

BRS 277: Wheat cultivar

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ABSTRACT - The wheat cultivar 'BRS 277' was developed by Embrapa (Empresa Brasileira de Pesquisa Agropecuária), resulting from a cross between OR1 and Coker 97-33. The plant height of 'BRS 277' is short, frost resistance in the vegetative stage is good and resistance to leaf rust moderate.

Key words: Wheat, cultivar, crop breeding.

INTRODUCTION

Agricultural research in Brazil has contributed significantly to increase wheat yields and improve the quality.

Genetic improvement of wheat in Brazil began in 1919, with the establishment of experimental stations in Alfredo Chaves, RS, (today Veranópolis) and Ponta Grossa, PR, by the Ministry of Agriculture. At that time, breeding work focused primarily on the selection of plants within progenies from seed collections of genotypes used by settlers. The first artificial crosses in wheat were performed only in 1925. As a result of these early efforts, the cultivar Frontana was released for cultivation in 1940 (Beckman 1965). This cultivar is still considered the greatest national contribution to wheat breeding worldwide, mainly due to the resistance to shattering, pre-harvest sprouting and to rust in adult plants (Sousa 2004).

Wheat breeding developed significantly in the 70's in Brazil, leading to the establishment of several governmental and private research centers in southern Brazil, mainly the National Wheat Research Center

(nowadays Embrapa Trigo in Passo Fundo, RS). This supported the expansion of cereal cultivation and the foundation of several cooperatives. The establishment of technical research groups was essential for the systematization and rationalization of the research work.

Laws and rules concerning the registration and protection of wheat cultivars were implemented from 1997 onwards. By this new system, the decision to launch a new cultivar is now the sole responsibility of the breeder of a genotype and a prior approval by the research committee is no longer required.

The objectives of the breeding programs in the country mostly followed the sequence: obtain cultivars tolerant to soil acidity; search for genotypes with genes for resistance to major wheat diseases; improvement of agronomic type and yield potential; and improvement of the technological quality. Currently, the goal is the creation of more balanced cultivars in terms of the agronomic and industrial performance, with a view to increase the durability on the field by the incorporation of genes for durable resistance to major biotrophic diseases of cereal. But

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the major challenge of national wheat cultivation is undoubtedly the expansion to other regions of Brazil, such as Cerrado regions (Sousa 2004).

The success of wheat breeding in the country was based on both the method of crosses as well as on introductions of germplasm, particularly through Mexican cultivars. Few results were obtained by mutation. The contribution of genetic improvement programs to the wheat production chain in Brazil is evidenced by the 429 recommended cultivars, from 1922 until 2003 (Sousa 2004). Only in Rio Grande do Sul, e.g., 43 cultivars from different institutions were recommended for cultivation in 2009 (Commission 2008).

The wheat breeding program of Embrapa aims to make cultivars available to the cereal production chain that have competitive agronomic performance and are appropriate for the different segments of milling industry, in terms of technological quality and suitability. This study aimed to disseminate information about the traits of the new wheat cultivar BRS 277 to the scientific community.

PEDIGREE AND BREEDING METHOD

'BRS 277' was obtained by hybridization, using the pedigree method; sowing was performed early, in view of the rather late cycle development. The cultivar was originated from the cross between the parents OR1 and Coker 97-33, made in a greenhouse of Embrapa Trigo, in 1994. In the bulk harvest of the F_1 population in 1995 in Passo Fundo, the general appearance was uniform. The mass segregating population derived from F_2 was established in 1996. The appearance of this hybrid population in the field was excellent and the agronomic traits were good, from which the plant called 1F was selected. From 1997 on (F_3 generation), 1998 (F_4 generation), and 1999 (F_5 generation), the plant health and agronomical traits of the selected plants were outstanding and plant height was short. After the selection in each generation, plants with deficient grain filling or with characteristic grain diseases were discarded in the laboratory. In 1999, the progeny of the F_5 generation was bulk-harvested and designated PF 990423, with particularly good resistance to powdery mildew and leaf rust. In 2000, this line was tested in the 1st year of the preliminary trials in Passo Fundo (RS); in 2001, in the Preliminary Test Network in Passo Fundo and Vacaria; and from 2002 on in the VCU testing in different environments of the states of southern Brazil.

