

CD 1104 - extra strong wheat with high yield potential

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Crop Breeding and Applied Biotechnology
16: 246-249, 2016
Brazilian Society of Plant Breeding.
Printed in Brazil
<http://dx.doi.org/10.1590/1984-70332016v16n3c37>

Abstract: CD 1104 is a cultivar indicated for the wheat-producing regions 1, 2, 3, 4 (irrigated) and 4 (rainfed) of the states of RS, SC, PR, SP, MS, MG, DF, GO, and MT. Its suitability for the industrial segment of strong flours and yield potential (mean of 4.427 kg ha⁻¹) are high.

Key words: *Triticum aestivum* L., bread baking quality, tolerance to soil aluminum.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is highly important in the agricultural economy of the world, ranking third in global grain production. Therefore, the search for greater productivity is one of the main goals of breeding programs worldwide (Carvalho et al. 2008). On the other hand, it is very important that at the time of harvest, the wheat grains have the desired technical properties that meet the demands of the processing industry and consequently of consumers.

According to Pomeranz (1987), the wheat grain quality can be influenced by a number of factors such as soil, climate, pests, diseases, management, harvesting, drying, storage, and milling. In view of these different factors, the use of cultivars with genetic potential for a specific industrial purpose is the best way of ensuring an end product with higher quality. Wheat with high gluten strength can be used in flour blends to improve the baking quality of other wheat varieties with low gluten strength (Gutkoski et al. 2007). With a view to the establishment of cultivars with high yield potential, along with the technical property high gluten strength, which is currently particularly valued by the food industry, COODETEC developed wheat cultivar CD 1104.

BREEDING METHODS

Cultivar CD 1104 was obtained from the cross between cultivars CD 108 and BRS 220, by COODETEC in 2002, in Palotina. The F1 seeds were sown in the same year in a greenhouse, in Cascavel. The plants were harvested at maturity and all ears bulk-threshed, resulting in the F2 population. The F2 population was grown in a field in Palotina, in 2003, applying the modified mass method. This procedure consists of selecting the best plants within a population, threshing all ears of all selected plants together, of which a significant sample of seeds

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Received: 17 June 2015
Accepted: 11 December 2015

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is sown on a plot with individual plants to obtain the next generation. The F3 population was conducted by the above method in Cascavel, in 2004. In 2005 and 2006, respectively, the populations F4 and F5 were grown in Palotina by the genealogical method. This procedure consists of selecting plants, the ears of each selected plant are threshed together and the seeds of each plant sown in the next generation in a plot with individual plants. The F6 population was also selected by the genealogical method in the field in Cascavel, in 2007, when the traits for various sibling lines were fixed, of which one line was selected (line CD 1034), from which CD 1104 was derived. The pedigree of this line is CC16440-00P-00T-7T-1Q-OT.

TRAITS AND PERFORMANCE

Line CD 1034 was included in the HC (Hot/Cold) genotype collection in 2008, and was tested in 2009 in Preliminary tests in Cascavel/PR, Palotina/PR, Guarapuava/PR, Não me Toque/RS, and in São Gotardo/MG, where yields exceeded those of the controls. The VCU trials of 2010-2014 were distributed at different locations of the wheat-producing regions and in different seasons (Table 1). The experimental design was in randomized blocks, with three replications in plots with six 5-m long rows, spaced 0.17 m apart. Fertilization and disease, pest and weed control were applied according to official technical recommendations (Comissão 2011). Prior to sowing, the seeds were treated with Triadimenol + Imidacloprid.

The variables measured in the VCU tests were grain yield, days from emergence to heading, days from emergence to maturity, plant height, lodging, hectoliter weight, 1000-grain weight, pre-harvest sprouting, and tolerance to soil aluminum. The grains of three replications per treatment were mixed, generating composite samples, including quality analyses, thereby obtaining the variables: falling number, gluten strength and alveograph tenacity/extensibility ratio; farinograph stability; and flour color. The latter was determined by the L, a, b system by which the values of L (lightness) vary from 0 (black) to 100 (white) and the a and b values (chromaticity coordinates) range from -a (green) to +a (red) and from -b (blue) to +b (yellow). At strategic locations, the genotypes included in the VCU tests were grown together without disease control, and the diseases leaf rust, leaf spot, powdery mildew, fusarium head blight, blast and mosaic virus were evaluated, among others.

