

**VARIABILITY AND HERITABILITY OF AVERAGE YIELD OF ONION
BULB (*ALLUM CEPA* L.)**

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Pavlović N., B. Zečević, M. Zdravković, M. Ivanović, and M.
Damjanović (2003): *Variability and heritability of average yield of onion
bulb (*Allum cepa* L.)*. – Genetika, Vol. 35, No. 3, 149-154.

In order to investigate the variability of bulb yield, the trial was set up on an experimental plot of the Centre for Vegetable Crops in Smederevska Palanka during 1997 and 1998. The trial was performed by applying the method of random block system in five replications. Ten varieties of different geographical origins were included as the research material. The recorded values of the investigated features were determined by applying the variance analysis of a two-factorial trial model 2 (HADŽIVUKOVIĆ, 1991). The components of the phenotype variance, genotype and phenotype coefficient of variation and heritability in broad sense were estimated according to SINGH and CHAUDHARY (1976). Significant variability was recorded for yield bulbs in both years of investigation. For this parameter, genotype variance was greater than the environmental. Phenotype coefficient of variation (PCV) was greater than genotype coefficient of variation (GCV). Heritability confirmed that the genotype variability was stronger in the overall phenotype variability.

Key words: onion, yield bulb, index, genotype and phenotype variation coefficient, genotype and environmental variance, heritability

INTRODUCTION

All the way from the North to the Equator onion is one of the most popular vegetable crop and its genotypes depend on ecological conditions and usage. The usage is directly connected to breeding. The most important gain of modern onion production is high yield and good quality. Standard bulb yield are bulbs with diameter more than 4 cm or the market bulbs. The yield of the non standard bulbs is also important for every day consumption and proceeding. Bulb yield per hectare directly depends upon the average bulb weight and the bulb shape. Bulb yield is the first of all the characteristic of the variety but it highly depends on ecological conditions, growing and agrotechnical measurements. When it comes to the ecological conditions, precipitation is very important for the total yield, and especially the bulb yield. (VARVINA *et al.* 1993).

In order to accomplish the gain of onion selection it is important to know the effect of variability on forming certain characteristics. Variability of onion quantitative characteristic can be genetic and ecological (external factors). The success of selection directly depends on these factors.

Having in mind the above, the aim of this work was to research the variability and heritability for ten different onion varieties of different geographical origin.

MATERIAL AND METHODS

In order to investigate the variability of onion bulb yield, a trial has been set up on an experimental plot of the Centre for Vegetable Crops in Smederevska Palanka during 1997 and 1998. The trial has been performed, applying the method of random block system in five replicas with 30 plants per replica. Ten varieties of different geographical origin were included as the research material. The recorded values of the investigated features were determined by applying the variance analysis of a two-factorial trial – model 2 (HADŽIVUKOVIĆ, 1991). The components of the phenotype variance, genotype and phenotype coefficient of variation and heritability in broad sense were estimated according to SINGH and CHAUNDHARY (1976).

RESULTS

Total yield per surface unit is the result of the average bulb weight and the number of plants – standard bulbs.

The average yield of standard bulbs for the researched genotypes was from 15.20 t/ha up to 39.18 t/ha. The lowest average yield of standard bulbs in 1997 had variety Attelo voroshaguam -13.07 t/ha, while the highest yield had variety AC 101 - 33.01 t/ha. During the second year of research the lowest average yield had Attelo voroshaguam (17.34 t/ha) and the highest variety Makoi bronzi (39.19 t/ha). In the first year, the lowest percent of standard bulbs had Tetenji rubin variety (83.20%), and the highest AC 101 variety (90%). In second year the lowest yield was the characteristic of Bunkino beo variety (79.50%), and the highest for

Makoi bronzi (95.20% - Table 1). In 1998 we noticed the growth of yield and bulb weight, which was the influence of ecological effect i.e. greater precipitation. For all the researched genotypes, we noticed the growth of yield but unequally, depending on adaptability on external factors.

Table 1. Middle value, variation coefficient and standard deviations for bulb yield of 10 varieties of onion

