Photosynthetic productivity of two winter wheat varieties (*Triticum aestivum* L.)

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ABSTRACT

This paper deals with the influence of Mg, N and the content of chlorophylls and carotenoids on photosynthetic productivity of two new genotypes of winter wheat, Lara and Perla, at two localities, Donji Miholjac and Kutjevo, during the vegetation periods 1997/1998 and 1998/1999. The applied parameters were determined by standard methods. The results showed effects of Mg concentration on all examined parameters with the exception of chlorophyll *b* content. The highest correlation coefficient was with the N concentration, significant correlation between the leaf area and N concentrations and between the leaf area and chlorophyll *a*. Statistical analysis showed very significant relationship between the content of organic matter and examined parameters with a large number of significant correlations. The most important correlation was found between the content of organic matter and N concentration, and between chlorophyll *a*, chlorophyll *b*, carotenoids and the content of organic matter. The link between N, Mg and other examined parameters was firm and significant as well as under strong influence of external factors.

Keywords: *Triticum aestivum* L.; genotype; magnesium; nitrogen; chloroplast pigments; organic matter

Deficiency in essential elements (N, Mg) may drastically reduce wheat development rate and yield whereas lack of nutrients, especially N, mostly reduces chlorophyll *a* (Masoni et al. 1990). Masoni et al. (1990) did not find out significant correlation between dry matter mass and concentration of the mentioned elements in the shoot dry matter. The role of N and the relationship between specific biogenic elements have the biggest impact on photosynthesis intensity and accumulation of organic matter. Chlorophylls content play the major role in the process of photosynthesis and depend directly on N nutrition and availability of Mg for apsorbtion from the soil (Sarić and Kovačević 1981). Chlorophyll content in wheat leaves is very stabile parameter and better for soil N uptake estimation in different wheat phenophases than leaves N concentration (Schadchina and Dimitreva 1995). Magnesium is essential for numerous processes in plant metabolism as an enzymes stimulator (eg. RUBISCO), supply with the required N is crucial for the wheat yield and quality (Vukadinović and Teklić 1988). Karlen and Whitney (1990) found lower N concentration in wheat in the vegetation period, a relatively constant Mg concentration and a significant increase of the total dry matter. Significant difference in chloroplast pigments (*a*, *b*, carotenoids) between the two wheat varieties, depending on N fertilization, was obtained by Vukadinović and Teklić (1987). The same authors claimed that as wheat-growing season was progressing, N concentrations were being reduce, due to intensive organic matter accumulation, that brought about negative correlations between N concentrations and chloroplast pigments. N concentration also varies according to wheat variety, whereas climate conditions of the vegetation season influence the efficiency and realization of genetic potential fertility and dynamics of nutritive elements (Teklić et al. 1993). Period characterized by the most pronounced sort wheat specificity in terms of organic matter accumulation is an intensive growth period i.e.from the beginning of tillering to flowering stage (Waldern and Flowerday 1979). According to Cox et al. (1985) data on dry matter and nitrogen accumulation of various wheat growth stages are required for understanding of the assimilation process as well as carbon and nitrogen share in plants growth. In order to attain high yield it is important to ensure photosynthetic rate by leaf area index (LAI) maintenance until late wheat maturity stage (Osaki et al. 1991). Increase of spring nitrogen top dressing leads to LAI increase that in turns slows down leaf area loss (Frederick 1997) followed by later wheat maturity (Peltonen-Sainio et al. 1997). Chatterjee et al. (1994) indicated that Mg excess in wheat plants resulted in visible Mn deficit symptoms whereas dry matter, chloroplast pigments content, grain yield etc. were not reduced in well Mg supplied plants.