The plant height of cultivar CD 1104 is medium (81 cm), ranging from 60 to 95 cm. The cycle is medium (52-86 d from emergence to heading; 105-133 d from emergence to maturity). In the mean, these traits were, respectively, 68 and 120 d. CD 1104 was classified as moderately susceptible to lodging, moderately resistant to moderately susceptible to pre-harvest sprouting and moderately tolerant to soil aluminum. The mean hectoliter weight was 79 kg hL⁻¹ and 1000-grain weight 35 grams.

In collections comprising the genotypes of the VCU tests at specific locations from 2010 to 2014 without disease control, information was obtained for the classification of cultivar CD 1104 with regard to the reaction to the main diseases. The cultivar was classified as moderately resistant to powdery mildew (*Blumeria graminis* f.sp. *tritici*), blast (*Pyricularia grisea*) and wheat mosaic virus (soil-borne wheat mosaic virus), and moderately susceptible to powdery mildew (*Blumeria graminis* f.sp. *tritici*), scab (*Fusarium graminearum*), leaf spots (*Septoria tritici* and *Bipolaris sorokiniana*),

Table 1. Locations and seasons of experiments of Value for Cultivation and Use (VCU) with cultivar CD 1104, in the wheat-growing regions 1, 2, 3, 4 (irrigated) and 4 (rainfed) including the states of RS, SC, PR, MS, MS, GO, and MG

Region/Location	2010	2011	2012	2013	2014
Wheat-growing region 1	-	-	-	9	9
Cruz Alta/RS	-	-	-	1	1
Passo Fundo/RS	-	-	-	1	1
Não Me Toque/RS	-	-	-	2	2
Vacaria/RS	-	-	-	1	1
Guarapuava/PR	-	-	-	2	2
Ponta Grossa/PR	-	-	-	1	1
Campos Novos/SC	-	-	-	1	1
Wheat-growing region 2	4	4	6	11	11
Santo Augusto/RS	-	-	-	2	2
Santa Rosa/RS	-	-	-	1	-
São Luiz Gonzaga/RS	-	-	-	1	1
Abelardo Luz/SC	-	-	-	2	2
Campo Mourão/PR	-	2	2	1	2
Cascavel/PR	3	2	3	3	3
Itaberá/SP	1	-	1	-	-
Itapeva/SP	-	-	-	1	1
Wheat-growing region 3	7	5	8	7	7
Arapongas/PR	-	1	1	1	-
Palotina/PR	4	4	4	3	3
Rolândia/PR	1	-	-	-	1
Dourados/MS	1	-	2	2	2
Manduri/SP	1	-	1	1	-
Santa Cruz do Rio Pardo/SP	-	-	-	-	1
Wheat-growing region 4	3	1	3	4	4
Catalão/GO	1	-	1	2	2
São Gotardo/MG	2	1	2	2	2

* In the years in which two trials were carried out in Catalão/GO and São Gotardo/MG, one was conducted in a dryland and the other in an irrigated cropping system. For the other locations, more than one test per year indicate different sowing times within the season recommended for cultivation specifically for that location.

Table 2. Means of the general gluten strength (W), yield stability (YST), falling number (FN), tenacity/extensibility ratio (P/L), flour color (COL L, COL a and COL b) per wheat-growing region of samples of tests conducted in the states of RS, SC, PR, MS, MS, GO, and MG

Wheat-growing region	No. of samples	W ($\times 10^4$ J.)	YST (min.)	FN (min.)	P/L (relation)	COL L (89 to 96)	COL a (-1.0 to +1.0)	COL b (6 to 10)
1	4	392	16.2	392	1.7	92.2	-0.02	10.4
2	11	422	17.7	395	1.6	92.2	-0.02	11.2
3	13	438	17.5	364	1.5	92.3	0.01	11.7
4	4	447	18.4	368	1.7	92.3	0.10	11.2
Mean	32	429	17.5	377	1.6	92.3	0.01	11.3

Table 3. Grain yield means (kg ha^{-1}) of cultivar CD 1104 and the controls in the tests carried out in the wheat-growing regions 1, 2, 3, 4 (irrigated) and 4 (rainfed) including the states of RS, SC, PR, MS, MS, GO, and MG

