CULTIVAR RELEASE

BRS TR209 – A semi-dwarf wheat cultivar with white flour and pre-harvest sprouting resistance for southern Brazil

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Abstract: *BRS TR209 is a new wheat cultivar from Embrapa recommended for wheat-growing regions 1 (RS, SC, and PR) and 2 (RS and SC) in southern Brazil. It is a semi-dwarf cultivar, shows resistance to pre-harvest sprouting (PHS), and has strong gluten strength and white flour.*

Keywords: Triticum aestivum*, quality, white flour*

INTRODUCTION

Southern Brazil accounts for over 90% of Brazil's wheat production, with Rio Grande do Sul and Paraná as the leading producers (CONAB 2026). However, the region is characterized by high rainfall during the crop cycle (INMET 2024), particularly in spring, when crops are in the final development stages. These conditions favor the occurrence of foliar and spike diseases, lodging, and consequently, reduced grain yield and quality.

In addition, lodging resistance in wheat crops is associated with genetic factors, such as short plant height (whether or not related to the presence of dwarfing genes, *Rht*) and stem strength, as well as management practices, including sowing density and the timing and rate of nitrogen topdressing, all in interaction with environmental conditions. Of the 97 cultivars recommended for Brazil in 2024, 36.1% are classified as short, 8.2% as short/medium, and 55.7% as medium, medium/tall, or tall (CBPTT 2024). Considering only the seven cultivars with the largest planted area (constituting 60% of the area), 57% are classified as short and 43% as medium. This profile is also evident in the studies of Marchioro et al. (2016), Scheeren et al. (2017), Franco et al. (2018), Caierão et al. (2022) and Caierão et al. (2025).

The introduction of dwarfing genes may be the next step toward further reduction in plant stature, although the effect of these genes on grain yield is a matter of debate. In the study by Yingying et al. (2018) on Chinese wheat lines derived from crosses between the cultivars Xifeng20 and Jinmai47

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(donors of the Rht8 gene) and Burtert937 (donor of the Rht4 gene), the combination Rht4 + Rht8 exhibited an increase in thousand-grain weight and final grain yield, while the effect of the genes in isolation resulted in a reduction in final yield.

Pre-harvest sprouting (PHS) has a significant impact on wheat grain production and quality (Lin et al. 2018). In Brazil, in years favorable to PHS, losses can exceed 100 million dollars (Bassoi and Flintham 2005). The use of cultivars resistant to this abiotic stress has become a prerequisite for successful cultivation, especially when they combine other resistance QTLs, including the locus on chromosome 4A reported by Flintham et al. (2002).

Bread-making aptitude is also an essential characteristic for wheat cultivars recommended for southern Brazil, particularly if combined with the stability of this profile under varying climatic conditions and the production of light flour, which increases the commercial value of the final product. Of the wheat cultivars recommended for Brazil in 2025, most are classified as Bread Wheat (CBPTT 2024); few, however, combine this classification with the characteristic of white or bleaching flour that confers greater market value to the harvested product.

This study aims to present the detailed agronomic characteristics of the new Embrapa wheat cultivar BRS TR209, the first semi-dwarf cultivar in Brazil with bleaching flour and resistance to pre-harvest sprouting.

BREEDING METHOD

The cultivar BRS TR209 is derived from the cross BRS Umbu/PF 070486//Marfim carried out in 2010 at Embrapa Wheat in Passo Fundo/RS. The F_1 generation was sown in a greenhouse in 2011 and harvested in bulk. The F_2 to F_6 populations were advanced under field conditions, also in Passo Fundo/RS, from 2012 to 2016 in plots consisting of three 3-meter-length rows under reduced sowing density and subjected to the genealogical selection method. In each generation, plants exhibiting short height, high tillering capacity, and good responses to the main biotic and abiotic stresses of the crop were selected, through comparison with check cultivars established in each group of 100 plots. Plants selected in the field were threshed in each generation, and then grain was selected in the laboratory, choosing well-formed, healthy, and glassy-red kernels. The resulting selection history of cultivar BRS TR209 is F118345-D-4F-1F-3F-4F-1F-1F-0F. The plant selected in the F_6 generation was threshed and gave rise to a homozygous line also grown in Passo Fundo/RS (plot composed of one 1-meter-length row) in a Pre-PO (Pre-Observation Plot) in 2018. In 2019, the line was evaluated in Observation Plots (PO) consisting of six 6-meter-length rows, in which initial evaluations of grain yield were carried out. Due to its agronomic type (semi-dwarf plant with high tillering), high grain yield, and white flour aptitude, the line was selected and named PF 190209. In 2019 and 2020, this line was included in preliminary line-competition trials, conducted locally (2019 – Passo Fundo/RS) and regionally (2020 – Passo Fundo/RS, Vacaria/RS, and São Luiz Gonzaga/RS). In 2022, 2023, and 2024, it was included in Value for Cultivation and Use (VCU) trials for registration with the Brazilian Ministry of Agriculture, Livestock and Food Supply (MAPA).