MATERIAL AND METHODS

The research included two new genotypes of winter wheat: Lenta and Perla grown in two locations, near Donji Miholjac and in Kutjevo (Slavonia). The research was done in two vegetation periods 1997/1998 and 1998/1999. The characteristics and genetic background of the examined wheat genotypes varied. The varieties Slavonia × Gemini were used for creating the genotype Lenta, while

Table 1. Results of soil analysis of investigated localities

Localities	Soil analyses				
	pH (H_2O)	pH (KCl)	humus (%)	P_2O_5 (mg/100 g soil)	K_2O (mg/100 g soil)
Donji Miholjac	5.70	4.43	1.47	14.67	18.08
Kutjevo	7.10	6.03	1.47	30.56	15.82

Njivka × Gemini were used for the genotype Perla. The chosen locations differed in the height above sea level, chemical content of the soil, fertilizers, and climatic conditions. The height above sea level of Donji Miholjac is Hs = 86 m, a low-lying area, while Kutjevo lies in the hilly region and its height above sea level is Hs = 236 m. Differences in the chemical composition of the soils and fertilizers were shown in Tables 1 and 2.

The average monthly temperatures in Donji Miholjac ranged from –0.3°C (December 1997) to –1.1°C (December 1998) and from 20.8°C (July 1998) to 22.4°C (July 1999). The Kutjevo temperatures ranged from –0.6°C (December 1997) to –1.1°C (December 1999) and from 20.3°C (July 1998) to 22.3°C (July 1999). Differences in the amount of precipitation were bigger than temperature differences. The mean monthly precipitation in Donji Miholjac was 66.7 mm/m^2 in December 1997 and 92.4 mm/m^2 in December 1998. These values were much higher in Kutjevo 126.0 mm/m^2 and 114.5 mm/m^2 (December 1997 and 1998) and in July 1998 and 1999 the values ranged from 147.3 mm/m^2 to 127.6 mm/m^2. The average air humidity in Donji Miholjac was 91% and 86% in December 1997 and 1998 and in July 1998 and 1999 it was 74% and 73%, respectively. The Kutjevo humidity was 94% and 93% (December 1997 and 1998) and 72% and 81% (July 1998 and 1999).

Plant sampling, was done seven times during the wheat vegetation season in 1997/1998 and 1998/1999 i.e. in the tillering stage (stage 2 and 5), heading stage (stage 6 and 10), earing up stage (stage 10.1), flowering stage (stage 10.5), and milk stage (stage 11). Wheat stages were determined according to the Feekes scale. The following wheat qualities were examined: leaf area, chloroplast pigments concentration, concentration of Mg and N, dry matter of the above ground parts of and organic matter per unit dry mass.

1. Leaf area was determined by the method of leaf contours on paper based on the leaf area of five average plants (× 4) and the total number of plants per area unit. Twenty samples were taken from each wheat genotype and the leaf area was given in m^2/ha (Sarić et al. 1986).
2. Chlorophylls pigments were determined on 0.1 g of the fresh matter from the most developed leaf of the primary wheat stalk. The concentration of chlorophyll *a*, chlorophyll *b* and carotenoids was determined spectrophotometrically (wave lengths 662, 644 and 440 nm) from the acetone extract using the methods of Holm and Wettstain and it was expressed in mg/g of the dry mass (Sarić et al. 1986).
3. To determine the concentration of Mg and N twenty plant samples (above ground parts of the plant × 4) were taken from each genotype during the wheat phenophase. The samples were dried at 105°C until the constant weight was reached. Then, they were weighed, ground and mixed into an average sample. Digestion of the plant material (1 g) was done by the wet procedure according to Faller (10 ml of the mixture of H_2SO_4 and $HClO_4$ + 20 ml concentration of H_2O_2, in the 30th minute). N concentration was determined by the micro Kjeldahl method, and Mg by the atomic absorption spectrophotometry (AAS method).
4. Dry matter of the above ground parts of the plant (kg/ha) was determined according to a dry matter mass of 20 average plants (× 4) and according to the total number of plants per area unit taken during the earing stage. The total number of plant samples, taken from each wheat genotype, was 80. The plant material was dried at 105°C until the constant weight was achieved.
5. Organic matter per unit dry mass was expressed in kg of organic matter/ha and calculated on the basis of carbon percentage in total dry matter. Carbon content of a leaf dry matter was defined by carbon oxidation, i.e. by the bichromate method (30 ml 0.333 M $K_2Cr_2O_7$ + 20 ml conc. H_2SO_4 at temperature 98–100°C in the 90th minute) and by spectrophotometric measuring (588 nm).
6. Influence of genetic specificity and agroecological conditions of locality on wheat phenophases and on chloroplast pigments concentration (*a*, *b* and carotenoids), leaf area, dry matter of above ground parts as well as organic matter per unit dry mass was investigated by variance analysis and tested by *F*-test. The significance of differences between examined genotypes and locations was determined by *LSD* test ($P < 0.01^{**}$, $P < 0.05^{*}$), and mutual interdependence between parameters was defined by multiple regression and correlation analysis.

