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VARIETY PERFEKTA – ANOTHER CONTRIBUTION TO BIODIVERSITY OF WINTER WHEAT IN SERBIA

Abstract

The winter wheat variety Perfekta (Kg 29/3) is variety enhancer obtained by crossing of Pobeda and Studenica. It was recognized by the Commission for the approval of varieties in 2009th, after two years of investigation in the network of micro-trials in Serbia. Its features are very good resistance to lodging, low temperatures, most of important diseases and pests. It has excellent technological quality (enhancer) and belongs to A2 quality group and I quality class. It is high yielding variety with genetic potential for grain yield about 12 t/ha. It can be grown in different agro-ecological conditions and the best results achieved on fertile and middle fertile soils, with application of intensive crop management. It is suitable for organic production.

Key words: *wheat, variety, Perfekta, yield, quality.*

INTRODUCTION

Wheat is a very important plant species, which in the past and today is used for food or as a source of food for more than two-thirds of the human population in the world. This is the primary reason that wheat was the subject of extensive scientific research, in order to improve its yield and quality as well as adaptive abilities. In many years of hard work breeding, breeders have developed original methods and used knowledge and methods from other disciplines in the creation of new wheat varieties. Wheat breeding aims to create a phenotype with higher adaptive value, greater tolerance to stress conditions, with better use of environmental factors, by changes in the stages of growth and development.

To achieve success in breeding it is very important to choose the parents who are well combined with certain properties. Today in the world there are a large number of created varieties which can be used as parental pairs in hybridisation. In selecting varieties for crossing it is necessary to know their genetic basis as well as the stability characteristics of the interaction with the environment (Kraljević-Balalić et al. 2001, Zečević et al., 2004). The yield of grain is controlled by a large number of genes, whose stability may be measured based on the manifestation of values in different environmental conditions. Varieties with higher adaptive capacity will show a greater yield stability and can be successfully grown in different environmental conditions. Having in mind that the high yield and excellent processing quality are negatively correlated traits, it is necessary patient and laborious research work for achieving a desirable combination of these two complex properties.

Up to 2013th the Center for Small Grains in Kragujevac created 41 varieties of winter wheat, many of which have found a place in practice in our country as well as in neighboring countries, significantly contributing to the increase in production and overall sustainable development. Scientific research programs were targeted to creating of new varieties with increased yield, quality, disease and stress factors resistance and tolerance (Popović, 1988, 1989).

Also in more than a century long tradition of work on winter wheat breeding in Kragujevac, researchers were continually attempted to create varieties with reduced stem height and medium early to medium late ripening. Due to its high resistance and tolerance to economically more important diseases and pests of wheat, as well as to drought, low temperature, heat stress, acid soils and others adverse biotic and abiotic factors, winter wheat varieties created in Kragujevac are recognizable by very good and stable results, which is especially characteristic for its production in the Central and Southern Serbia. In addition to its high genetic potential for yield of grain and other desirable agronomic traits, the KG wheat varieties are also characterized with excellent technological quality parameters for production of bread or pastry (Milovanović et al., 2008). The continuous work on the creation of high yielding wheat varieties with excellent technological quality, as is the case in variety Perfekta, as well as their intensive spreading in production, will enable significant advances in scientific and sustainable economic development of our country.

MATERIALS AND METHODS

A new variety of winter wheat Perfekta (KG-29/3) was studied in the network of micro-trials of Serbian Commission for recognition of new varieties during the seasons 2007/08 and 2008/09. The trials were conducted at six locations (Kragujevac, Novi Sad, Pančevo, Sremska Mitrovica, Sombor and Zaječar). Experiments were designed in a complete randomized block design with plot size of 5 m² in five replications. Use value of variety Perfekta and its most important agronomic traits were compared with standard variety Pobeda. On the experimental field was assessed

time of heading, plant height, resistance to lodging and resistance to causal agents of rust and powdery mildew. Testing of resistance to diseases of leaf rust and powdery mildew was conducted in Kragujevac in the stage of adult plants in conditions of artificial infection in the field, and the disease severity (DS) is presented in the form of infection by the modified Cobb's scale (0-99). Resistance of varieties to low temperatures was investigated in the cold chambers (-14C/12h) according to the method of Jurjev, wherein the number of the surviving plants is shown in percentage.