Sorte	Prinos									
	1997				1998					
	8(t/ha)	CV%	% stan- dardnih	S	8(t/ha)	CV%	% stan- dardnih	S	8(t/ha)	CV%
Holandski žuti	30.26	12.17	85.03	2.14	37.22	11.07	94.50	3.04	33.73	15.58
Piroška	28.15	16.73	83.00	4.28	32.75	19.23	90.00	4.17	30.44	10.29
Atteleo vorosh.	13.07	20.37	85.00	2.65	17.36	20.34	94.00	5.81	15.20	9.54
Tetenji rubin	28.28	10.02	83.20	5.30	30.40	12.74	92.26	1.95	30.33	9.23
Bunkino beo	23.50	18.35	86.32	2.64	30.25	15.24	79.58	4.94	26.87	15.10
Jasenički crveni	29.41	9.92	86.00	1.59	37.62	9.41	92.40	2.22	33.51	18.37
Makoi bronzi	32.65	8.10	85.21	2.66	45.72	12.15	95.20	1.87	39.18	29.25
Jasenički žuti	30.29	14.08	85.65	3.56	42.91	15.85	95.01	4.32	36.59	28.25
Kupusinski	29.59	11.69	84.20	1.43	38.83	8.85	91.20	2.98	34.21	20.67
AC 101	33.01	11.47	90.00	2.82	38.77	12.55	91.57	2.89	35.89	12.89
8	27.82	13.34	85.36	2.90	31.60	13.74	92.57	3.41	31.59	16.91
CV%	20.91				22.36					

LSD 0.05 = 3.86; 0.01 = 5.08

According to PANAJOTOVIĆ (1980) the yield for 6 genotypes on the same locality was 45 t/ha.

The variability for the researched genotypes was from 8.10 for Makoi bronzi variety up to 20.37 for Attelo voroshaguam in the first year of research. In second year, variability was from 8.85% for Kupusinski and 20.34% for Attelo voroshaguam. Variability of specific genotype during the years of research shows that variety Tenji rubin varied the least (9.23%) while Makoi bronzi varied the most (29.25%). The variability for average yield of researched genotypes in 1997 was 20.91% and in 1998 – 22.36% (Table 1).

Tabela 2. Two-factorial analysis of the variance of the yield bulb in 10 onion varieties

Trait	Source	Df	SS	MS	F (exp)	F (tab)	
						0.05	0.01
Yield	Variety	9	4380.60	486.83	50.99**	2.04	2.72
	Year	1	1490.96	1490.96	156.20**	4.00	7.08
	V X Y	9	238.36	26.48	2.77**	2.04	2.72
	Error	72	687.22	9.54			

Table 2 shows genotype variance analysis, years and their interaction. The result of two-factorial analysis of variance shows highly significant differences both among genotypes and years. The genotype interaction with the external conditions, which is also highly significant shows that outside conditions and the way of production play a big role in variation of onion yield.

The results of our research match the results of ARENFAK *et al.* (1993), SIDHU *et al.* (1989). These authors found highly significant differences between years and genotypes. They also found significant interaction among genotypes and years. This fact is usually the limitation factor for onion yield.

The value of variance components for average yield, show that this trait is strongly controlled by genetic factors, while the influence of external factors is lower. This is also impacted by influence of genetic variance in total phenotype (71% and 74%). In 1997 the value of ecological variance was 11.37 and the value of genetic variance 31.56. During the second year of research we found higher value for genotype (59.12) and ecological variance (17.40) (Table 3).

Tabela 3. Genetic (Sg^2), ecological (Se^2) and phenotypic (Se^2) variance, coefficient of genetic (GCV) and phenotypic (FCV) variation, and heritability coefficient from the variance analysis of the yield bulb of 10 onion varieties

Trait		Sg^2	Se^2	Sf^2	GCV (%)	FCV (%)	h^2
Yield	1997	31.56	11.37	42.93	20.19	23.55	0.73
	1998	59.12	17.40	76.52	21.73	24.72	0.77

The genotype variation was 20.19% and 21.73%, while phenotype variation in both years had higher value. Heritability in broader sense was 0.74% and 0.77% (Table 3).

Similar results have been found by KAMPE (1967) and ZECEVA (1973). High values of genotype and phenotype variations were also found by SINDHU *et al.* (1988), as well as high value for heritability.

CONCLUSION

The results show high variability of average onion yield. In both years, the manifested values of genetic variance were greater than ecologic, the phenotype variation was higher than genetic. The values of phenotype variances components and heritability in broader sense, show that this trait is more controlled by genetic factor than ecological.

Received December 17th, 2003

Accepted December 29th, 2003

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**VARIJABILNOST I KOEFICIJENT HERITABILNOSTI PROSEČNOG
PRINOSA LUKOVICA CRNOG LUKA (*ALLIUM CEPA* L.)**

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Izvod

U cilju ispitivanja prosečnog prinosa lukovica crnog luka, postavljen je ogled na oglednom polju Centra za povrtarstvo u Smederevskoj Palanci u toku 1997 i 1998 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 dobijena je za prinos lukovica u obe godine istraživanja. Ispitivana osobina imala je varijansu genotipa veću od varijanse faktora spoljašne sredine i koeficijent fenotipske varijacije veći od koeficijenta genetičke varijacije. Veći udeo genetičke u ukupnoj fenotipskoj varijabilnosti potvrđuje i izračunata vrednost koeficijenta heritabilnosti.

Primljeno 17. XII 2003.
Odobreno 29. XII 2003.