Table 2. Fertilization (kg/ha) of the localities in 1997/1998 and 1998/1999

Localities	1997/1998					1998/1999				
	N b.d.	N t.d.	N Σ	P_2O_5 Σ	K_2O Σ	N b.d.	N t.d.	N Σ	P_2O_5 Σ	K_2O Σ
Donji Miholjac	107	82	189	67.5	52.5	126	68.5	194.5	67.5	52.5
Kutjevo	40	117	157	120	80	121	95	176	120	80

Table 3. Average values of examined parameters of photosynthetic productivity of Lenta and Perla genotypes in 1997/1998

Genotype	Localities	Growth stages	%N	%Mg	LA	Chl *a*	Chl *b*	Carotenoides	Dry mass	Organic matter content per dry mass
			per unit dry mass		m²/ha	mg/g dry mass			kg/ha	
Lenta	Donji Miholjac	2	3.07	1.00	6 809	1.02	0.48	0.77	993	221
		5	2.62	0.74	19 382	0.76	0.37	0.66	2 075	705
		6	2.14	0.63	33 125	0.98	0.30	0.63	6 026	2000
		10	1.83	0.66	54 406	1.77	0.53	1.10	6 478	1943
		10.1	1.41	0.69	43 461	1.38	0.79	0.92	10 829	2851
		10.5	1,.31	0.65	38 478	2.16	1.00	1.54	12 052	5214
		11	0.90	0.55	29 872	1.90	0.59	1.03	16 925	5593
	Kutjevo	2	3.04	0.62	11 432	0.95	0.47	0.75	1 030	363
		5	2.40	0.48	11 691	0.98	0.29	0.77	1 154	357
		6	1.60	0.64	20 262	1.49	0.46	1.02	6 625	2337
		10	1.16	0.51	42 945	1.76	0.56	1.09	8 572	3228
		10.1	1.18	0.58	30 530	2.25	0.69	1.44	9 945	3460
		10.5	1.08	0.53	30 412	3.00	0.84	1.78	11 988	4354
		11	0.88	0.50	23 658	2.68	0.80	1.48	20 766	7866
Perla	Donji Miholjac	2	3.99	0.93	7 367	1.17	0.58	0.91	890	203
		5	3.01	0.74	18 244	1.16	0.55	0.91	1 704	639
		6	2.31	0.80	26 007	1.50	0.48	1.01	4 032	1526
		10	1.70	0.70	35 074	1.87	0.55	1.18	5 338	1997
		10.1	1.58	0.80	37 752	1.70	0.98	1.16	8 643	2822
		10.5	1.42	0.74	32 622	2.07	0.97	1.51	8 991	4201
		11	1.17	0.70	25 232	1.80	0.55	1.02	11 512	4151
	Kutjevo	2	3.47	0.78	8 316	1.11	0.53	0.84	662	283
		5	2.47	0.85	10 809	1.03	0.30	0.80	883	257
		6	1.92	0.68	28 438	1.35	0.48	0.92	5 185	2085
		10	1.65	0.70	41 696	1.85	0.71	1.15	8 785	3120
		10.1	1.04	0.67	33 787	2.41	0.61	1.55	10 943	4118
		10.5	1.06	0.59	31 351	2.48	0.70	1.57	19 539	3168
		11	0.77	0.59	23 809	2.02	0.60	1.19	21 562	7674

