



CULTIVAR RELEASE

Common bean cultivar BRS Ametista with large Carioca grains and disease resistance

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Abstract - BRS Ametista is a common bean cultivar with Carioca grain and yields similar to cultivar Pérola, but with larger grain size, resistance to anthracnose and Fusarium wilt. It is recommended for 18 states in all regions of Brazil and can be planted on over 95% of the area used for common bean in the country.

Key words: Phaseolus vulgaris, grain size, Fusarium wilt.

INTRODUCTION

Common bean is a socially and economically important crop in Brazil and is grown in almost all states of the nation. In the last 10 years, the acreage of common bean in Brazil decreased by 13.3%. On the other hand, the production increased by 19%, owing to the significant increase in average productivity (73%). Despite the increased production, the domestic supply is still insufficient, since consumption increased by 10.94%, in only the period between 2004 and 2010 (CONAB 2011). Thus, new cultivars should continuously be developed in common bean breeding programs to meet the needs of producers and consumers.

In Brazil, common beans are separated in several market groups, according to their grain types; the Carioca group (79%) and black (17%) account for almost all of the Brazilian production (Del Peloso and Melo 2005), i.e., the

Carioca group is the most important. Efforts of the Brazilian agricultural research corporation Embrapa have focused primarily on developing cultivars with Carioca grain that meet different needs of the supply chain of common bean. The main traits prioritized in breeding programs are the following: suitability for direct mechanical harvesting (BRS Horizonte (Melo et al. 2005), BRS Cometa (Faria et al. 2008) and BRS Estilo (Melo et al. 2010), disease resistance (BRS Pontal (Del Peloso et al. 2004) and BRS Notável (Pereira et al. 2012), delayed grain darkening after harvest (BRS Requite (Faria et al. 2004)), earliness (BRS Cometa and BRS Notável), grain yield (BRS Pontal, BRS Estilo and BRS Notável). In addition to the agronomic traits, other characteristics are highly relevant as well for the acceptance of new cultivars, e.g., the market quality of the grain, primarily related to size, shape and color of the beans, mainly for the market group Carioca.

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The current marketing standard for the Carioca grain demands beans with light background, large and not shiny. For meeting these criteria, the grains of cultivar Pérola became standard on the Brazilian market since over 10 years. Consequently, to ensure a good acceptance on the market, a new cultivar should have grains with the same or a better commercial quality than the standard.

BREEDING METHODS

The BRS Ametista was originated from a hybridization between the lines PR9115957 / LR720982CP at Embrapa Rice and Beans, in 1993. After crossing, the F₁ generation was grown in a greenhouse for plant propagation in that year. The other selection steps were all performed in Santo Antônio de Goiás. The F₂ population was sown in the field in 1994 and selected for large Carioca grains. Also in 1994 and 1995, the F₃ and F₄ generations, respectively, were selected for plant architecture and for large Carioca grains and in 1995, plants in the F₅ generation were selected for rust resistance and grain type, resulting in F_{5,6} families. These F_{5,6} families were selected for resistance to anthracnose, rust and angular leaf spot, in 1996. In 1997, families of the F_{5,7} generation were selected for resistance to bacterial blight, plant architecture, grain yield, and large Carioca grain. In the F_{5,8} generation, in 1998, lines were selected for yield and plant architecture. In the F_{5,9} generation, in 2000, plants were selected for grain yield and plant architecture, leading to the selection of line LM 200204188.

