

ITEMS FROM BRAZIL

BRAZILIAN AGRICULTURAL RESEARCH CORPORATION — EMBRAPA
Rodovia BR 285, km 294, Caixa Postal 451, Passo Fundo, RS, Brazil.*The triticale crop in Brazil.*

Alfredo do Nascimento, Junior.

In Brazil, between 2000 and 2004, the area on which triticale was grown stabilized between 109 and 126 x 10³ ha; a maximum area (134,868 ha) was harvested in 2005. This area has declined since 2007. In 2009, 69,350 ha of triticale were recorded, the smallest area in nine years. The national average yield of triticale grain in 2009 was 2,157 kg/ha, less than that of the previous year (2,441 kg/ha), and significantly below the global average of 3,927 kg/ha in 2009 (FAO 2010, IBGE 2010). When comparing grain yields, however, the plant type should be considered. In Brazil, triticale cultivars are spring type, the same as in Australia with similar yields in both countries. In countries such as Germany, France, Poland, and Sweden, triticale is a winter crop requiring longer cycles and vernalization, with average grain yields higher than 5,000 kg/ha.

Currently, triticale is sown in the states of Rio Grande do Sul, Santa Catarina, Paraná, Mato Grosso do Sul, São Paulo, and Minas Gerais in Brazil. The IBGE data do not include Mato Grosso do Sul and Minas Gerais. The largest areas of triticale were harvested in Paraná and São Paulo, and the average grain yield was highest in São Paulo in 2009. Together, Paraná and São Paulo account for 86% of the national triticale production. In the states of Paraná, São Paulo, Mato Grosso do Sul, and Minas Gerais, blast (*Pyricularia grisea*) is the main problem effecting triticale and wheat. Other cereals, such as barley, oat, and rice, and species of weedy grasses, also are hosts for blast. In green house experiments, we observed that all Brazilian triticale cultivars were susceptible. In 2009, the disease reduced triticale production up to 100% in some areas.

In southern Brazil, Fusarium head blight is one of the most yield-limiting factors for triticale and other winter cereals. The search for less susceptible genotypes to the disease is a constant in our breeding programs.

References.

- Food and Agricultural Organization of the United Nations. 2011. FAOSTAT – <http://faostat.fao.org/site/567/default.aspx?PageID=567#ancor>.
- Instituto Brasileiro de Geografia e Estatística. Levantamento Sistemático da Produção Agrícola. <http://www.ibge.gov.br/home/estatistica/indicadores/agropecuaria/lspa/default.shtm>.

BRS Saturno – the newest triticale cultivar developed in Brazil.

Alfredo do Nascimento, Junior, Márcio Sôe Silva, Eduardo Caierão, and Pedro Luiz Scheeren.

Pedigree and breeding method. The cultivar BRS Saturno resulted from the cross ‘PFT 512/CEP 28–Guará’ made by Embrapa Trigo in 1995. The line PFT 512 was derived from the cross ‘ANOAS/CEP 23–Tatu’ at the International Centre for Maize and Wheat Improvement Center (CIMMYT) in El Batán, Mexico, in 1986. This line was introduced by Embrapa into the 26th International Triticale Yield Nursery (ITYN) in Passo Fundo (RS) in 1993. The ITYN, composed of inbred triticale lines, was sent to several countries for evaluation and selection. Entry number 11 (of the 26th ITYN) with the selection sequence CTM86.123-17MI-2MI-13BI-2Y-0PAP-1Y-0B was selected. Number 11 was subjected to modified mass selection in Passo Fundo, where atypical and agriculturally inadequate plants were eliminated and superior and homogeneous plants selected, resulting in the following selection sequence: CTM86.123-17MI-2MI-13BI-2Y-0PAP-1Y-0B-0F (0F = selection in Passo Fundo-RS) resulting in the line PFT 512. Segregating populations were developed and selected in Passo Fundo, by the pedigree method, from 1997 on, leading to the selection of 100 spikes from plot 710108. In 1998, all 100 spikes were sown in rows, one spike/row, and spikes were selected, one/plant, from 12 plants of row 7 in plot 820485, which were separately sown in rows (one spike/row) in 1999. In the same year, spikes

of two sister lines were harvested from the plots 920356 and 920357. Twelve spikes/row were phenotypically selected increase homogeneity. In 2000, the genotype was included in the internal collection of Embrapa–Wheat for agronomic and biological evaluation and was simultaneously grown in a spike-multiplication plot for seed production. In 2001, the genotype was labeled PFT 112, for the preliminary triticale trial (EPRTCL) in Passo Fundo. Between 2002 and 2004, seed of the line was multiplied and purified and again selected in rows (one spike/row) with subsequent mass multiplication. From 2003 to 2010, PFT 112 was tested in the Value for Cultivation and Use of Triticale Trial (VCUTCL) at various locations in southern Brazil, where it stood out for its grain yield, hectoliter weight, and less susceptibility to Fusarium head blight. PFT 112 was assessed in the Distinctness, Uniformity and Stability (DUS) Trials in 2003, 2004, and 2005 by Embrapa–Wheat, in Passo Fundo.

