

SCS205 Riqueza: Carioca common bean cultivar for Southern Brazil

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Abstract – Santa Catarina Agricultural Research and Rural Extension Company (Epagri) developed the SCS205 Riqueza bean cultivar, of the carioca seed group. This new cultivar has excellent grain yield, high sanity, with a high grain weight associated with precocity. The plants are semi-erect with undetermined growth habit, adapted to mechanical harvesting.

Key words: *Phaseolus vulgaris*; grain yield; crop breeding.

SCS2015 Riqueza: cultivar de feijão do tipo carioca para o Sul do Brasil

Resumo – A Epagri desenvolveu o cultivar de feijão SCS205 Riqueza, do grupo carioca. Este novo cultivar tem um excelente rendimento de grão, alta sanidade, com alto peso de grão associado com precocidade. As plantas são semi eretas com hábito de crescimento indeterminado, adaptadas à colheita mecânica.

Termos de indexação: *Phaseolus vulgaris*; rendimento de grão; melhoramento.

Introduction

Common bean (*Phaseolus vulgaris* L.) is a staple food for Brazilians, as one of the most important sources of protein, calcium, iron, phosphorus and B vitamin, and associated with food safety. Brazil is the largest bean producer, accounting for approximately 20% of the world production. Family farmers are responsible for 70% of Brazilian production, still insufficient for the country's consumption (CTSDF, 2012). The agricultural success of a bean cultivar necessarily depends on its agronomic performance. Thus, the biggest challenge for the breeder is the identification of genotypes that have good performance, coupled with yield stability under different environmental conditions (CRUZ & REGAZZI, 1997).

Epagri common bean genetic breeding program has the objective of obtaining cultivars with high yield combined with grain quality, resistance to anthracnose, and drought tolerance. During a cultivar development process, around fifty combination crosses are performed per period, totalizing

a hundred combinations per year. A thousand segregating families are evaluated in the field for each generation, followed by phenotypic selection, value for cultivation and use (VCU) experiments, disease and grain quality selection, and evaluation for drought tolerance. SCS205 Riqueza was released for Santa Catarina, Paraná and Rio Grande do Sul, Brazilian states. This cultivar offers high grain yield, early maturation cycle, grain quality, disease resistance. In addition, it is recommend for cultivation in areas with no water deficiency and on fertile soils.

Breeding method

Hybrid seeds were obtained through the hybridization between BRS Campeiro (black seeds) and IAC Tybatã (carioca seeds), carried out in 2000/01 and a progress generation was conducted in 2001 to obtain the F₂ generation. In 2001/02 and 2002/03 crop years, the F₂ and F₃ generations were conducted in the field without selection. The F₄ population was conducted in the field during the 2003/04 crop year,

with bulk and grain color selections. A negative selection was performed on F₅ population (2004/05) in order to eliminate undetermined type 4 plants, disease-susceptible plants, and plants with long guides. Grain quality and color selection were performed after the harvesting period.

The F₆ generation was conducted in the field during the 2005/06 crop year, with the selection of individual plants, obtaining superior lineages for the agronomic traits of plant size, sanity, number of pods, grain quality and color. The evaluation of F₇ lines was carried out in the next season (2006/07) with the selection to plant size, productivity, sanity and grain quality. The F₈ generation was evaluated in the field, with selection of lines for productive performance, grain quality and health of plants and pods. Preliminary tests for color, size, uniformity and yield evaluation were performed in 2008/09 and 2009/10 crop seasons, with F₉ and F₁₀ generations, respectively, in a randomized complete block experiment design with four replications in 4 row and 4 meter plots. Four promising lines

