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A NEW VARIETY OF WINTER WHEAT – A FACTOR OF QUALITY AND YIELD

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***Key words**: wheat, breeding lines, yield, quality*

INTRODUCTION

Wheat is the most common plant species, grown on every continent and at different altitudes.Such a great adaptibility enables this species to its origin and its genome consists of three genomes of three different plant species, namely: *Aegilops speltoides*, *Triticum urartu* and *Aegilops tauschii* (Braun et al., 2008). Through the process of spontaneous hybridization our common hexsaploid wheat was created and it contains all the genes of mentioned species.

One of the main tasks of the Department for grain crops is the creation of wheat varieties that will integrate more positive traits, such as high genetic potencial, good techological characteristics, excellent lodging resistance, excellent resistance on low temperatures, tolerance to plant deseases, major biological adaptibility, early ripening. Our recent results show that it is possible to integrate more of these traits in one genotype, but it is quite difficult to have it consolidated at the higher level and have more required traits in the optimum (Nikolić et al., 1998). The specified variety BL 168-2 has most of the above mentioned traits in a truly higher level, compared to our earlier varieties.

Although, in recent years, our areas under wheat tend to decrease, it is necessary to emphasize that there is an interest in serious producers for this production, but they are more demanding when it comes to varieties and new hybrids. The producers are still interested in early maturing and quality varieties (Mišić et al., 1998). It is known that the mentioned problems cannot be solved by significant increase of areas, rather by creating new varieties that have good adaptability, stability and high yield, with the optimal use of modern farming methods can achieve higher production, which is imperative (Denčić et al., 2008). In recent times, the value of one wheat variety is not valued only by the amount yield of grains, than by the yield of finished products.

Varieties with good technological properties and with the same or higher yield, which is definitely better, have a higher yield of flour or bread per hectare (Žeželj1984).

The variety BL 168-2 was used as material for this research, which was created by hybridization of our varieties BL 1-94 x Proteinka. Donors of many essential genes are varieties used in earlier crosses, from which there is transferred part of the germplasm in these two genotypes that were used as parental components. Specified germplasm is incorporated from other divergent genotypes in variety BL 1-94, which was created by crossing varieties Sava x Partizanka. Donors of many genes for indicators of technological quality (Glu and other genes) and genes for the reduction of plant height, lodging resistance, resistance to low temperature and tolerance to plant diseases, (Lr – resistance to *Puccinia recondita*; Sr – resistance to *Erysiphe graminis*; Pm – resistance to *Septoria sp*.) were both varieties of direct crosses, as well as those of closer genetic characteristics. Hybrid material was bred by pedigree method with a continuous selection of typical plants. Variety BL 168-2 was selected from phenotypically homogeneous materials in the F6 generation, tested in the preliminary and later in comparative trials with more standards and on the basis of our results reported to the Commission for variety recognition.

The testing of recently reported variety for recognition is performed according to the methodology on how to test varieties of winter wheat at two localities (Butmir and Živinice) over three years (2006/07, 2007/08, 2008/09). The trials were set up according to a random block system (randomized) system. The basic plot size is 5m2 with 5 replications. Variety Tina was used as standard. Grain yield of variety was processed using the joint analysis of variance, and evaluation of the significance of medium based on LSD test.

RESULTS AND DISCUSSIONS

In the three-year span, the tested variety achieved a grain yield of 6918.62 kg / ha, which is 479.33 kg / ha or 7.45% more than the standard variety – Tina. This difference is highly significant. The coefficient of variation rose to 0.09%. Based on our results of comparative trials, the locality – Economy of the Agricultural Institute of Republic of Srpska, Banja Luka, this variety achieved a three-year average yield of 8020 kg / ha. According to research in the same period, there was also analyzed the influence of factors of variety and locality on yield, where they recorded a highly significant and significant impact of tested varieties.

Table. 1. Grain yield of variety BL 168-2 (kg/ha) tested by years and localites

Tested variety	2006/2007		2007/2008		2008/2009		
	Butmir	Živinice	Butmir	Živinice	Butmir	Živinice	Average
BL 168-2	6.928	6.680 +	7.000 +	6.880 +	7.000 +	7.020 ++	6.970
Tina	6.540	6.216	6.420	6.340	6.620	6.500	6.560
Average	6.852	6.352	6.610	6.540	6.750	6.720	6.725
P=5% LSD	401,2	403,27	484,1	367,30	287,1	227,68	
P=1%	563,2	566,05	679,6	515,57	403,0	319,59	
CV (%)	4,24	4,60	5,31	4,07	3,08	2,45	

In the third year of study (2008/2009), the tested variety achieved grain yield of 7010 kg / ha, which is, from the first year of study (2006/2007), higher by 166 kg / ha or 2.43%, and 30 kg / ha or 0.44% higher in the second year of testing (2007/2008). This difference was not statistically significant and can be classified into the domain of statistical error.