PERFORMANCE

The performance of cultivar 'BRS 277' in terms of the value of Cultivation and Use (VCU test) was evaluated from 2002 to 2005, at 30 locations in different agroclimatic regions, defined for the crop in every state. In Rio Grande do Sul (RS) the tests were conducted in Vacaria, Passo Fundo, Tupanciretã, Piratini, Santa Rosa, São Borja, and in Pelotas; in Santa Catarina (SC) in the municipalities of Campos Novos and Abelardo Luz, and in Paraná (PA) in Ponta Grossa and Guarapuava. The controls for comparison were BRS 176 and BRS 177 (2002) and BRS Umu and BRS Figueira (2003 to 2005). All tests were conducted in a randomized block design with three treated replications and one replication without treatment. The treated replications were basis for the calculation of grain yield and the replication without treatment used to evaluate the genotype disease response at each location. Each experimental unit consisted of one genotype, sown in five 5m rows, for a total area of 5m². All cultural treatments during the installation and duration of the experiment were performed according to scientific indications defined by the Comissão Brasileira de Pesquisa de Trigo (Comissão 2008).

Table 1 shows the data grain yield of BRS 277 and controls in each test to determine the value of Cultivation and Use (VCU) underlying the registration of the genotype by the Ministério da Agricultura, Abastecimento e Pecuária (MAPA). Cultivar BRS 277 exceeded the control means in all trials by 11%, corresponding to a yield of 3952 kg ha⁻¹. In terms of annual performance, yields were 17% higher in 2002, 5% in 2003, 1% in 2004 and 20% in 2005. The mean grain yield of the cultivar was highest in 2004 (4163 kg ha⁻¹). All trials considered for the evaluation had acceptable coefficients of variation for the quantitative variable grain yield (less than 20%).

In the mean of the evaluation years, the test weight of BRS 277 was 76 kg hl⁻¹ and the controls 74.3 (BRS Figueira), 75.0 (BRS Umu) and 73.8 kg hl⁻¹ (BRS 177). The mean 1000-seed weight of the BRS 277 is 28.3 g. The grain is light red and hard.

In studies the optimum nitrogen rate for a maximum exploitation of the yield potential of the cultivar was defined at 50 kg ha⁻¹ of the macronutrient, which should be recommended in view of the agronomic traits of 'BRS 277' (Wiethölter et al. 2008).

Table 1. Grain yield (kg ha⁻¹) of cultivar 'BRS 277', and relative percentage of the control means in the late-cycle VCU trials in the states of Rio Grande do Sul, Santa Catarina and Paraná, from 2002 to 2005, Embrapa Trigo, 2009

Cultivars	2002 2 locations		2003 11 locations		2004 9 locations		2005 8 locations		2002-2005 30 locations	
	Kg ha ⁻¹	%	Kg ha ⁻¹	%	Kg ha ⁻¹	%	Kg ha ⁻¹	%	Kg ha ⁻¹	%
BRS 277	3.679	117	3.956	105	4.163	101	4.010	120	3.952	111
BRS 176	3.257	103	4.040	107	-	-	-	-	3.648	105
BRS 177	3.045	97	3.473	92	-	-	-	-	3.259	94
BRS Figueira	2.719	86	3.724	98	4.006	97	3.139	94	3.397	94
BRS Umbu	3.677	117	3.838	102	4.274	103	3.589	108	3.844	107
Cm	3.151	100	3.781	100	4.140	100	3.330	100	3.600	100

Cm = yield means of the two controls per year; Cm 2002 = BRS 176 and BRS 177; Cm 2003 to 2005 = BRS Figueira and BRS Umbu; % = Relative percentage of the mean grain yield of cultivar BRS 277 and the control mean (Cm)

'BRS 277' was, preliminarily, classified in the soft wheat class, with mean alveographic values of 205 x 10⁻⁴J (range 111 x 10⁻⁴J to 359 x 10⁻⁴J) in the years when it participated in the VCU testing (Table 3). Based on the samples, the following mean results were obtained for flour color (using the Minolta colorimeter): L = 92.5, a = -0.30 and b = 11.00. In the experimental data the mean flour extraction of the cultivar was 59% (moisture basis 14%), using a Quadrumat Senior mill; the P/L ratio was 0.6 and the mean falling number 372 seconds.

