

## CULTIVAR RELEASE

### BRS 276: Wheat cultivar

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**ABSTRACT** - The wheat cultivar 'BRS 276' was developed by Embrapa (Empresa Brasileira de Pesquisa Agropecuária). 'BRS 276' resulted from a cross between Embrapa 27\*3/KleinH 3247 a 33400 and PF 93218, has stable yields and belongs to the Bread class. The mean grain yield in years of evaluation was 3,769 kg ha<sup>-1</sup>, exceeding the controls by 4%.

**Key words:** Wheat, cultivar, crop breeding.

#### INTRODUCTION

Wheat (*Triticum aestivum* L.) is a widely adapted autogamous species around the world and of great significance for agriculture in Brazil. Currently, Brazil consumes around 11 million tons of wheat per year, far above the national production of cereals, which reached just over 6 million tons in 2008 (Conab 2009).

The national agricultural research has contributed significantly to increase productivity and improve the quality of Brazilian wheat. These efforts began in 1919 with the establishment of experimental stations in Alfredo Chaves (today Veranópolis) and in Ponta Grossa, PR by the Ministério da Agricultura. The breeding work initially focused on plant selection from progenies derived from seeds of plant material used by the settlers and the first artificial crosses were performed only in 1925. The development in the 70's was prosperous for wheat breeding in Brazil, when private and state research centers were created, with direct effects on the expansion of wheat cultivation in the country (Sousa 2004). Since then, research has led to the development of more than 100 new cultivars that

contribute to higher mean grain yields in the field and the sustainability of rural properties.

The objective of the Embrapa breeding program for the wheat production chain is to make cultivars available that are competitive at the agronomic level and appropriate in terms of quality and use for the different segments of milling and bakery industry. Some of the main challenges are an increased grain yield potential associated with a plant architecture that supports these increases; tolerance/resistance to biotic (to mainly leaf rust and wheat scab) and abiotic stress (pre-harvest sprouting, soil acidity and shattering). 'BRS 276' was released in partnership with the Fundação Pró-Sementes de Apoio a Pesquisa, which participates in the process of testing, marketing and distribution of the Embrapa cultivars. It is characterized by good leaf health and yield stability.

#### PEDIGREE AND BREEDING METHOD

'BRS 276' was derived from the cross between the female parent Embrapa 27 \* 3/Klein H 393247 a 33400 with the male parent PF 93218 (Embrapa 27\*2/Klein Criollo), made in a greenhouse of Embrapa Trigo, in 1994. The F<sub>1</sub> generation was sown in the summer of 1994/1995

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in a greenhouse (plot number 512163). After threshing the selected plants, the grains were visually selected in all generations. In the  $F_2$ ,  $F_4$ ,  $F_5$  and  $F_6$  generations plants resistant to powdery mildew and wheat leaf rust were selected under field conditions with natural pathogen infection, by the pedigree method. In this period plants were resistant to other diseases, e.g., soil-borne wheat mosaic virus (WMV), leaf spot and wheat scab, were also selected under natural pathogen infection.

In 1998, the growth of population in the  $F_6$  generation in the experimental field of Embrapa Trigo, was uniform. The plot was harvested and the line designated PF 980537. It had the following history of selection: F 50117-A-901F-951F-901F-2F-0F. In 1999, the line was evaluated for grain yield in the 28<sup>th</sup> preliminary trial of wheat lines in Passo Fundo, and in the following years, in other tests of the experimental network of Embrapa.

### PERFORMANCE

To determine the Value of Cultivation and Use (VCU test), the performance of cultivar 'BRS 276' was evaluated from 2003 to 2005 at 47 locations belonging to different

agro-climatic regions defined for the crop, separately for each state. In Rio Grande do Sul the tests were conducted in Cachoeira do Sul, Inhacorá, Passo Fundo, Piratini, Santa Rosa, São Borja, São Luiz Gonzaga, Tapera, Tupanciretã and Vacaria; in Santa Catarina - in the counties of Abelardo Luz and Campos Novos; in Paraná - in Cafelândia, Campo Mourão, Ponta Grossa, Guarapuava and Cascavel. Each experimental unit consisted of one genotype that was sown in five 5 m rows, for a total of 5m<sup>2</sup>. All cultural treatments during the installation and performance of the experiment followed the scientific indications of the Comissão Brasileira de Pesquisa de Trigo. The control cultivars Ônix and BRS 208 were used for comparison. All tests for grain yield estimates were conducted in a randomized block design with three replications sprayed with fungicides and 1 replication without treatment in some places, for evaluation of diseases incidence.