PERFORMANCE AND AGRONOMIC PROFILE

Performance was evaluated in Value for Cultivation and Use (VCU) trials carried out during 2022, 2023, and 2024 at multiple locations in the states of Rio Grande do Sul, Santa Catarina, and Paraná (Table 1), covering Wheat-Growing Regions 1 and 2 (Cunha et al. 2006, MAPA 2008).

The trials were arranged in a randomized complete block design with three replications. Each experimental unit consisted of six 6-meter-length rows with a row spacing of 0.17 m and useful area of 5m². All crop treatments, including base/topdressing fertilization and disease, pest, and weed control, were carried out in accordance with the technical recommendations for wheat and triticale cultivation (CBPTT 2024). Prior to sowing, seeds were treated with Triadimenol + Imidacloprid. The following agronomic variables were analyzed in the trials: grain yield, plant height, plant cycle (from emergence to heading and from emergence to maturation), and crop reaction to the main biotic and abiotic stresses. Additionally, the main technological quality parameters, including test weight and thousand-seed weight, were analyzed at the Post-Harvest Laboratory of Embrapa Wheat. Analysis of variance was performed on the grain yield data, and mean values were compared using Tukey's test at 5% probability. Relative yield percentages were calculated based on the mean of the two check cultivars.

Table 2 shows the mean grain yield of the BRS TR209 cultivar and of the check cultivars used for comparison in the evaluation years. BRS TR209 showed an overall average grain yield of 4,903 kg ha^{-1}, not differing statistically from the average of the controls (Cm), which was 5,015 kg ha^{-1} according to Tukey's test ($p < 0.05$), representing a relative yield in comparison to mean checks of 97.8%. The mean grain yields obtained in 2022, 2023, and 2024 were 6,256 kg ha^{-1}, 3,094 kg ha^{-1}, and 5,360 kg ha^{-1}, respectively.

BRS TR209 is a semi-dwarf cultivar, with a mean plant height of 60 cm (Figure 1A), and has a medium growth cycle (to maturity). Regarding the main abiotic stresses, it shows an intermediate tolerance to frost in the vegetative stage, as well as moderate resistance to toxic aluminum, shattering, lodging, and pre-harvest sprouting. In relation to the main biotic stresses, it is moderately susceptible to powdery mildew (*Blumeria graminis* f.sp. *tritici*), scab (*Fusarium graminearum*), wheat blast (*Pyricularia griseae*), wheat mosaic virus (WMV), and barley yellow dwarf virus (BYDV). It is classified as moderately resistant to leaf spot diseases (*Septoria tritici* and *Bipolaris sorokiniana*) and resistant to leaf rust (*Puccinia triticina*).

To determine the technological quality profile of the BRS TR209 cultivar, 21 wheat samples from VCU trials conducted from 2022 to 2024 were analyzed – 14 samples from Wheat-Growing Region 1 and 7 from Wheat-Growing Region 2. The mean values from the analyses carried out at the Embrapa Wheat Post-Harvest Laboratory are shown in Table 3. Differences were observed in the mean values of the main quality parameters between the regions. The mean gluten strength was 305 W × 10^{-4} J and the stability was 18.7 minutes, consistent with the criteria for classifying the cultivar as bread wheat (MAPA 2010) (Figure 1B). It has an excellent tenacity-to-extensibility ratio for bread making, a mean P/L ratio of 0.77, in addition to a good elasticity index (61.0), falling number (366 seconds), and protein content (14.2%). The grain is characterized as soft (average hardness index of 39). BRS TR209 is classified as a whitening wheat cultivar (Minolta parameters L* = 94.6 and b* = 9.9).

Table 1. Locations and seasons of the Value for Cultivation and Use (VCU) trials of cultivar BRS TR209 in wheat-growing regions 1 and 2 (MAPA 2008), including the states of Rio Grande do Sul, Santa Catarina, and Paraná, during 2022, 2023, and 2024

Region/Location	State	Altitude (m)	Latitude	Longitude	Number of trials		
					2022	2023	2024
Wheat-growing region 1					5	5	5
Campos Novos	SC	934	27º 24' 06''	51° 13' 33''	1	1	1
Guarapuava	PR	1098	25° 23' 43''	51° 27' 22''	1	1	1
Irati	PR	812	25° 28' 02''	50° 39 '04''	1	-	-
Passo Fundo	RS	687	28° 15' 46''	52° 24' 30''	2	2	2
Vacaria	RS	971	28° 30' 39''	50° 55' 47''	-	1	1
Wheat-growing region 2					3	3	3
Chapecó	SC	674	27° 05' 47''	52° 37' 70''	1	1	1
Santo Augusto	RS	528	27° 51' 03''	53° 46' 38''	-	-	-
São Borja	RS	123	28° 39' 38''	55° 58' 39''	1	-	-
São Luiz Gonzaga	RS	260	28° 24' 30''	54° 57' 41''	-	1	1
Três de Maio	RS	343	27° 46' 24''	54° 14' 37''	1	1	1