Wheat-producing region	Cultivar	2010	2011	2012	2013	2014	Mean	%
1	CD 1104	-	-	-	5690	5047	5369	102
	C ₁	-	-	-	5593	4922	5258	99
	C ₂	-	-	-	5604	5025	5315	101
	C _M	-	-	-	5599	4973	5286	100
2	CD 1104	5106	3817	3866	5144	4573	4501	109
	C ₁	4154	3280	3698	4198	4377	3941	96
	C ₂	4529	3413	3758	4845	4896	4288	104
	C _M	4342	3347	3728	4521	4636	4115	100
3	CD 1104	3292	3513	3353	2110	3407	3135	114
	C ₁	3119	3305	2866	2031	3131	2890	105
	C ₂	2610	3199	2411	1887	2974	2616	95
	C _M	2865	3252	2638	1959	3053	2753	100
4 (irrigated)	CD 1104	7413	7700	5642	6653	6706	6823	111
	C ₁	6285	7115	5407	6162	6343	6262	102
	C ₂	6634	6785	5196	5526	5982	6025	98
	C _M	6460	6950	5302	5844	6162	6144	100
4 (rainfed)	CD 1104	-	-	2358	1967	2748	2358	104
	C ₁	-	-	2292	1849	2734	2292	101
	C ₂	-	-	2245	1782	2709	2245	99
	C _M	-	-	2268	1816	2721	2269	100

C_M = Control means. In the wheat-growing regions 1 and 2, controls C₁ and C₂ were, respectively, BRS Guamirim and QUARCZO in all years; in wheat-growing region 3, the controls C₁ and C₂ were, respectively, CD 150 and IPR 85, in 2010 and CD 150 and BRS PARDELA in 2011, 2012, 2013, and 2014; in wheat-growing region 4 (irrigated), controls C₁ and C₂ were, respectively, CD 150 and BRS 264, in 2011 and 2013 and CD 150 and CD 116 in 2012 and 2014; and in the wheat-growing region 4 (rainfed), controls C₁ and C₂ were, respectively, CD 116 and BRS 264 in 2012, 2013 and 2014.

glume blotch (*Septoria nodorum*), and to leaf rust (*Puccinia triticina*).

In the analysis of processing quality of 32 samples of the experiments conducted from 2009 to 2014 in the wheat-growing regions 1, 2, 3 and 4, mean of 429×10^4 joules of gluten strength (W) and stability of 17.5 minutes were found, classifying CD 1104 in the group of strong wheat cultivars (Table 2). The high mean W value of cultivar CD 1104 indicates that the flour obtained from grain of this cultivar can be used in blends with weak wheat flour, to improve the flour quality for bread-baking. In terms of gluten strength and stability in different environments, cultivar CD 1104 had a medium performance and was thus classified as strong wheat in the wheat-growing region 1 as well. In this way, it became part of the choice group of high-W cultivars released on the market by COODETEC (Franco et al. 2009, Franco et al. 2011, Franco et al. 2013).

The grain yield means of cultivar CD 1104 in the wheat-growing regions 1, 2, 3, 4 (irrigated) and 4 (rainfed), were 2%, 9% 14%, 11%, and 4% higher than those of the control mean, respectively (Table 3). The overall grain yield mean was 4427 kg ha^{-1} , exceeding the controls by 8%. In view of the grain yield performance of cultivar CD 1104, it was indicated for cultivation in the wheat-growing regions listed above, for the states of RS, SC, PR, SP, MS, MG, DF, GO, and MT. The cultivar was registered by the Registro Nacional de Cultivares (no 32282). Cultivar CD 1104 has a high yield potential,

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strong wheat quality, high gluten strength and stability in different environments, representing a promising option for farmers of the segment of strong wheat production.

BASE SEED PRODUCTION

The Cooperativa Central de Pesquisa Agrícola - COODETEC (BR 467 - km 98 - PO Box 89 - CEP. 85813-450, Cascavel, Paraná, Brazil), is authorized to license seed companies for the production of protected varieties (law nº 9456/97), to multiply and sell seed to grain producers. Cultivar CD 1440 was released on the market in 2013, with an availability of 5000 bags 40 kg seeds.

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