Table.2. Influence of variety factors (S) to grain yield in three-year average

Tested variety	kg/5m^2	kg/ha	Relative yield (%)	Significance
BL 168-2	3,459333	6.918,67	107,45	++
Tina	3,219667	6.439,34	100,00	
P=5% LSD		253,31		
P=1%		336,47		

The locality Butmir achieved a three-year average grain yield of 6737.34 kg / ha, which is 199.67 kg / ha or 3.06% more than the locality Živinice. This difference is significant.

The tested variety achieved higher yield than the average for 133 kg / ha. In these localities, there are also examined four varieties, and their values have determined the average of localities.

Table 3. Influence of locality factors (L) to grain yield in the three-year average

Locality	kg/site	kg/ha	Relative yield (%)	Significance
Butmir	3,36	6.737,34	103,06	+
Živinice	3,26	6.537,67	100,00	
P=5% LSD		179,12		
P=1%		237,92		

This variety was also tested for two years in the network of macro trials, also on the locality - Economy of the Agricultural Institute, along with 31 varieties that are new or leading in manufacturing, where the variety BL 168-2 is also achieved notable yield of 7956 kg / ha and ranked second of 31 variety, in 2009. Average values of quality parameters are: weight of 1000 grains was higher by 0.67 g, hectoliter weight was higher by 0.02 kg, the proportion of grain fraction > 2.8 mm was higher by 0.48 %, raw protein content is higher for 0,43%, compared with the standard. Absolute and volume weight are essential indirect indicators of grain quality. These two high values are a reliable indicator of the excellent biological plasticity and its capacity to adapt to different ecological conditions. Both of these values are higher than the standard variety which can be seen from Table 4 and 5. The absolute weight of about 42 g is the optimal value of this trait that is essential both for the major production and for technological traits.

Table 4. Weight of 1000 grains (g)

Tested variety	Butmir				Živinice				3-year average
	06/07	07/08	08/09	Average	06/07	07/08	08/09	Average	
BL 168-2	43,7	44,1	40,46	42,76	44,2	44,0	40,78	43,00	42,88
Tina	42,4	43,9	41,23	42,51	43,1	43,7	39,00	41,91	42,21
Average	42,75	43,60	40,71	42,36	43,30	43,15	40,03	42,16	42,26

Table 5. Hectoliter weight of grains (kg)

Tested variety	Butmir				Živinice				3-year average
	06/07	07/08	08/09	Average	06/07	07/08	08/09	Average	
BL 168-2	76,8	78,5	76,0	77,10	78,2	77,9	76,0	77,37	77,24
Tina	77,1	79,1	76,0	77,40	76,9	78,2	76,0	77,04	77,22
Average	76,93	77,70	76,05	76,90	77,20	77,75	76,05	77,01	76,96

Table 6. Share of grain which fraction is larger than 2.8 mm (%)

Tested variety	Butmir				Živinice				3-year average
	06/07	07/08	08/09	Average	06/07	07/08	08/09	Average	
BL 168-2	94,1	92,8	99,4	95,44	93,2	92,6	99,2	95,00	95,22
Tina	94,9	93,1	99,4	95,80	92,5	92,1	96,4	93,67	94,74
Average	93,90	92,94	99,48	95,36	92,73	91,85	98,68	94,42	94,89

Great importance for obtaining a products of wheat milling and baking wheat flour have a high-quality content and composition of proteins in grain. Content and quality of protein structure depends of genotype and environmental factors, or the level of aeromechanics and interaction of genotype – ecological environment. Compared to the standard variety, this variety was better for about 43 %, bearing in mind that variety Tina, by it technological traits is classified as B2-quality group.

