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CD 1550 – bread wheat cultivar with high gluten strength for the cooler regions of Brazil

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Abstract – *Cultivar CD 1550 is well-suited for the wheat-growing regions 1 and 2 of Rio Grande do Sul, Santa Catarina and Paraná and 3 of Paraná. It has the characteristics of bread wheat and high gluten strength. The average potential yield is 3828 kg ha^{-1}, 7% higher than that of the controls.*

Key words: *Wheat breeding, agronomic type, baking quality.*

INTRODUCTION

The development of new higher-yielding wheat cultivars is a constancy in wheat breeding programs, but according to Franceschi et al. (2009), aside from satisfactory yields, the harvested wheat grain must also fulfill the technological quality standards of the processing or milling industry, thus avoiding the use of additives, for reasons of costs and food safety. The gene expression for processing *or* industrial quality of a particular wheat cultivar can be influenced by a number of environmental factors, e.g., soil fertilizer, management, environment, and grain harvesting, drying, storage, and milling. Therefore, it is important that a flour with industrial quality suited for the intended purpose cultivar can be produced, regardless of the various environmental factors. To this end, wheat cultivar CD 1550 was developed, with bread-making quality *or* a bread wheat cultivar, high gluten strength, tolerance to pre-harvest sprouting and high potential yields.

BREEDING METHODS

Cultivar CD 1550 resulted from a cross between wheat cultivar ÔNIX and line CDFAPA 2001129 (CDFAPA 2001129 = OR 1/CD 102), made by COODETEC, in 2002, in Palotina. The F_1 seeds were sown in November 2002, in a greenhouse in Cascavel, resulting in F_2 seeds. These were sown in the field in Palotina in 2003, and selected by modified mass selection, which consists of selecting plants within a population and then threshing them in bulk. The F_3 seeds were sown in Palotina in 2004, and selected by the mass method. The F_4 and F_5 populations were selected, respectively, in 2005 and 2006, in Palotina, through the pedigree method. The F_6 populations were selected in 2007 in Palotina, by the pedigree method; plots with uniform plants were bulk-harvested, originating several sister lines. Cultivar CD 1550, with the pedigree CC16679-00P-0P-2P-5P-0P, was derived from the best of these lines.

PERFORMANCE CHARACTERISTICS

Cultivar CD 1550 was included in preliminary grain yield tests in 2008, conducted in Cascavel and Palotina, where its results exceeded those of the controls. Named CD 0983, it was evaluated in tests of Value of Cultivation and Use (VCU) in 2009-2012. The VCU tests were carried out according to the wheat-growing regions (Embrapa Trigo 2006), as shown in Table 1. The great number of environments promotes the choice of genotypes more adapted (Benin et al. 2013). Although cultivar CD 1550 was registered in early 2012, it was maintained in the VCU trials of 2012 and 2013.

The experiment was arranged in a randomized block design with three replications, in plots consisting of 6.5 m-long rows, spaced 0.20 m apart. Fertilization and pest and disease control were performed according to technical guidelines (Reunião 2008). Prior to sowing, the seeds were treated with the insecticides imidacloprid + triadimenol.

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Table 1. Locations and years of the tests of Value for Cultivation and Use (VCU) with cultivar CD 1550, in the wheat-growing regions 1, 2 and 3, from 2009 to 2013

Region/Location	2009	2010	2011	2012	2013
Wheat region 1	**6**	**7**	**7**	**6**	**9**
Cruz Alta/RS	-	1	1	1	1
Não Me Toque/RS	2	2	2	2	2
Passo Fundo/RS	-	-	-	1	1
Vacaria/RS	-	-	-	-	1
Campos Novos/SC	1	1	1	-	1
Castro/PR	1	2	-	-	-
Guarapuava/PR	2	1	3	2	2
Ponta Grossa/PR	-	-	-	-	1
Wheat region 2	**5**	**9**	**6**	**7**	**9**
Santa Rosa/RS	-	1	-	-	1
Santo Augusto/RS	1	1	-	-	2
São Luiz Gonzaga/RS	-	1	1	1	1
Abelardo Luz/SC	1	2	2	2	2
Cascavel/PR	3	3	3	4	3
Wheat region 3	**1**	**4**	**3**	**3**	**1**
Palotina/PR	1	4	3	3	1

The traits grain yield, days from emergence to heading, days from emergence to maturity, plant height, lodging, test weight, 1000-grain weight, gluten strength, yield stability, falling number, relative tenacity/extensibility, and flour color were determined. This latter flour trait was determined by a device known as a Minolta colorimeter that measures three color intensities: color L (whiteness), on a scale of 0 (black) to 100 (white); the closer to 100, the whiter is the flour; the wheat cultivars in Brazil range from 89 to 96; color a, ranging from -1.0 (tendency to green) to +1.0 (tendency to red); and color b, ranging from 6.0 (tendency to blue) to 10.0 (tendency to yellow). At strategic locations, collections of genotypes used in the VCU trials were grown without fungicide application, to assess reactions to the diseases leaf rust (*Puccinia triticina*), leaf spot (*Bipolaris sorokiniana* and *Drechslera* spp), powdery mildew (*Blumeria graminis* f.sp. *tritici*), head blight (*Fusarium graminearum*), glume blotch (*Stagonospora nodorum*), blast (*Pyricularia grisea*), and to wheat mosaic virus.