RESULTS

Examined genotypes had high concentrations of N and Mg at both locations during the tillering stage and in both years. As the vegetation advanced, the N concentration decreased, while the Mg concentration became fairly balanced (Tables 3 and 4). However, the concentrations of Mg and N were higher in Donji Miholjac than in Kutjevo during the tillering stage and in both years. Ph value of the soil was more favourable for Mg assimilation in Donji Miholjac (Table 1). Mg concentration of both genotypes (Lenta and Perla) was relatively high in both locations and in both years during the whole period of wheat vegetation (Tables 3 and 4).

In 1997/1998, starting from the tillering stage (stage 2) until the shooting (stage 10), the leaf area of the examined genotypes increased significantly at both locations (Table 3), while in 1998/1999 the area constantly increased starting from the tillering (stage 2) until the earing up stage (stage 10.1) (Table 4). Bigger increase of the leaf area was in Donji Miholjac in both years due to successfully organized N fertilization (bigger amount of N during basic fertilization and additional plant nutrition, Table 2). In 1997/1998, starting from the shooting stage (stage 10) until the milk stage (stage 11), the leaf area decreased depending on the genotype and location (Table 3). However, in 1998/1999 the decrease started during the earing up stage (stage 10.1) and lasted until the milk stage (Table 4). Very important locality influence on leaf area development, phenophases and genotype was determined in 1997/1998. Interaction of locality, phenophases and genotype was also very significant (Table 7). In 1998/1999 a very important impact of a phenophase on the investigated trait, localities and genotype was determined by the analysis of variance whereby interactions of localities, phenophases and genotype were important too (Table 8). The content of photosynthetic pigments of the examined genotypes was the highest during the flowering stage (stage 10.5) at both locations in 1997/1998 (Table 3), while in the following year the highest content was observed during the earing stage (stage 10.1) (Table 4). Higher content of chlorophyll *a* was observed in all genotypes at Kutjevo location in 1997/1998 (Table 3) where additional 117 kg/ha of N was added to plant nutrition (Table 2). Very significant influence of phenophases on chlorophyll content *a* and localities were determined by *F*-test in both years whereas genotype impact was not statistically significant (Tables 7 and 8). The concentration dynamics of chlorophyll *b* and carotenoids was very similar to that of chlorophyll *a* and it was higher in all wheat phenophases at both locations. The highest values of chlorophyll *b* content and carotenoids were noticed during the flowering stage (stage 10.5) at both locations in 1997/1998 (Table 3). In 1998/1999 the research on concentration of chlorophyll *b* and carotenoids depended on the wheat phenophase and the genotype (Table 4). Both years investigated by *F*-test were characterized by a very significant influence of phenophases, localities and genotype on chlorophyll *b* and carotenoid concentrations. Interactions of localities, phenophases and genotype were also very significant (Tables 7 and 8).

As wheat matured the dry matter of the wheat above ground parts was constantly increasing (Tables 3 and 4). In 1997/1998 research years, during the milk stage, the genotypes Lenta and Perla had more than 20 000 kg/ha of dry matter at Kutjevo location, while it was lower in Donji Miholjac, where significant differences were determined

Table 4. Average values of examined parameters of photosynthetic productivity of Lenta and Perla genotypes in 1998/1999