Performance. The triticale cultivar BRS Saturno is resistant to powdery mildew and leaf rust; tolerant to blight; moderately resistant to leaf spots (*B. sorokiniana*, *Drechslera* spp., and *St. nodorum*) and to soilborne wheat mosaic virus (SBWMV); moderately susceptible to preharvest sprouting, barley yellow dwarf virus (BYDV), and bacterial leaf streak (*Xanthomonas translucens* and *Pseudomonas* spp.); and susceptible to blast (*Pyricularia grisea*) and Fusarium head blight, with a lower susceptibility level to Fusarium than other triticale cultivars in Brazil.

BRS Saturno is hexaploid, has a medium cycle (70–85 days from emergence to heading and 135–150 days to maturity), and a tall plant height (117 cm in Passo Fundo). Anthocyanin pigmentation in the coleoptile is strong to very strong, and low to mean in the auricle. Waxiness of the flag leaf sheath is strong. The spikes are long, completely awned, and light in color at maturity. The hair density of the stem is high.

This is the second Brazilian triticale cultivar developed by crosses made in Brazil. The lower susceptibility to FHB than that of other triticale cultivars (types I, II, III, and V), excellent grain quality, higher hectoliter weight than of the recommended varieties, and considerable yield adaptability indicate that this cultivar is valuable in production systems.

In the VCU studies conducted in Rio Grande do Sul, Santa Catarina, Paraná, Mato Grosso do Sul, and São Paulo between 2003 and 2005, the grain yield of BRS Saturno was 3,946 kg/ha, exceeding by 12.3% the mean yield of the two best triticale cultivars at each site (BRS 148, BRS 203, Embrapa 53, or Iapar 23–Arapoti) used as standards.

The mean performance of BRS Saturno for each state between 2003 and 2010 is in Table 1. Grain yield (1,121 kg/ha) was lowest in Mato Grosso do Sul and highest (8,347 kg/ha) in São Paulo (both in 2006). The mean value was 4,310 kg/ha. According to field observations, and despite the spring growth habit, low temperatures during the vegetative growth favor the performance of BRS Saturno. Thus, environments with drought and high temperatures do not allow for the maximum yield expression of the cultivar. However, environments with adequate water availability and lower temperatures during plant development show the yield potential of BRS Saturno, which exceeds those of the main varieties in Brazil, especially in years of excessive rainfall with the occurrence of FHB during flowering, due to the lower susceptibility of BRS Saturno. Table 1 shows that 17 of the 29 entries that exceeded 4,000 kg/ha were grown in the southern states (RS, SC, and PR), with exception of the maximum yield in São Paulo in 2006.

Due to the performance of BRS Saturno and the similarity of climate and cultivation between Santa Catarina and Rio Grande do Sul (southern region) and Paraná, Mato Grosso do Sul, and São Paulo (central south region) and the currently available cultivation technologies, this triticale cultivar was included in the National Registry of Plant Varieties

Table 1. Grain yield average (kg/ha) of BRS Saturno, from 2003 to 2010, in experiments in the Value for Cultivation and Use Trials in the southern states of Brazil (— indicates no yield trials were conducted at these locations in the respective year).

State	Year								Mean
	2003	2004	2005	2006	2007	2008	2009	2010	
Rio Grande do Sol	4,203	3,765	4,198	4,221	3,897	4,455	4,420	5,021	4,273
Santa Catarina	5,517	4,246	2,874	4,871	4,166	5,093	—	—	4,461
Paraná	3,527	4,784	4,525	7,677	5,654	6,229	—	3,991	5,198
São Paulo	3,231	3,833	3,607	8,347	—	—	—	—	4,755
Mato Grosso do Sul	—	2,988	1,207	1,121	—	—	—	3,317	2,158
General mean									4,310

(no. 26744, on 21 May, 2010), for grain production and trade in all wheat-growing regions in south and south-central Brazil (RS, SC, PR, MS, and SP), under rainfed cultivation in the cold season.

The grains of BRS Saturno can be used in human and animal nutrition and the flour for the production of cookies and pasta food.

Seed maintenance and distribution. BRS Saturno is a protected cultivar; Embrapa is in charge of basic seed multiplication, by the Serviço de Negócios para Transferência de Tecnologia da Embrapa (SNT), and the multiplication of certified seed in partnership with the Fundação Pró-Sementes de Apoio à Pesquisa.

Wheat in Brazil – the 2010 crop year.

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In the 2010 crop year, Brazilian wheat production was nearly 6×10^6 tons (Conab 2011), which is enough to supply 50% of the domestic demand (Table 2). The deficit in production makes Brazil the largest wheat importer. The southern region, comprised of the states of Rio Grande do Sul, Santa Catarina, and Paraná, accounts for 94% of the national production. Nonetheless, due to the characteristics of the cultivation system utilized, the average grain yield is not the highest in the country.

In 2010, the wheat area planted was lower than 2009 (2,149.8 to 2,428.0). Total production and average grain yield/ha in 2010 were about 15.0% smaller than those of 2009. The average grain yield in the southern region of Brazil in the 2010 crop season was the highest in the history. Low temperatures during the vegetative and grain-filling stages associated with sunny days contributed to high productivity. The grain quality was good as well.

