

## YIELD AND QUALITY OF BREAD WHEAT VARIETIES CREATED IN THE INSTITUTE OF PLANT GENETIC RESOURCES IN SADOVO, BULGARIA

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The Institute of Plant Genetic Resources (IPGR), Sadovo, Bulgaria, is a big wheat breeding center. Variety seeds for the productive system of the country and for the export are growing there. The yield and the quality of 15 varieties were assessed in the period of 2005, 2006, 2007, 2008. High yielded varieties – average 6.3–6.7 t/ha, are Sadovo 772, Guinness 1322, Murgavets, Katya, Geya-1. They exceed the yield of the national standard Sadovo-1 (6.2 t/ha). The wheat quality potential depends on the genetic basis of variety as well as on the agro-climatic conditions of the region such as high test weight 40.3–47.3 g; 1000 kernel weight 70.2–79.4 kg/hl. The vitreousness of grain varied from 35 % (2005) to 70 % (2008). Strong-blended wheat varieties Pobeda, Momchil and Sadovo 552 have content of wet gluten of 29.6–30.5 % and lower gluten softening of 5.6–7.3 mm. The examined high yielded varieties with good grain quality especially Katya, Sadovo 772, Geya-1 and Guinness/1322 are eligible to be grown under dry conditions.

**Key words:** wheat variety; yield; grain quality; gluten

### ПРИНОС И КВАЛИТЕТ НА ЛЕБНИ СОРТИ ПЧЕНИЦА СОЗДАДЕНИ ВО ИНСТИТУТОТ ЗА РАСТИТЕЛНИ ГЕНЕТСКИ РЕСУРСИ ВО САДОВО, БУГАРИЈА

Институтот за растителни генетски ресурси во Садово, Бугарија, претставува еден голем селекционен центар. Тука се одгледува еден вариетет на семиња за производниот систем на земјата и за извоз. Приносот и квалитетот на 15 сорти пченица се оценувани во периодот на 2005, 2006, 2007, 2008 година. Високоприносните сорти пченица, во просек 6,3 до 6,7 т/ха, се *садово 772*, *џинес 1322*, *мурџавец*, *каџија*, *теја-1*. Тие го надминале приносот на националниот стандард *садово 1* (6,2 т/ха). Потенцијалот за квалитет на пченицата зависи од генетската основа на сортата, како и од агроклиматските услови на регионот, високата тестна маса (40,3–47,3 g) и масата на 1000 зрна (70,2–79,4 kg/hl). Стаклавоста на зрното варираше од 35 % (2005) до 70 % (2008). Силно мешаните пченични сорти *победа*, *момчил* и *садово 552* имаат содржина на влажен gluten од 29,6 до 30,5 % и помало омекнување на glutenот од 5,6 до 7,3 mm. Испитуваните високоприносни сорти со добар квалитет на зрното, особено *каџија*, *садово 772*, *теја-1* и *џинес 1322* се погодни за одгледување на суви услови.

**Клучни зборови:** сорта; принос; квалитет на зрното; gluten

### INTRODUCTION

The genetic basis of a variety is the most important factor which determines productivity and quality of wheat grown at specific conditions. The wheat varieties created in the Institute of Plant Genetic Resources are registered in the national “A” list and included in the seed productive system of the country. They occupied almost 50% of the land under wheat in the country and guarantee a reliable yield and good quality [4, 8, 13]. Each

year the IPGR – Sadovo, Bulgaria grows certified high-quality stock seeds under controlled agro-technological practices and sales them to the farmers.