Genotype	Localities	Growth stages	%N	%Mg	LA	Chl *a*	Chl *b*	Carotenoides	Dry mass	Organic matter content per dry mass
			per unit dry mass		m^2/ha	mg/g dry mass			kg/ha	
Lenta	Donji Miholjac	2	3.58	0.73	11 933	1.24	0.30	0.72	774	282
		5	3.65	0.62	19 346	1.43	0.40	0.95	1 479	495
		6	2.78	0.60	35768	1.24	0.39	0.81	4 145	1666
		10	2.39	0.65	57 616	2.03	0.58	1.34	5 693	1307
		10.1	1.52	0.58	61 784	2.18	0.57	1.42	10 646	3917
		10.5	1.66	0.64	60 036	2.01	0.61	1.22	12 298	3451
		11	0.98	0.59	26 833	0.44	0.20	0.28	20 296	6921
	Kutjevo	2	3.64	0.62	6 370	1.16	0.21	0.88	377	164
		5	3.62	0.54	12 051	0.98	0.44	0.74	893	408
		6	2.58	0.60	37 554	1.40	0.40	0.97	2 249	713
		10	1.84	0.51	42 198	1.75	0.41	1.13	3 469	1514
		10.1	1.95	0.62	54 169	1.80	0.41	1.15	12 451	4130
		10.5	1.41	0.58	50 391	1.68	0.85	1.03	13 860	5378
		11	0.85	0.53	26 342	1.65	0.57	1.02	17 518	3471
Perla	Donji Miholjac	2	3.95	0.74	11 233	1.20	0.32	0.83	568	200
		5	3.52	0.59	22 829	1.65	0.55	1.08	1 798	581
		6	3.51	0.70	23 498	1.33	0.53	0.91	3 843	842
		10	3.28	0.74	53 822	2.02	0.62	1.38	3 839	1277
		10.1	2.07	0.68	58 710	2.17	0.68	1.26	9 609	2861
		10.5	1.40	0.50	55 036	2.26	0.68	1.26	12 038	4759
		11	1.11	0.54	22 978	2.18	0.73	1.35	16159	4695
	Kutjevo	2	3.42	0.72	6 456	1.72	0.37	1.25	396	128
		5	3.00	0.64	12 141	1.43	0.44	0.91	828	278
		6	2.51	0.60	41 589	1.41	0.47	0.96	2415	612
		10	2.38	0.60	47 398	2.12	0.48	1.27	3 036	806
		10.1	1.63	0.60	63 085	2.32	0.42	1.42	11 523	4119
		10.5	1.48	0.58	51 850	1.73	0.50	1.19	13 367	5129
		11	1.23	0.66	20 357	1.74	0.54	1.06	15 904	4191

Table 5. Coefficients of correlations between the investigated parameters and organic matter content per unit dry mass at both localities in 1997/1998 ($P < 0.05^{*}$, $P < 0.01^{**}$)

	Mg	Chl *a*	Chl *b*	Carotenoides	Leaf area	Dry mass	Organic matter content
N	0.635**	–0.717**	–0.472**	–0.370**	0.873**	–0.612**	–0.849**
Mg		–0.395**	–0.059ns	–0.202*	0.302**	–0.340**	–0.392**
Chl *a*			0.337**	0.323**	0.579**	0.783**	0.786**
Chl *b*				0.361**	0.304**	0.334**	0.594**
Carotenoides					0.312**	0.554**	0.695**
Leaf area						–0.506**	–0.423*
Dry mass							–0.656**

* significant at 5% level, **significant at 1% level, ns not significant

between the examined genotypes (Table 3). It is obviously that larger top dressing amount delayed leaf aging at Kutjevo locality (Table 2). Thus, organic matter of the investigated genotypes was permanently increasing until reached milk stage (Tables 3 and 4). In 1998/1999, during the milk stage (stage 11), significant differences were established in the amount of dry matter among all genotypes and locations (Table 4). Genotypes Lenta and Perla had higher organic matter per unit dry mass at Donji Miholjac locality compared to Kutjevo locality (Tables 3 and 4). Highly significant influence of phenophases, localities, and genotype on dry matter accumulation and organic matter content in the investigated wheat genotypes was determined by *F*-test in both years. (Tables 7 and 8).