Analysis of physical and chemical-technological traits of grain was performed at the Institute of Food Technology in Novi Sad on average samples from the first year of trials (from the Novi Sad and Sombor) by using standard methods. The protein content is determined by the Macro-Kjeldahl method and the result is expressed on dry matter. Sedimentation value of wheat is determined by the Yugoslav standard method JUS EB8.030. of 1978th (method of Zeleny). The content of wet and dry gluten of wheat were determined in accordance with the international standard method ICC (the International Association for Cereal Science and Technology), No. 106 of 1960. Laboratory milling and determination of total flour recovery was performed on laboratory mill MLU 202 of company Bühler. For the determination of farinograph value was used 60 percentage laboratory flour milled with Bühler. Determination of farinograph was partially harmonized with the international standard method ICC, No. 115 of 1968. Laboratory baking test was carried out according to the procedure elaborated in the Institute for Small Grains at Faculty of Technology in Novi Sad. It was customized to the most frequently used process of making bread in the bakery industry. The values shown for all properties represent the calculated arithmetic mean.

On the basis of grain yield per locations and years were determined mean values of grain yield for the studied and the standard variety for the entire period of examination. Using analysis of variance method obtained data were statistically analyzed, while the significance of differences in grain yield was tested by LSD test for significance levels $P=0.05$ and 0.01 .

RESULTS AND DISCUSSION

The winter wheat variety Perfekta (Kg 29/3) belongs to a group of enhancers and it was obtained by crossing of varieties Pobeda and Studenica. It was recognized by the Serbian Commission for approval of varieties in 2009th. Authors of this variety are PhD Milivoje Milovanović, MSc Vladimir Perišić and PhD Mirjana Staletić.

The variety Perfekta has a white spike without awns with present scurs on the upper third of the spike, and large bright red colored grain. It is characterized by medium tall stem (the average height of about 93 cm), and very good resistance to lodging, which allows the application of intensive crop management in its cultivation (Table 1). According to duration of vegetation (to heading) it can be classified in the group of medium-late varieties (0.15 days later than the standard variety, on average).

During the examination variety Perfekta demonstrated a high resistance to the causers of leaf rust and powdery mildew.

Table 1: The most important agronomic and physiological characteristics of winter wheat Perfekta

Traits	Perfekta	Pobeda (St.)
Height (cm)	93,15	99,2
Loading (0-9)	1,95	1,75
Heading (+- days)	+0,15	-
Resistance to diseases (DS: 0-99)		
- <i>Puccinia recondita tritici</i>	15	5
- <i>Erysiphe graminis tritici</i>	5	5
Resistance to low temperatures		
% of plants survival	60	90

Table 2. Physical and chemical-technological traits of grain of variety Perfekta

Traits	Perfekta	Pobeda (St.)
Physical properties of grain		
-mass of hectolitre (kg)	83,50	83,10
-1000 kernels weight (g)	42,3	41,1
- grain size		
a) % on sieve 2,8 mm	73,0	71,1
b) % on sieve 2,5 mm	22,0	22,3
c) % on sieve 2,2 mm	3,5	5,7
d) % on sieve 2,0 mm	1,3	0,8
Chemical and technological properties		
- glassiness (%)	56,00	70,00
-% of row proteins	13,8	14,0
- protein sedimentation volume (ml)	43	48
- quality class	1	1
- content of wet gluten (%)	35	35
- content of dry gluten (%)	13	12
- Total flour recovery (%)	79,2	80,6
- falling number by Hagberg (s)	341	365
- water absorption	60,4	60,3
- development time of dough (min.)	4,8	5,5
- Stability (min)	2,5	2,0
- degree of softening (FJ)	33	45
- quality number and quality group	81,5 A-2	74,6 A-2
- resistance to extension (EJ)	140	158
- extensibility (mm)	183	179
- ratio of resistance . extensibility (r/e)	0,76	0,88
- yield of bread (g/100 g of flour)	135,6	134,5
- loaf volume (ml/100 g of flour)	600	567
- Crumb value (CV)	6,3	5,8

Mass of hectolitre of grain is an important indicator of technological quality and depends on grain fullness, chemical composition, surface grain (rough or smooth), the nature of impurities and moisture. Perfekta has high mass of hectolitre of grain (83.50 kg/hl), which is at the level of the standard variety Pobeda. Its 1000 kernels weight indicates very good seed size and grain fullness. On the basis of 1000 kernels weight (42.3 g), and based on the share of grain fractions above 2.8 mm (73%), Perfekta can be classified as variety of very coarse-grained (Table 2). The 1000-kernels weight and mass of hectolitre are genetically controlled traits that vary greatly influenced by environmental factors.

Protein content provided that its quality is of good composition, indicates on the possibility of obtaining products of milling and baking of higher technology characteristics. Grain of variety Perfekta is rich in proteins and it has excellent sedimentation value. With its 13.8% protein content and sedimentation value of 43 ml, Perfekta is classified in the first class quality (JUS). Its high content of protein was also confirmed by the high content of wet gluten content (35%), which is at the level of Pobeda, which belongs to the varieties of excellent technological quality. On farinograph and extensograph, Perfekta showed very good results for most of parameters. According to the farinograph quality number (81.5), Perfekta is in the A-2 subgroup which is at the level of Pobeda. Results of bread baking tests also confirmed the high technological value of variety Perfekta.