Table 2. Cultivated area, total production, and grain yield of wheat in Brazil in 2010 (Source: CONAB 2011).

Region	Area (ha x 1,000)	Production (t x 1,000)	Grain yield (kg/ha)
North	—	—	—
Northeast	—	—	—
West-central	55.4	153.2	7,765.0
Southeast	66.8	196.6	2,943.0
South	2,027.6	5,531.0	2,728.0
Brazil	2,149.8	5,881.6	2,736.0

Reference.

CONAB, 2011. Companhia Nacional de Abastecimento. Central de Informações Agropecuárias/Grãos/Trigo. Disponível em: <http://www.conab.gov.br/conabweb/index.php?PAG=131>.

Wheat genetic progress from 2007 to 2010 in the state of Rio Grande do Sul, Brazil.

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Rio Grande do Sul State is one of the main wheat-growing areas in Brazil (around 35% of the Brazilian production). Important wheat breeding research is based in the State. The genetic progress and benefit resulting from these programs were compared through estimates for the period of 2007 to 2010. The analysis was performed on grain yield data (kg/ha) collected in the annual state yield trials network using the minimum squares method by the Brazilian Wheat Research Commission. The inclusion, exclusion, permanence, and renewal rates of the genotypes in the trials and in the recommended wheat lists also were studied on the same set of data. The genetic progress made in wheat yield estimated for Rio Grande do Sul was 7.8% for 2007–10. The genotype inclusion rate was 0.0%, 25.6% and 17.1% for the years 2008, 2009, and 2010, respectively. The genotype exclusion rate was 0.0%, 20.9% and 26.8% in the years 2008, 2009, and 2010, respectively. The maximum rate of genotype renewal was in 2009, reaching 32.4%. The Rio Grande do Sul wheat breeding programs were highly effective for the period studied with annual mean genetic gain of 1.9% (62.7 kg/ha/year).

Active Wheat Germplasm Bank of Embrapa: current situation and future perspectives.

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The Active Wheat Germplasm Bank (AGB–Wheat) located at Embrapa Trigo, Passo Fundo, RS, Brazil, was funded in 1978, and since that time is concerned with enhancement as well as biodiversity conservation of wheat and related species. Today there around 15,000 wheat accessions, including related species, registered and stored at AGB–Wheat. At this moment, AGB–Wheat is under restructuring in order to resize the bank and eliminate of the redundancy, which means the actual number of accession will be reduced in the future. Under conservation are species from the genera *Triticum*, *Aegilops*, *Agropyron*, *Elymus*, *Elytrigia*, and *Leymus*. The accession data are managed by an appropriate software system. As a routine, AGB–Wheat activities include diversity enhancement, conservation, characterization, and evaluation. In the last two years, 1,742 new accessions from Brazil and other countries were introduced into the AGB, and 1,130 access were distributed in exchange to different institutions including other Embrapa stations. During this time, we multiplied/regenerated and morphologically characterized 2,512 accessions in the field and in the greenhouse. The organization and validation of a core collection of 240 accessions will be increased in the near future to better represent the whole AGB collection. Characterization and evaluation related to the main concerns for wheat growing in Brazil, such as biotic stress (Fusarium head blight and wheat blast), abiotic stress (sprouting), and technological flour quality will be made on the core collection. In addition, molecular and cytological analyses will be done.

ITEMS FROM CROATIA**BC INSTITUTE FOR BREEDING AND PRODUCTION OF FIELD CROPS**

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A new generation of winter wheat cultivars developed at the Bc Institute Zagreb.

Work on breeding winter wheat at the Zagreb Bc Institute have been in progress continuously for more than 60 years. The results of this work are many cultivars registered in the Republic of Croatia and abroad. A new generation of winter wheat cultivars have been developed taking into account the needs and demands of the producers, including Bc Mira, Bc Renata, Dora, Marina, Bc Lidiya, Bc Lira, Bc Irena, and Bc Anica.

Bc Irena and Bc Anica are the newest registered winter wheat cultivars from the Bc Institute in 2010 (Table 1 and Table 2, p. 8). The main characteristics of these cultivars is a broad genetic base that provides a high yield potential, stability, and very good grain and flour quality. These cultivars represent progress in wheat breeding. The results of the Committee for

Variety Registration, small- and large-scale trials, and seed production confirm a high agronomic value of the newly released Bc winter wheats (Table 3, p. 8, and Figs. 1 and 2, p. 8). They have

Table 1. Yield results of the new winter wheat cultivar Bc Irena compared with the standard cultivars (The Committee for Variety Registration of the Republic of Croatia, 2007–10).

Cultivar	Yield results (t/ha)				Sana = 100	Žitarka = 100	Divana = 100
	2007–08	2008–09	2009–10	Average			
Bc Irena	9.069	7.690	5.234	7.331	101.0	104.7	121.7
Sana	9.201	7.124	5.456	7.260	100.0		
Žitarka	8.221	7.328	5.463	7.004		100.0	
Divana	6.962	6.416	4.688	6.022			100.0