DISCUSSION

Examined genotypes had the highest accumulation intensity, i.e. concentration of N and Mg during the tillering stage (stage 2) at both locations and in both years. However, different mineral nutrition and climate conditions at both locations had an impact on element assimilation and the obtained results were in accordance with many authors who emphasised the importance of N in wheat nutrition (Cox et al. 1985, Sarić et al. 1986, Vukadinović and Teklić 1988, Osaki et al. 1991, Schadchina and Dimitreva 1995, Frederick 1997, Peltonen-Sainio et al. 1997). As vegetation advanced N concentration decreased and dry matter content increased, which was the result of plant growth and photosynthesis (Tables 3 and 4). This was confirmed by a significant negative correlation between N concentration and organic matter content per unit dry mass ($r = –0.849^{**}$, $P < 0.01$, $r = –761^{**}$, $P < 0.01$) (Tables 5 and 6). Significant organic matter content per unit dry mass of the investigated genotypes in both investigation years was under phenophases, localities and genotype influence (Tables 7 and 8). Statistical analysis showed very significant correlation between organic matter content and other investigated parameters where phenophases influence was most pronounced ($F = 152.54^{**}$, $F = 152.67^{**}$) (Tables 7 and 8). There were also a large number of significant correlations (Tables 5 and 6). In both years Mg concentration was related to all other parameters except for the chlorophyll *b* content (which was unexpected) but the highest correlation coefficient was with N concentration ($r = 0.635^{**}$, $P < 0.01$, $r = 0.548^{**}$, $P < 0.01$) (Tables 5 and 6). It was obvious that higher N concentration of the wheat leaf was accompanied by

Table 6. Coefficients of correlation between the investigated parameters and organic matter content per unit dry mass at both localities in 1998/1999 ($P < 0.05^{*}$, $P < 0.01^{**}$)

	Mg	Chl *a*	Chl *b*	Carotenoides	Leaf area	Dry mass	Organic matter content
N	0.548**	–0.410**	–0.443**	–0.249*	0.732**	–0.759**	–0.761**
Mg		–0.362**	–0.076ns	–0.208*	–0.375**	–0.300**	–0.325**
Chl *a*			0.317**	0.223**	0.499**	0.583**	0.781**
Chl *b*				0.260**	0.244**	0.310**	0.605**
Carotenoides					0.202**	0.424**	0.501**
Leaf area						–0.418**	–0.437*
Dry mass							–0.632**

* significant at 5% level, **significant at 1% level, ns not significant

Table 7. Variance analysis for N, M concentrations and investigated parameters of photosynthetic wheat productivity in Lenta and Perla genotypes at both localities in 1997/1998 ($P < 0.05^{*}$, $P < 0.01^{**}$)

	F-test			Interaction			
	location (L)	genotype (G)	phenophase (P)	L × G	L × P	G × P	L × G × P
N	22.73**	69.93**	229.32**	3.21**	5.64**	2.01**	5.88**
Mg	21.92**	78.91**	132.02**	2.11**	4.13**	1.91**	4.16**
Chl *a*	28.06**	2.02ns	242.13**	1.87**	13.81**	2.36**	5.25**
Chl *b*	20.07**	2.27**	163.64**	2.67**	28.13**	1.46**	4.19**
Carotenoides	16.72**	3.01ns	169.31**	3.56**	16.15**	3.28**	5.68**
Leaf area	156.93**	12.58**	121.56**	4.17**	17.68**	2.95**	3.47**
Dry mass	25.42**	43.26**	145.67**	8.54**	28.61**	4.05**	3.29**
Organic matter content	61.28**	5.32**	152.54**	2.06ns	22.06**	2.12**	1.66*