Cultivar BRS 277 was registered for cultivation in the states of Rio Grande do Sul (regions 1, 2 and 3), Santa Catarina (regions 4 and 5) and Paraná (regions 7 and 8).

OTHER TRAITS

'BRS 277' belongs to the bioclimatic group of spring wheat. The stature is short (mean height of 80 cm, from 2003 to 2004) and the cycle is late, with average heading of 100 days to maturation of 150 days. It is moderately frost-resistant in the vegetative stage and also to pre-harvest sprouting. It is classified as moderately susceptible to lodging and shattering. The

resistance to the major wheat diseases was characterized as moderate to powdery mildew (*Blumeria graminis*) and the glume blotch (*Stagonospora nodorus* f. sp. *tritici*), scab (*Fusarium graminearum*) and to Barley yellow dwarf virus (BYDV). It is susceptible to spot blotch (*Bipolaris sorokiniana*) and Wheat Mosaic Virus. In the field, the BRS 277 was classified as moderately resistant to leaf rust; but in the greenhouse, in evaluation with differential series, the performance differed according to the fungus race and susceptibility was observed to the races B43 and B50 (Table 2).

The leaves of 'BRS 277' are predominantly recurved at an angle of 45° to the main stem and the auricles are colorless or slightly colored. The ears are fusiform, awned and light-colored at maturity. In tests of the Distinctness, Uniformity and Stability (DHE), small annual variations considered intrinsic to the genotype were observed in the cultivar performance regarding: grain shape (predominance of oval grain with a percentage of less than 20% elongated grain); shape of the glume shoulder (predominance of sloping with occurrence of straight and high glume shoulders, at a frequency of 18%) and shape of the top node (predominantly long with occurrence of squared nodes).

Table 2. Response of cultivar 'BRS 277' to different leaf rust races in the wheat seedling stage

Race of leaf rust																				
B 26	B 27	B 29	B 32	B 33	B 35	B 37	B 38	B 39	B 40	B 41	B 43	B 44	B 45	B 48	B 49	B 50	B 51	B 52	B 53	B 54
Response	;	;	;	0;	;	;	1	1	;	;	1	3	;	;	;	12	3	;	0;	0;

; = traces

grade 0 to 4 = Level of susceptibility (4 = most susceptible)

Table 3. Qualitative profile of the wheat cultivar BRS 277; samples analyzed at the Laboratório de Qualidade da Embrapa Trigo

Trait	Unit	RS	SC	PR	Brazil
No. of samples	Nº	5	2	3	10
Gluten strength (medium)	10 ⁻⁴ J	221	189	190	205
Gluten strength (maximum)	10 ⁻⁴ J	359	245	268	359
Gluten strength (minimum)	10 ⁻⁴ J	111	133	118	111
Falling number	Seconds	331	404	420	372
Extraction	%	57	59	61	59
Elasticity index	%	51	48	51	50
Tenacity (P)	mm	66.0	62.0	53.0	61.3
Extensibility (L)	mm	109.8	108.5	123.7	113.7
Ratio P/L	-	0.6	0.6	0.4	0.6
Protein	%	10.0	12.4	12.2	11.1
Minolta color L	Minolta	92.6	92.5	92.2	92.5
Minolta color a	Minolta	-0.3	-0.5	-0.2	-0.3
Minolta color b	Minolta	10.4	11.8	11.5	11.0

SEED MAINTENANCE AND DISTRIBUTION

BRS 277 is registered by the MAPA under number 24071. Embrapa Trigo is responsible for the genetic seed of cultivar BRS 277, the Serviço de Negócios para Transferência de Tecnologia da Embrapa (SNT) for the basic seed and the Instituidores da Fundação Pró-Sementes de Apoio a Pesquisa, in partnership with Embrapa, for the certified seed.

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