Table 2 shows the mean grain yield in the wheat-growing regions 1, 2 and 3, where the grain yield of cultivar CD 1550 was 4%, 8% and 10% higher than the average of the two best controls, respectively. Due to the excellent performance of cultivar CD 1550, it was indicated for the wheat-growing regions in the States of Rio Grande do Sul, Santa Catarina and Paraná (Brasil 2012). Cultivar CD 1550 has bread-making quality *or* is a bread wheat cultivar, high grain yield potential, good lodging resistance, and excellent agronomic traits, making it an option for wheat farmers in Rio Grande do Sul, Santa Catarina, and Paraná.

OTHER TRAITS

Cultivar CD 1550 has an average plant height (on average 81 cm, varying from 55 to 91 cm). The cycle lasts on average 52-90 d from emergence to heading and 110-143 d from emergence to maturity. The means of these traits in the Regions 1 and 2 were 76 and 130 days, respectively. Lodging resistance of cultivar CD 1550 was also good, while the mean test weight was 78 kg hL^{-1} and mean 1000-grain weight 36 g (Table 3).

In the field experiments conducted from 2009 to 2013, the severity of powdery mildew (*Blumeria graminis* f.sp. *tritici*) was determined *on a 1-9 scale* and the cultivar classified as moderately resistant. To head blight (*Fusarium graminearum*), resistance was low, indicating moderate susceptibility of the cultivar. The severity of leaf blotch and septoria glume blotch (*Bipolaris sorokiniana* and *Septoria tritici*) incidence was high, classifying the cultivar as susceptible. To glume blotch (*Septoria nodorum*), severity indices from low to medium were observed, classifying the cultivar as moderately susceptible. The severity of leaf rust (*Puccinia triticina*) was low, indicating moderate resistance. The occurrence of soil-borne wheat mosaic virus (SBWMV) infection was low, i.e., the cultivar is moderately resistant. To rice blast (*Pyricularia grisea*), cultivar CD 1550 was classified as moderately resistant (Table 3).

In the analysis of processing *or* industrial quality (Table 4), the mean gluten strength of 30 samples of experiments

Table 2. Mean grain yield (kg ha^{-1}) of cultivar CD 1550 and the two best controls, in VCU trials conducted in the wheat-growing regions 1, 2 and 3, in the states of Rio Grande do Sul, Santa Catarina and Paraná, from 2009 to 2013 -

Wheat region	Cultivar	2009	2010	2011	2012	2013	Mean	%
1	CD 1550	3765	4347	3727	3430	5799	4214	104
	Mean T*	3556	4181	3440	3527	5646	4070	100
2	CD 1550	3698	4290	3864	4096	4927	4175	108
	Mean T*	3318	4049	3629	3870	4520	3877	100
3	CD 1550	2310	3907	3437	2995	2822	3094	110
	Mean T*	2137	3354	3213	2659	2744	2821	100

* Composite mean T of the controls BRS Guamirim and ÔNIX in 2009-2011 and controls BRS Guamirim and QUARTZO in 2012 and 2013.

Table 3. Means of the traits heading (HD), maturity (MA), plant height (PH), lodging (LO), test weight (TW), 1000-grain weight (GW), and diseases leaf rust (LR) , leaf spots (LS), powdery mildew (PM), blast (BL), head blight (HB), and wheat mosaic virus (MV) of cultivar CD 1550 and the control ÔNIX, from 2009 to 2013

Cultivar	Characteristics					
	HD (days)	**MA** (days)	**PH** (cm)	**LO** (%)	**TW** (kg hL^{-1})	**GW** (g)
CD 1550	76	130	81	3	78	36
ÔNIX	78	132	83	9	78	35
Cultivar	**Diseases**					
	LR (%)	**LS** (grade 0-9)	**PM** (grade 0-9)	**BL** (grade 0-9)	**HB** (grade 0-9)	**MV** (grade 0-9)
CD 1550	7	3.2	1.8	3.2	0.5	0.7
ÔNIX	38	3.5	1.9	3.0	1.2	0.8

Table 4. Means of gluten strength (W), stability (ST), falling number (FN), ratio of tenacity/extensibility (P/L), flour color (COL L, COL a and COL b) of cultivar CD 1550 in each wheat-growing region, from 2009 to 2013

Wheat region	No. of samples	**W** ($x10^{-4}$ J.)	**ST** (min.)	**FN** (min.)	**P/L** (ratio)	**COL L** (89 to 96)	**COL a** (-1.0 to +1.0)	**COL b** (6 to 10)
1	11	275	13.6	358	1.1	92.6	-0.07	10.2
2	9	306	13.8	350	1.3	92.4	-0.01	10.7
3	10	314	13.9	347	1.2	92.6	0.11	10.9
Mean	30	298	13.8	352	1.2	92.5	0.01	10.6

conducted in the wheat-growing regions 1, 2 and 3 of the states of Rio Grande do Sul, Santa Catarina and Paraná, was 298 (W). This value classified the cultivar as bread wheat, including it in the group of bread wheat cultivars already available on the market for the cooler regions of Brazil (Franco et al. 2014, Marchioro et al. 2007, Marchioro et al. 2009, Scheeren et al. 2014).

BASIC SEED PRODUCTION

The Cooperativa Central de Pesquisa Agrícola (COODETEC - BR 467 - km 98 - PO Box 301, 85.813-450, Cascavel, Paraná, Brazil), licenses seed companies to multiply and market protected cultivars, according to Law No. 9456/97. Cultivar CD 1550 was launched on the market in 2012, with an availability of 3800 bags of 40 kg of seeds.

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