Table 2. Grain yield of BRS TR209 in relation to the check cultivars at sites in wheat-growing regions 1 and 2 (MAPA 2010), evaluated in 2022, 2023, and 2024. Passo Fundo, RS, Brazil, 2024

Cultivar	2022	%[1]	2023	%[1]	2024	%[1]	Mean	%[1]
BRS TR209	6,256 a[3]	102.1	3,094 b	86.3	5,360 ab	100.5	4,903 b	97.8
Check 1 (C1)	5,933 a	96.8	3,214 b	89.7	5,042 b	94.5	4,730 b	94.3
Check 2 (C2)	6,319 a	103.2	3,953 a	110.3	5,631 a	105.5	5,301 a	105.7
C_m [2]	6,126 a	100.0	3,584 ab	100.0	5,336 ab	100.0	5,015 ab	100.0
CV (%)	6.45		13.96		6.69		4.62	

[1] Percentage of grain yield of cultivar BRS TR209 in relation to the mean of the check cultivars; [2] C_m: Mean of the two check cultivars; [3] In each year and colum, mean values followed by the same letter did not differ statistically according to Tukey's test ($p < 0.05$); C1: BRS Reponte (2022), TBIO Calibre (2023 and 2024); C2: TBIO Ponteiro (2022 and 2023), ORS Confeitaria (2024).

Although its relative yield is 97.8% compared to the checks, the cultivar exhibits a combination of aggregated attributes that are rarely found in a single cultivar. It is not only a semi-dwarf cultivar (a genetic platform distinct from other wheat cultivars recommended for southern Brazil) but also combines bread-making aptitude with high stability in farinograph performance, flour-whitening capacity, and resistance to pre-harvest sprouting. These characteristics make this cultivar a true novelty in wheat breeding in Brazil.

OTHER TRAITS

BRS TR209 has an erect flag leaf with highly pigmented auricles. The upper leaf node has a predominantly broad shape. The cultivar is characterized by a pyramidal, awned, and light-colored spike. The glume shoulder is predominantly inclined, and the glume tooth length is classified as medium (≥ 3mm to < 7mm). The grain is oval and red.

BRS TR209 carries favorable alleles for resistance to leaf rust and stripe rust, specifically at the Lr23/Yr27, Lr26/Yr9, Lr34/Yr18/Lr47, and Yr5 loci. It also contains a QTL (Rwt3-1D) for wheat blast resistance expressed in leaves, located on chromosome 5A. Regarding resistance to pre-harvest sprouting, the cultivar has the Phs1 allele (QTL/gene on chromosome 4AL; Torada et al. 2016), a favorable allele within the QTL region on chromosome 4BL (Wang et al. 2019), and an additional favorable allele in the QTL region on chromosome 7AL. With respect to end-use technological quality, BRS TR209 carries the Glu-B1al (Bx7OE band), Glu-D1d (5+10 bands), and Glu-A1b (2* band) alleles, all associated with superior breadmaking quality, which was confirmed by rheological and baking tests. For flour color, it carries the Lox-B1a allele, associated with high lipoxygenase activity, contributing to lighter flour color, a trait desirable for the baking industry.

BRS TR209 is registered with the Brazilian Ministry of Agriculture, Livestock and Food Supply (MAPA) under number 60334 (05/09/2025).

BASIC SEED PRODUCTION

Embrapa Wheat (Rodovia BR 285, km 294, 99050-970, Passo Fundo, Rio Grande do Sul, Brazil) is authorized to license seed producers to produce, multiply, and sell protected varieties (Law no. 9456/97).

Figure 1. Agronomic plant ideotype (A) and bread test (B) of cultivar BRS TR209. Passo Fundo, RS, Brazil. 2025.

Table 3. Technological quality profile of BRS TR209 in wheat-growing regions (WGR) 1 and 2 (MAPA 2010). Passo Fundo, RS, Brazil, 2024

Trait	WGR 1	WGR 2	Sum/Mean
Number of samples	14	7	21
Gluten strength (W x 10^{-4} J)	285	343	305
Tenacity (P)/Extensibility (L) ratio	0.67	0.96	0.77
Elasticity index	59.3	64.4	61.0
Flour yield (%)	52.42	53.81	52.87
Falling number (seconds)	366	367	366
Protein content (%)	14.1	14.4	14.2
Farinograph stability time (min)	16.3	22.4	18.7
Hardness Index (SKCS)	39	40	39
Flour color (Minolta)			
L* value (lightness)	94.6	94.5	94.6
b* value (+: yellow color)	9.9	9.8	9.9

SKCS = Single Kernel Characterization System.

DATA AVAILABILITY

The data generated and/or analyzed during the current research are available from the corresponding author upon reasonable request.

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