Yield of grain is the most important feature of each genotype but also the most complex. In microtrials of Commission for the recognition of new varieties, variety Perfekta achieved mean yield for all trials of 9.070 kg/ha, which is 319 kg more than the standard variety Pobeda (Table 3). Analysis of variance did not confirmed statistically significant differences in grain yield between the examined varieties. Observed by locations and years the greatest yield of 11.976 kg/ha variety Perfekta achieved in the first year of investigation in Novi Sad. Also, the yields of grain above 10 t/ha Perfekta achieved in Pancevo (11.020 kg/ha) and in Zaječar in the first year of investigation (10.332 kg/ha). In the second year of investigation its greatest yields were achieved in Novi Sad (10.588 kg/ha) and Zajecar (8.844 kg/ha). This indicates that the variety Perfekta can be successfully grown in different environmental conditions. The best results achieved on fertile and middle fertile soils, with application of intensive crop management. Its optimal sowing time in our production environment is in the second decade of October, with use of 250-300 kg/ha of certified seeds. Its requirements are 100-130 kg/ha of pure nitrogen, with adequate quantities of phosphorus and potassium.

Table 3. Grain yield of variety Perfekta in the experiments of the Commission for the recognition of varieties in the period 2007/08-2008/09.

Locality	Year	Yield (kg/ha)	
		Perfekta	Pobeda (St)
Kragujevac	2007/08.	8.016	7.124
	2008/09.	5.964	6.076
	\bar{x}	6.990	6.600
Novi Sad	2007/08.	11.976	11.084
	2008/09.	10.588	9.714
	\bar{x}	11.282	10.399
Pančevo	2007/08.	11.020	10.921
	2008/09.	8.104	8.114
	\bar{x}	9.562	9.517
Sremska Mitrovica	2007/08.	8.804	8.306
	2008/09.	8.347	8.214
	\bar{x}	8.576	8.260
Sombor	2007/08.	8.924	8.536
	2008/09.	7.920	8.780
	\bar{x}	8.422	8.658
Zaječar	2007/08.	10.332	9.208
	2008/09.	8.844	8.940
	\bar{x}	9.588	9.074
Mean (2007/08-2008/09.)		9.070	8.751
LSD	0,05	360	
	0,01	422	

CONCLUSIONS

Based on the above mentioned it may be noted that the Center for Small Grains Kragujevac created another high-yielding winter wheat variety of excellent technological quality, giving significant contribution to broadening of biodiversity of winter wheat in Serbia. In addition to high yield and quality, winter wheat variety Perfekta is characterized by many other positive traits. It is medium late variety, tolerant to drought and low temperatures and has a good resistance to causal agents of more important diseases of wheat. It has large grain of very good mass of hectolitre. According to the quality indicators it belongs to I quality class and A2 quality group (enhancer). It withstands to different agro-ecological conditions of production. It should be grown on medium fertile and fertile soils under conditions of optimal crop management in order to maximize the realization of its high genetic potential for yield.

Because of these desirable characteristics variety Perfekta is suitable for cultivation in terms of organic production. Its high resistance to more important diseases and pests of small grains usually allows its successful production without the use of pesticides (or on a reduced scale), while at the same time its high technological quality contributes to its successful use in the manufacture of quality bakery products.

Its high tolerance to cold, drought, acidic and medium fertile soils provides a stable and highly competitive results for its yield and technological quality of grain in different edaphic, climatic and production conditions prevailing in many regions of wheat production in the Republic of Serbia. In terms of optimal sowing and germination, it shows a high adaptability and competition ability to the major weed species of small grains, which largely eliminates the need for herbicide application, thus contributing to the preservation of our environment and reducing of production costs.

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SORTA PERFEKTA- JOŠ JEDAN DOPRINOS BIODIVERZITETU OZIME PŠENICE U SRBIJI

Apstrakt

Ozima pšenica Perfekta (Kg 29/3) je sorta poboljšivač dobijena ukrštanjem sorti Pobeda i Studenica. Priznata je od strane Komisije za priznavanje sorti 2009. godine, posle dvogodišnjeg ispitivanja u mreži mikroogleda. Vrlo dobre je otpornosti prema poleganju, niskim temperaturama, važnijim bolestima i štetočinama. Odličnog je tehnološkog kvaliteta (poboljšivač) i pripada kvalitetnoj grupi A2 i I kvalitetnoj klasi. Veoma je rodna sorta, genetičkog potencijala za prinos zrna oko 12 t/ha. Može se gajiti u različitim agroekološkim uslovima a najbolje rezultate postiže na srednje plodnim zemljištima i u uslovima intenzivne agrotehnike. Pogodna za uslove organske proizvodnje.

Ključne reči: pšenica, sorta, Perfekta, prinos, kvalitet