### MATERIAL AND METHODS

The soil type in the region of Sadovo is luvisols, subtype vertic. These soils are favorable for optimal vegetation and the development of wheat

plants. Despite being low in assimilated nitrogen, the soil was well reserved in assimilated potassium and microelements Fe, Zn, Mn, Cu. The field trials with 15 wheat varieties (*T. aestivum*) after pea were carried out. The method of Latin square was used. Each plot area consisted of 10 m<sup>2</sup> in four replications. During each experimental year 35 kg/da ammonium nitrate and 25 kg/da superphosphate were applied. Full protection was given against pests, diseases and weeds. All the variety data presented are from seed productive fields over the period from 2005 to 2008. Agro-ecological conditions of the region were very changeable and included many variations of climate. The May and June harvest of 2005 was wet. There was an unprecedented drought in May 2006. The hottest harvest year was 2007, April being particularly dry. The rainfalls in June were the reason for lodging of crops and didn't compensate the insufficiency of soil humidity in spring. The winter of 2008 was very cold with extreme drought in February, March and May. Quality assessments were carried out according to approved Bulgarian standard methods which determined technological and market parameters of grain samples such as test and 1000 kernel weight; content of wet gluten was determined on 25 g whole mill sample using gluten washer; softening of gluten was determined by putting a 4 g of gluten ball in thermostat at 30 °C for 1 hour; sedimentation value was determined by using acetic acid-glacial and vitreousness using a farinoscope.

## RESULTS AND DISCUSSION

Some of varieties included in the experiment were described as follows: Pobeda-St, Momchil and Sadovo 552 are blending-strong wheat [1]; Katya, Sadovo772 [2], Geya-1, Yunak, Guinness/1322 are early matured and have good drought tolerance; Pobeda and Diamond have good cold resistance; Sadovo 1-St and Diamond are with very good ecological flexibility and Boryana is with very good economic efficiency [4, 5, 7, 8, 10, 11]. The grain yield per decare is shown in Table 1.

Agro-ecological conditions of the harvest 2008 were the most favorable for the wheat vegetation and varieties showed very high productive potential. For all the period the most high yielded varieties were Sadovo 772, Guinness/1322 (for two years), Murgavetz, Katya, Geya-1 and Petya (from

630 to 667 kg/da). They exceeded the standard Sadovo 1 by 34.4 kg/da, 44.7 kg/da, 33.2 kg/da, 28.8 kg/da, 17.2 kg/da, 10.1 kg/da, respectively.

Table 1

### *Grain yield of winter wheat varieties*

Wheat variety	Class	2005	2006	2007	2008	Average yield kg/da
Sadovo 1 st.	B	660	626.3	442.5	752.5	620.3
Murgavetz	B	625	640	536.3	812.5	653.5
Pobeda st.	B	552.5	615	422.5	630	555
Katya	B	637.5	723.8	508.8	726.3	649.1
Momchil	B	595	638.8	415	695	585.9
Geya-1	B	587.5	667.5	596.3	698.8	637.5
Sadovo 552	B	560	613.8	383.8	735	573.2
Yunak	B	527.5	715	525	697.5	616.3
Guinness/ 1322	B			575	755	665.0
Petya	B	540	688.8	496.3	796.3	630.4
Sadovo 772	B	607.5	661.3	587.5	762.5	654.7
Bononya	B	607.5	591.3	480	692.5	592.8
Prelom	B	512.5	693.8	367.5	736.3	577.5
Dimond	B	537.5	707.5	463.8	763.8	618.2
Boryana	B	540	633.8	563.8	683.8	605.4

The strong wheat varieties Pobeda, Momchil and Sadovo 552 gave relatively lower yield (555, 586 and 573 kg/da) but actually it was compensated with a high content of wet gluten in the grain, over 28.0 %, according to the regulation for "A" quality group [9] (Tables 1, 2). The interaction between the genotype and the environment during vegetation formed the basis of the wheat quality. The high temperatures during grain filling and during grain forming as well as balanced deficiency of atmosphere humidity of 2006, affected synthesis of proteins which was behind than the synthesis of carbohydrates. As a result the content of wet gluten decreased, averaging 23.3 % (Table 2). Because of the hot stress two weeks before the harvest (temperatures over 30 °C) wheat forcibly matured and the softening of gluten increased (>7

mm), so the quality declined. Even from some samples wet gluten was not able to wash out [6].