* significant at 5% level, **significant at 1% level, ns not significant

higher Mg concentration, which was usual for young plants provided they were sufficiently supplied with mineral elements from the soil. In both years the leaf area showed the highest correlation with N concentration ($r = 0.735^{**}$, $P < 0.01$, $r = 0.732^{**}$, $P < 0.01$), which indicated that N supply was a precondition for development of the leaf area (Tables 5 and 6). With regard to a very significant correlation between the leaf area and the chlorophyll *a* content ($r = 0.579^{**}$, $P < 0.01$, $r = 0.499^{**}$, $P < 0.01$) and between chorophyll *a* and organic matter content ($r = 0.786^{**}$, $P < 0.01$, $r = 0.781^{**}$, $P < 0.01$), the influence of N on photosynthetic productivity was completely justified. Based on dry matter accumulation and Mg concentration, it could be concluded that the examined genotypes of winter wheat assimilated from 80 to 130 kg/ha of Mg from the soil. Therefore, the availability of Mg from the soil could significantly influence wheat productivity through related processes of photosynthesis. The relationship between N, Mg and other physiological parameters, e.g. leaf area, chloroplast pigments concentration, dry matter accumulation and organic matter content per unit of dry mass (Tables 5 and 6), is firm and significant, but strongly influenced by external factors (Tables 7 and 8). Organic matter content per unit of dry mass is an indicator showing genetic specificity of wheat productivity, but strongly affected by phenophase and locality (Tables 7 and 8). Phenophase, i.e. the dynamics of wheat growth and development, along with the interaction between location and phenophase, have the most outstanding influence on indicators of photosynthetic wheat productivity (chloroplast content pigments, leaf area, accumulation of dry matter and organic matter content per unit of dry mass). The impact of location is greater than that of genetic specificity, excluding the dry mass of the above ground parts of wheat (Tables 7 and 8). A great number of factors, which have a deciding role for yield realization, contribute differently to new wheat genotypes under specific agro-ecological conditions.

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Table 8. Variance analysis for N, Mg concentrations and investigated parameters of photosynthetic wheat productivity in Lenta and Perla genotypes at both localities in 1998/1999 ($P < 0.05^{*}$, $P < 0.01^{**}$)

	F-test			Interaction			
	location (L)	genotype (G)	phenophase (P)	L × G	L × P	G × P	L × G × P
N	21.13**	59.63**	212.42**	2.41**	6.14**	2.31**	5.63**
Mg	20.02**	58.31**	142.62**	2.01**	3.42**	1.60**	4.66**
Chl *a*	21.69**	2.92ns	119.65**	2.87ns	12.81**	4.58**	7.22**
Chl *b*	32.67**	4.93**	55.64**	2.57**	18.13**	2.47**	5.59**
Carotenoides	13.12**	6.91**	69.73**	1.56**	14.25**	2.18**	6.38**
Leaf area	110.16**	21.17**	130.38**	3.50**	12.59**	6.64**	4.03**
Dry mass	22.86**	55.42**	169.87**	4.18**	35.66**	3.27**	3.73**
Organic matter content	51.18**	4.32**	152.67**	1.96ns	21.99**	2.31*	2.67*

* significant at 5% level, **significant at 1% level, ns not significant

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ABSTRAKT

Fotosyntetická produktivita dvou odrůd ozimé pšenice (*Triticum aestivum* L.)

Byl sledován vliv prvků Mg a N a obsahu chlorofylu *a*, *b* a karotenoidů na fotosyntetickou produktivitu dvou nových odrůd ozimé pšenice Lara a Perla na dvou lokalitách Donji Miholjac a Kutjevo ve vegetačním období let 1997/1998 a 1998/1999. Ke stanovení jednotlivých parametrů byly použity standardní metody. Výsledky ukázaly závislost mezi koncentrací Mg a všemi sledovanými parametry s výjimkou obsahu chlorofylu *b*. Nejvyšší koeficient korelace byl zjištěn u koncentrace N, vysoce významná korelace byla nalezena mezi listovou plochou a koncentrací N a mezi listovou plochou a chlorofylem *a*. Statistická analýza naznačila vysoce významnou závislost mezi obsahem organické hmoty a jednotlivými parametry při vysokém počtu významných korelací. Nejdůležitější korelace byla zjištěna mezi obsahem organické hmoty a koncentrací N a mezi chlorofylem *a*, *b* a karotenoidy a obsahem organické hmoty. Vazba mezi N a Mg a ostatními parametry byla významná a byla silně ovlivněna vnějšími faktory.

Klíčová slova: *Triticum aestivum* L.; genotyp; hořčík; dusík; barviva chloroplastů; organická hmota

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