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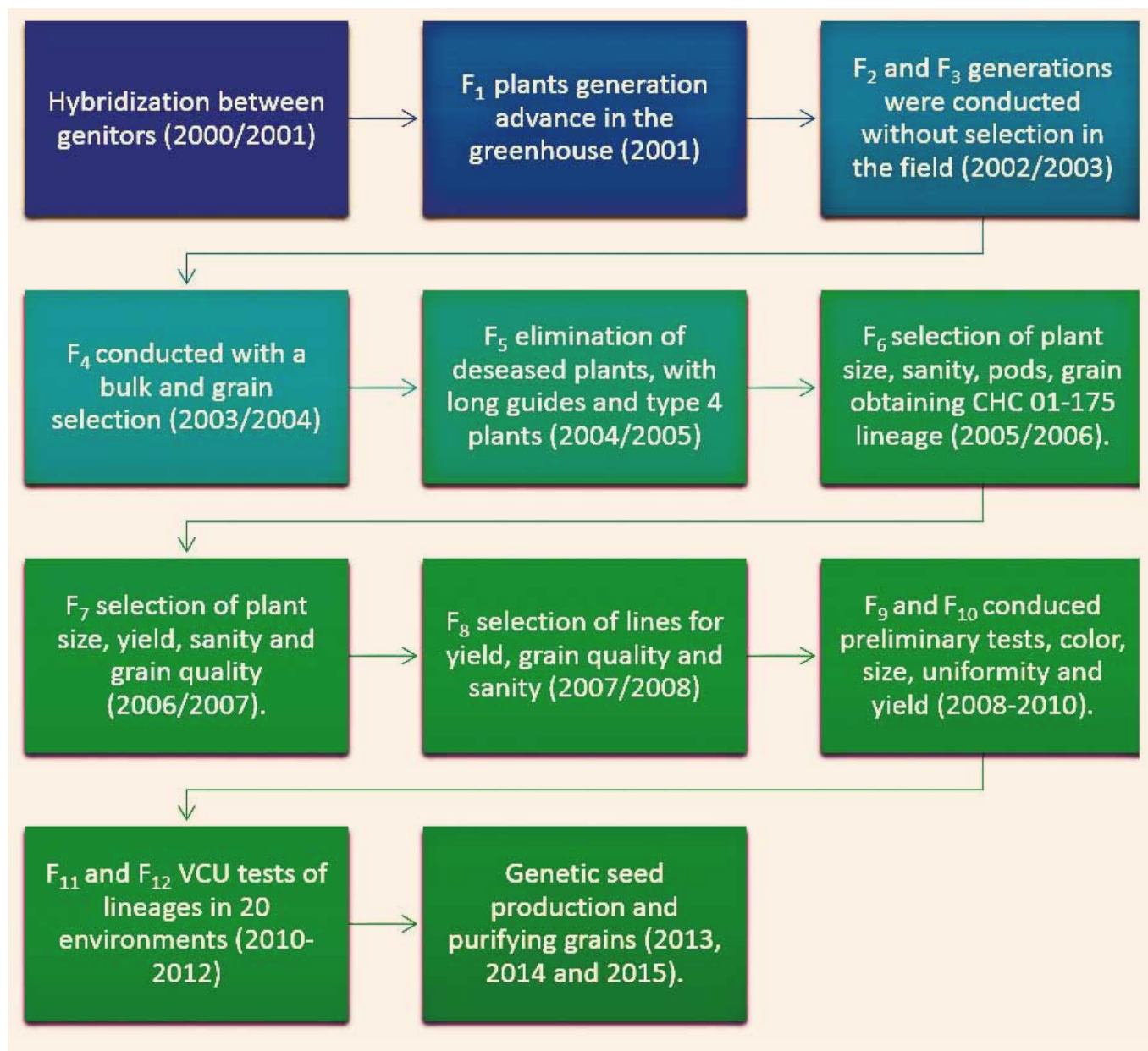


Figure 1. Breeding methodology and selection cycles of SCS205 Riqueza new common bean cultivar. Epagri/Cepaf, Chapecó, 2016

of the same crossing were identified and evaluated by VCU tests during the season and off-season periods of the 2010/11 and 20011/12 agricultural years. After identifying the top lineage (CHC 01-175), the production of the genetic seed was initiated and purified in the next three years. All the selection cycles (Figure 1) were conducted in Chapecó, SC, (27°05'24" S, 52°39'05" W, and 668m altitude).