The relative percentage of grain yield of cultivar 'BRS 276' was higher than the mean of the controls in the three states evaluated. In Rio Grande do Sul, Santa Catarina and Paraná, the relative percentage was,

**Table 1.** Grain yield (kg ha<sup>-1</sup>) of cultivar 'BRS 276', of the controls Ônix and BRS 208 and percentages of the means of these controls in the VCU trials in the states of RS, SC and PR, from 2003 to 2005

Year	Data	State			Mean/Sum
		RS	SC	PR	
2003	No of evaluation sites	10	2	3	15
	BRS 276	4,252	3,863	4,356	4,157
	Ônix	4,726	3,917	4,210	4,284
	BRS 208	4,028	4,247	4,192	4,156
	% Relative Cm <sup>1</sup>	97.1	94.6	103.7	98.5
2004	No of evaluation sites	4	2	4	10
	BRS 276	3,955	3,920	3,805	3,893
	Ônix	3,352	3,721	3,751	3,608
	BRS 208	3,688	4,095	3,820	3,868
	% Relative Cm	112.4	100.3	100.5	104.2
2005	No of evaluation sites	5	2	4	11
	BRS 276	3,110	2,959	3,700	3,256
	Ônix	2,757	2,535	3,045	2,779
	BRS 208	3,187	2,734	3,640	3,187
	% Relative Cm	104.6	112.3	110.7	109.2
2003 a 2005	No of evaluation sites	19	6	11	36
	BRS 276	3,772	3,581	3,954	3,769
	Ônix	3,612	3,391	3,669	3,557
	BRS 208	3,634	3,692	3,884	3,737
	% Relative Cm	104.7	102.4	105.0	104.0

<sup>1</sup> Cm = yield means of the two controls

respectively, 104.7, 102.4 and 105% (Table 1). In 36 experiments conducted in the three years of evaluation the yield of cultivar BRS 276 was in the mean 3,769 kg ha<sup>-1</sup> (104% compared to the mean of Ônix and BRS 208). The yield of the cultivar was highest in 2003 in the county of Guarapuava (2005), reaching 5,943 kg ha<sup>-1</sup>. For hectoliter weight and weight of 1000 seeds, the mean of 'BRS 276' was 76.35 kg hl<sup>-1</sup> and 34.3 g, respectively.

The optimum nitrogen rate to exploit the maximum yield potential of the cultivar was defined at 60 kg ha<sup>-1</sup> of this macronutrient, which should be recommended in view of the agronomic traits of 'BRS 276' (Wiethölter et al. 2008).

The cultivar 'BRS 276' 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 276' belongs to the bioclimatic group of spring wheat and has an early maturity cycle (on average 78 days of silking and 130 days of maturation at Passo Fundo). It is moderately resistant to aluminum toxicity of soil and shattering. It is moderately susceptible to pre-harvest sprouting, frost in the vegetative state, and to lodging.

In terms of the major wheat diseases, the cultivar was moderately resistant to glume blotch

(*Stagonospora nodorum* f. sp. tritici) and moderately resistant to powdery mildew (*Blumeria graminis*), spot blotch (*Bipolaris sorokiniana*), scab (*Fusarium graminearum*), Soil Borne and to Wheat Mosaic Virus (WMV). The cultivar was resistant to leaf rust (*Puccinia triticina*) in the field and susceptible to the races B45, B50 and B52 in the greenhouse (Table 2).

The leaves are mostly recurved with colorless auricles. The ears are fusiform, awned and light-colored at maturity. The shape of the glume shoulder is predominantly straight and high and the glume length short (mean of 2.7 mm). The grain is predominantly oval, red and hard.

'BRS 276' was initially classified as bread wheat, with a mean gluten strength (W) of 227 x 10<sup>-4</sup>J in 32 samples from the experimental sites in the states of Rio Grande do Sul (15 samples), Santa Catarina (3 samples) and Paraná (9 samples) (Table 3). In view of the wide range of the alveographic values the cultivar was classified as Soft wheat in the state of Rio Grande do Sul and Santa Catarina and in Paraná, as bread wheat. The cultivar had a mean falling number of more than 361 seconds, indicating good tolerance to preharvest sprouting, an Elasticity Index of 48% and a tenacity (P)/extensibility (L) ratio of 0.7. The flour of 'BRS 176' is fair (L = 93.3 and b = 9.4) (Table 3).

Table 2. Response of cultivar 'BRS 276' to the different races of wheat leaf rust in the 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
Response	0	0	0	0	0	;	0	0	0	0	;	0	0	3	;	0	3	;	3	0

; = traces; 0 to 4 scale = susceptibility levels (4 = most susceptible)

Table 3. Qualitative profile of the wheat cultivar 'BRS 276'; samples analyzed at the Laboratório de Qualidade da Embrapa Trigo

Trait	Unit	RS	SC	PR	Brazil
No. of samples	No	15	3	9	27
Gluten strength	10 <sup>-4</sup> J	193	193	295	227
Falling number	Seconds	371	348	350	361
Extraction	%	62	62	57	60
Elasticity index	%	45	47	55	48
Tenacity (P)	mm	68	71	85	74
Extensibility (L)	mm	109	94	114	109
Ratio P/L	-	0.7	0.8	0.8	0.7
Protein	%	11.1	11.7	12.8	11.9
Minolta color L	Minolta	93.6	93.2	92	93.3
Minolta color a	Minolta	-0.2	0.0	0.0	-0.1
Minolta color b	Minolta	9.7	9.2	9.0	9.4

## SEED MAINTENANCE AND DISTRIBUTION

'BRS 276' was registered (no. 23922) by the Ministério da Agricultura, Pecuária e Abastecimento (MAPA). Embrapa Trigo is in charge of the genetic seed of the cultivar, the Serviço de Negócios para Transferência de Tecnologia da Embrapa (SNT) is responsible for the basic seed, and the Instituidores da Fundação Pró-Sementes de Apoio a Pesquisa, working in partnership with Embrapa, are responsible for the certified seed.

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