In the course of the harvest the grain was dry with moisture content less than 13 %, and there was no obvious evidence of physical damage to the grain. It is well known that wheat varieties created in the IPGR Sadovo have large grains. 1000 kernel weight is much higher than the standard's regulation (35 g), especially the varieties Prelom, Momchil, Sadovo 1, Geya-1 and Boryana which have 1000 kernel weight ranging from 45 to 47.3 g. The test weight measures how well grains pack in a given volume and is a function of grain density, uniformity of size, shape and skin texture. More than 76 kg/hl were measured for Guinness/1322, Pobeda, Petya, Katya, Murgavetz, Yunak and Momchil (Table 2). The average value of vitreous-

ness for 2007 was 66 %, for the next 2008, it was 70%. The wet weather of 2005 in the stage of grain filling declined this character to 34.4 %. During the four year trials the varieties Pobeda, Geya-1 and Petya showed very good vitreousness of 65.5%, 66% and 63 %, respectively. Good levels of wet gluten are essential for better bread-making quality. However this character, is very much affected by climatic and husbandry factors [12]. The varieties had high gluten content in 2005, average of 31.6 %. In spite of unfavorable abiotic factors the gluten quality of the strong varieties Pobeda, Momchil and Sadovo 552 (expressed by gluten softening) was better than the quality of the rest. The variety Prelom had the similar parameters – heavy grain with high content and quality of gluten (Table 2).

Table 2

*Grain quality of winter wheat varieties*

Wheat variety	1000 kernels weight g		Test weight kg/hl		Vitreousness %		Wet gluten %		Softening of gluten mm	
	$\bar{x}$	min-max	$\bar{x}$	min-max	$\bar{x}$	min-max	$\bar{x}$	min-max	$\bar{x}$	min-max
Pobeda st.	40.7	36.2–48.5	78.1	76–81.5	65.5	45–82	29.6	24–39	7.3	5.8–12
Bononya	40.3	39.7–48	75.6	73.2–79.4	46.3	30–61	28.0	22.7–32.2	9.6	6.7–12.0
Murgavetz	44.2	41.4–46.5	76.8	73.4–81.1	56.3	32–73	23.7	18.5–28.8	11.3	9.5–13
Katya	37.0	33.8–42	78.0	76.6–82.9	55.3	30–80	26.5	23.7–30.2	8.0	6–10
Momchil	47.3	44.6–51.5	77.3	73.2–81.9	55.8	30–84	30.0	23.9–36.9	6.7	5–10
Geya-1	45.4	40.6–52.5	73.0	70.6–77.1	66.0	28–64	25.8	23.2–28.8	9.8	7.5–12
Sadovo 552	42.2	38.9–49	75.5	73.2–79.6	54.0	43–65	30.5	23.2–36.4	5.6	5–11
Yunak	44.2	38.8–48	76.6	73.2–82.2	54.0	34–78	28.3	21–36	10.0	6–13
Guinness/1322	39.2	36.4–42	79.4	77–81.7	47.0	33–61	26.8	20–33.6	9.0	5–13
Petya	37.5	34.2–42.5	76.3	73.2–80.2	63.0	42–74	27.3	26.5–28.3	6.7	6.5–7
Sadovo 772	42.0	39.4–47	75.2	72.0–79	54.5	34–72	24.6	17.2–31.4	6.9	4–10
Sadovo 1 st	45.3	41.2–53	74.7	74–76	42.8	34–64	24.3	17.5–32.7	9.0	6.8–11
Prelom	46.0	42–50.5	70.2	65.4–76.1	50.5	32–66	29.1	21–37.2	7.0	6.5–11.5
Dimond	43.7	39.2–46.4	75.7	73.6–78.9	51.3	27–82	27.8	22–34.7	9.4	5.5–13.5
Boryana	45.0	41.8–52	74.8	72.8–81.9	53.0	28–76	24.8	22–28.8	9.0	6.6–10.5

## CONCLUSIONS

The results obtained show that wheat varieties created in the breeding program of IPGR, Sadovo possess high yield and good grain quality [3]. They are the most eligible to be grown not only in the region of Sadovo, but in the whole of South Bulgaria as well as in the similar regions characterized with extremely abiotic stress factors – fre-

quently soil and atmosphere droughts, with high temperatures or snowless winters with critical low temperatures.

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