Cultivar characteristics

The yield performance of line CHC 01-175 was evaluated in some cities of Paraná (Londrina, Pato Branco, Ponta Grossa and Guarapuava), Rio Grande do Sul (Pelotas, Sobradinho, Santa Maria and São Luiz Gonzaga) and Santa Catarina (Águas de Chapecó, Canoinhas, Chapecó, Ituporanga, Ponte Serrada and Xanxerê) in 2010/11 and 2011/12 crop years (Table 1). The control cultivars BRS

Tangará (PR), Carioca (RS), SCS202 Guará (SC) and BRS Pérola (PR, RS and SC) were used for comparison. The experiments were conducted in a randomized block design, without fungicide treatment and without supplemental irrigation. The plots consisted of four lines, five meters long each, spaced 0.45m apart, of which the two center rows were evaluated in four replications. For the statistical analysis (R CORE TEAM, 2015), the effects of genotypes were ►

Table 1. Results of VCU experiments conducted in the states of Paraná (PR), Rio Grande do Sul (RS) and Santa Catarina (SC) in 2010/11 and 2011/12 crop seasons (totalizing four seasons), for SCS205 Riqueza and BRS Tangará, BRS Pérola, Carioca and SCS202 Guará control cultivars. Epagri/Cepaf, Chapecó, 2016

Location	Crop season	Year	Yield (kg ha ⁻¹)			Mean yield	CV (%)
			Riqueza	Tangará	Pérola		
Paraná							
Londrina	Water	2010/11	1,630.67*	1,011.33	382.33	696.83	20.60
Pato Branco	Water	2010/11	2,368.67*	2,341.67	1,017.33	1,679.50	19.78
Ponta Grossa	Water	2010/11	3,425.33*	2,888.00	1,732.00	2,310.00	21.22
Guarapuava	Drought	2010/11	2,635.33*	2,761.67	1,622.33	2,192.00	21.46
Ponta Grossa	Drought	2010/11	1,263.00	1,232.33	1,215.67	1,224.00	21.30
Guarapuava	Water	2011/12	2,930.50*	2,844.50	2,916.50	2,880.50	15.51
Londrina	Water	2011/12	993.00	1,233.00	693.25	963.13	18.57
Guarapuava	Drought	2011/12	3,712.50*	3,265.50	3,211.25	3,238.38	13.36
Pato Branco	Drought	2011/12	1,730.75*	1,271.00	1,280.50	1,275.75	17.27
Mean			2,304.39	2,101.97	1,623.07	1,862.52	-
P(%)			-	109.63	141.98	123.72	-
Rio Grande do Sul							
Pelotas	Water	2010/11	2,937.00*	2,440.00	2,352.00	2,396.00	16.50
Sobradinho	Water	2010/11	2,912.00	2,727.00	2,785.00	2,756.00	14.00
Santa Maria	Water	2010/11	3,066.00*	2,158.44	2,438.31	2,298.38	11.99
Santa Maria	Drought	2010/11	1,465.67*	1,096.10	1,511.04	1,303.57	15.86
Sobradinho	Water	2011/12	1,272.00	1,535.00	1,507.00	1,521.00	31.50
Santa Maria	Water	2011/12	1,449.31	1,102.63	1,385.69	1,244.16	22.80
São Luiz Gonzaga	Drought	2011/12	2,537.00	2,342.00	2,125.00	2,233.50	13.70
Sobradinho	Drought	2011/12	1,565.00	1,187.00	1,672.00	1,429.50	19.10
Mean			2,150.50	1,823.52	1,972.00	1,897.76	-
P(%)			-	117.93	109.05	113.32	-
Santa Catarina							
Chapecó	Water	2010/11	3,884.58*	3,492.05	3,417.82	3,454.94	11.85
Canoinhas	Water	2010/11	3,679.26*	3,895.81	3,456.69	3,676.25	9.39
Ponte Serrada	Water	2010/11	3,950.28*	3,476.11	4,221.11	3,848.61	12.52
Chapecó	Drought	2010/11	2,510.00*	2,462.00	2,342.00	2,402.00	9.6
Águas de Chapecó	Drought	2010/11	2,488.00*	2,220.00	1,970.00	2,095.00	13.46
Xanxerê	Drought	2010/11	2,771.00*	2,446.00	2,454.00	2,450.00	10.46
Chapecó	Water	2011/12	3,450.00*	2,932.00	3,014.00	2,973.00	12.72
Canoinhas	Water	2011/12	3,712.00*	3,313.00	3,413.00	3,363.00	11.67
Ponte Serrada	Water	2011/12	4,578.00	4,620.00	4,135.00	4,377.50	11.69
Águas de Chapecó	Drought	2011/12	3,578.00	2,968.00	2,857.00	2,912.50	13.55
Xanxerê	Drought	2011/12	2,145.00*	2,095.00	1,857.00	1,976.00	16.73
Ituporanga	Drought	2011/12	4,169.00*	3,710.00	4,210.00	3,960.00	9.06
Mean			3,409.59	3,135.83	3,112.30	3,124.07	
P(%)				108.73	109.55	109.14	

* Presented statistically significant difference for test F at 5% of probability. P(%) – Percentage of positive relation between SCS205 Riqueza cultivar and the genotype in the column used as a control.

considered fixed and the other effects were considered random.