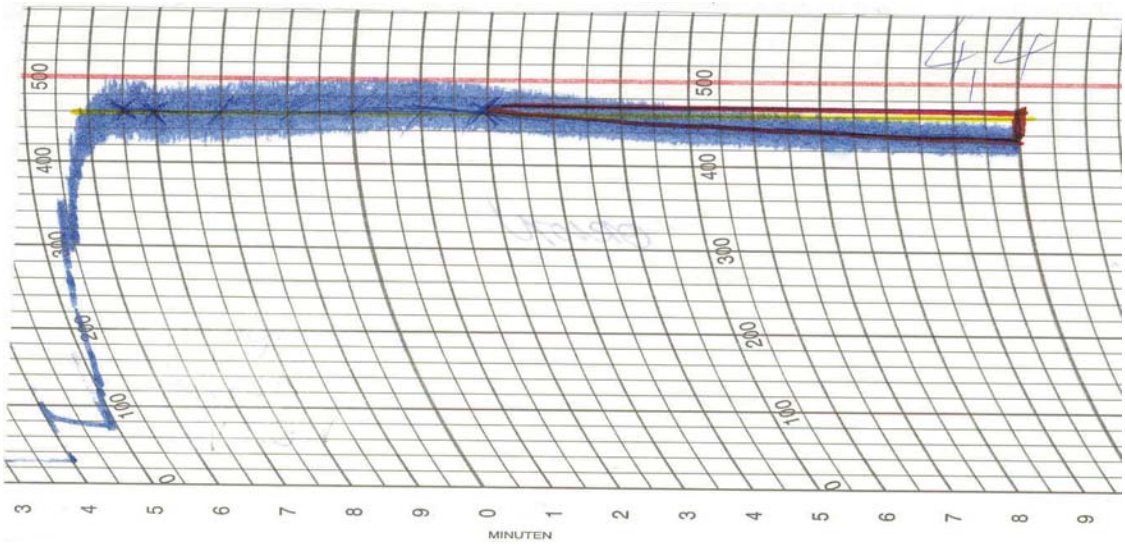

Chart 1. Diagram of dough characteristics of variety BL 168-2

Table 7. Protein content (%)

Tested variety	Butmir				Živinice				3-year average
	06/07	07/08	08/09	Average	06/07	07/08	08/09	Average	
BL 168-2	11,67	12,59	11,48	11,92	12,11	12,85	12,31	12,43	12,18
Tina	11,72	11,98	11,18	11,63	12,09	12,45	11,05	11,87	11,75
Average	11,78	12,08	11,74	11,87	12,15	12,81	11,86	12,28	12,08

This variety is characterized by good wet gluten content 29.3%, water absorption should be an indicator of the quality and if this value is greater the higher the yield of bread.

Higher quality code also indicates the better quality of raw proteins, that number here is 57.3%, for example at variety Partizanka 56.7% in one year and another 72.9%, the energy of dough also by the variety Partizanka to earlier data in a single year was 64 cm^2, and another 107cm^2 (Mišić et al., 1998).

Values of energy for this variety according to sample from one year are 100 cm^2. If the energy is higher stability of the dough to withstand the physical stress on the stretching and tearing is greater.

Other traits

Compared with one of the earliest varieties which are grown in our area, NSR-5, this variety is mature 4 days later, the earliest of our grown varieties, which is also a good result, when we know that we have the frequent occurrence of drought and temperature stress in the period of wheat maturity (temperature over 35 degrees), which is adversely for the grain filling period, total yield and quality. With the average plant height of about 84 cm and optimum thickness it provides excellent lodging resistance and optimum use of nitrogen fertilizers to achieve appropriate yields. This wheat variety shows satisfactory tolerance to causes of plant diseases.

Table 8. Plant height (cm)

Tested variety	Butmir				Živinice				3-year average
	06/07	07/08	08/09	Average	06/07	07/08	08/09	Average	
BL 168-2	80,3	81,9	88,8	83,60	88,4	87,7	84,6	86,23	84,96
Tina	90,1	91,1	99,1	93,43	88,8	90,9	95,9	91,86	92,65
Average	89,30	87,55	91,23	89,25	89,00	87,03	90,68	88,06	88,76

Table 9. Crop lodging (0 – 9)*

Tested variety	Butmir				Živinice				3-year average
	06/07	07/08	08/09	Average	06/07	07/08	08/09	Average	
BL 168-2	1	1	1	1	1-2	2	2	1,38	1,19
Tina	1	1-2	1-2	1,34	2	2	2	2,0	1,67
Average	1	1,13	1,13	1,09	1,38	1,50	1,75	1,43	1,26

** 0 = no lodging; 9 = 100% lodging*

Good value for these two traits is a good basis for excellent technological quality or the higher protein content that is shown here with 12.31%. According to the protein content this variety is classified into B1 – quality group.

CONCLUSIONS

The tested variety BL 168-2, along the three years of testing, in both localities, achieved significantly higher yield compared to the standard.

The three-year average achieved a yield of 6873 kg / ha to 494 kg / ha or 7.75% more than the standard varieties.

According to the important technological traits and some properties of the group of other agronomic characteristics this variety is at the level of the standard.

ABSTRACT

Highly viable, early maturing, excellent technological quality, resistent to lodging, optimal seed size, excellent indirect indicators of quality, good resistance to plant diseases are all characteristics of a new variety of winter crop created by crossing the genetically divergent parents varieties BL 1-94 x Proteinka incured for a new variety of winter wheat under the code name BL 168-2. According to the overall three-year average, the variety BL 168-2 achieved an average yield of 6918 kg/ha which is 479,3 kg or 7,45 % more than the standard variety – Tina. The three-year average of raw protein content was 12,8%, water absorption 59%, energy of dough 100cm^2, belongs to B1 quality class. By the trait of resintance to lodging it is at the level of the standard.

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