŽAJA SUVE MATERIJE U LUKOVICAMA CRNOG LUKA  
(*Allium cepa* L.)**

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Izvod

U cilju ispitivanja varijabilnosti prosečnog sadržaja suve materije u lukovicama crnog luka, postavljen je ogled na oglednom polju Centra za povrtarstvo u Smederevskoj Palanci u toku 2000. i 2001. godine. Ogled je izveden po slučajnom blok sistemu u pet ponavljanja. Za istraživački materijal korišćeno je deset sorata, različitog geografskog porekla. Utvrđene vrednosti ispitivanih svojstava su obrađene analizom varijanse dvofaktorijskog ogleda-model 2. (Hadživuković, 1991). Komponente fenotipske varijanse, genotipski i fenotipski koeficijent varijacije i heritabilnost u širem smislu izračunate su prema Singh i Chaudhary (1976).

Značajna varijabilnost je dobijena za prosečni sadržaj suve materije u lukovicama tokom obe godine istraživanja. Ispitivana osobina imala je varijansu genotipa veću od varijanse faktora spoljašnje sredine i koeficijent fenotipske varijacije veći od koeficijenta genetičke varijacije. Veći udeo genetičke u ukupnoj fenotipskoj varijabilnosti potvrđuje visoka heritabilnost.

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