CHC 01-175 yield exceeded the best control cultivar by 9.63% in Paraná, and by 23.72% of controls average. In Santa Catarina, this new cultivar showed agronomic superiority of 9.06% for the best control cultivar, and 13.32% for the control average. Similar results were obtained in Rio Grande do Sul, with 8.73% superiority for the best control, and 9.14% for the control average. CHC 01-175 showed a productivity average of 2,717.55kg.ha⁻¹ in all the locations, 14% higher than the average of the two cultivars used for comparison in the VCU experiments.

The line CHC 01-175 was approved as SCS205 Riqueza (Figure 2) and is recommended for all bean-cultivating regions in the South of Brazil for first and second crop seasons (water and drought periods). SCS205 Riqueza phenotypic characteristics (Table 2) that differentiate this new cultivar are the absence of anthocyanin on the hypocotyl, the white color of wing and banner flower, indeterminate growth habit, semi-erect plant, grains with light background and predominantly brown stripe, moderate resistance to anthracnose (*Colletotrichum lindemuthianum*) and to the bean golden mosaic virus.

SCS205 Riqueza cooking mean time, evaluated over two seasons (2010/11 and 2011/12) is 25 min, with an average protein content of 21.1%, showing a different phenotype compared to cultivars FTS Magnífico (24.9 min and 20.05%) and BRS Pérola (21.25 min and 20.83%).

Other features

SCS205 Riqueza has excellent grain yield, with a productivity potential of 4,000 kg.ha⁻¹. It is resistant to the races of *Colletotrichum lindemuthianum*

Table 2. Phenotypic and biological characteristics of the new common bean cultivar SCS205 Riqueza. Epagri/Cepaf, Chapecó, 2016

Characteristic	SCS205 Riqueza
Plant	
Hypocotyl color	Green
Plant structure	Semi erect
Growth habit	Undetermined type II
Guide length	Medium
Stem	With no anthocyanin
Leaf color (4th node)	Medium green
Average cycle of emergency to flowering	39 days
Average cycle of emergency to harvest	89 days
Mechanical harvesting	Adapted
Grain	
Grain color	Carioca
Flower color	White
Grain shape	Eliptical
Degree of flatness	Half full
Weight of thousand grains	254 grams
Average time of cooking	21 minutes
Average protein grain content	24.20%
Desease reaction	
Anthracoze (<i>C. lindemutianum</i>)	MR
Angular leaf spot (<i>Phaeoisariopsis griseola</i>)	MS
Bacterial blight (<i>Xanthomonas campestris</i> pv. <i>phaseoli</i>)	MS
Fusarium wilt (<i>Fusarium oxysporum</i> f. sp. <i>phaseoli</i>)	MR
Indicated growing region	SC, PR and RS

Abbreviations: MR – moderately resistant; MS – moderately susceptible; SC – Santa Catarina; PR – Paraná; RS – Rio Grande do Sul.



Figure 2. New cultivar SCS205 Riqueza characterization: (A) Plants in vegetative development; (B) High blossoming potential; (C) Grain with light background and brown stripes. Epagri/Cepaf, Chapecó, 2016

(causal agent of anthracnose) 91, 73, 337 and 74, and susceptible to races 89, 81, 71, 65, 08 and 72. It shows high grain weight associated with high industrial grain yield, precocity and sanity. The period between emergency and blossoming is around 39 days, and between emergency and maturity is about 86 days. The plants exhibit semi-erect stature with type-two indeterminate growth habit, adapted to mechanical harvesting.

Seed maintenance and distribution

Bean cultivar SCS205 Riqueza was registered by the Ministry of Agriculture, Livestock and Supply (MAPA, Brazil) on November 20th, 2015 under the number 34656 and has been protected by the National Service for Cultivar Protection (SNPC) since July 5th, 2016 under the number 20160142. Epagri/Cepaf produces the genetic and certified seeds of this cultivar.

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