In 2001, this line was assessed in a Preliminary Test of Carioca beans in a randomized block design with three replications and plots consisting of two 4-m rows, in which over 109 lines and four controls were tested at four sites (Santo Antônio de Goiás (GO) and Seropédica (RJ), Ponta Grossa (PR) and Lavras (MG)). In 2003, this line was assessed in an Intermediate Test with over 24 lines and five controls, in blocks with three replications and four 4-m rows, in seven environments: in Santo Antônio de Goiás (GO) in the rainy season, Ponta Grossa (PR) in the rainy and dry season, Lavras (MG) in the winter, Sete Lagoas (MG) in the dry season, Simão Dias (SE) in the rainy season and Seropédica (RJ) in the winter. A pooled data analysis of yield and other agronomic traits indicated line LM 200204188, then named CNFC 10470, to be included in the Test of Value for Cultivation and Use (VCU). In 2004, the plants were multiplied to obtain enough seeds for VCU tests. In 2005, 2006, 2007, 2008, 2009 and 2010, line CNFC 10470 was evaluated in 129 VCU tests, along with the controls (Pérola, Iapar 81, BRS Pontal, BRS 9435 Cometa, and IAC Alvorada), in a randomized block design with four replications and plots of four 4-m rows, using the respective recommended technologies for the different environments and cropping systems.

GRAIN YIELD AND PRODUCTION POTENTIAL

In 128 VCU tests conducted from 2005 to 2010, in the winter growing season in Tocantins and Mato Grosso, in the rainy season in Sergipe, Alagoas, Pernambuco and Bahia, in the dry growing season in Mato Grosso do Sul, in the rainy and dry seasons in Santa Catarina, Paraná and Rio Grande do Sul, and in the rainy, dry and winter growing seasons in Goiás, São Paulo and the Federal District, the mean grain yield of BRS Ametista (CNFC 10 470) was equal to that of the controls (Pérola, Iapar 81, BRS Pontal, BRS 9435 Cometa, BRS Estilo, IAC Alvorada, IAC Carioca, IPR Tangará, SCS Guarará and BRS Requite) (Table 1).

The overall mean yield was 2,124 kg ha⁻¹, versus 2,144 kg ha⁻¹ of the controls and 2,164 kg ha⁻¹ of cultivar Pérola. Two controls were used in each comparison, one of which was

Table 1. Grain yield of BRS Ametista compared with the mean of two controls in the tests of Value for Cultivation and Use per State and growing season, between 2005 and 2010

State	Growing season	BRS Ametista (kg ha ⁻¹)	Mean of controls (kg ha ⁻¹)	Relative yield (%)	Number of environments
GO/DF	Rainy	1625	1564	103.5	10
	Dry	1125	1297	91.1	8
	Winter	2880	2713	105.8	9
	General	1895	1868	100.6	27
MT	Winter	2907	2866	100.8	3
TO	Winter	2816	2038	138.1	1
BA	Rainy	2213	2290	98.3	8
MS	Dry	2057	1984	105.8	7
SP	Rainy	2348	2426	98.3	13
	Dry	1917	1988	96.5	8
	Winter	2772	2926	93.7	8
	General	2346	2443	96.5	29
PR	Rainy	2218	2226	98.5	14
	Dry	1832	1774	103.5	9
	General	2067	2049	100.5	23
SC	Rainy	2333	2516	92.5	7
	Dry	1869	1939	92.6	4
	General	2164	2306	92.5	11
RS	Rainy	2909	2689	114.9	2
	Dry	797	579	137.5	1
	General	2205	1985	122.4	3
SE	Rainy	2286	2322	98.6	9
AL	Rainy	1068	975	111.9	3
PE	Rainy	1827	2012	90.2	4
General		2124	2144	99.7	128

always Pérola in all tests. The second control was preferentially IAPAR 81. Otherwise, one of the other above-mentioned cultivars was used, according to the constitution of the tests.

Considering the data for each growing season and state, BRS Ametista reached a superiority of 38.1% over the controls in the winter in Tocantins and 37.5% superiority in the state of Rio Grande do Sul, in the dry growing season. BRS Ametista had the highest overall relative yield (Table 1) in the state of Rio Grande do Sul, with a superiority of 22.4% compared to the controls, indicating a high suitability of the cultivar for the growing conditions and the soil and climate of this state. In the state of Paraná, which produces approximately 27% of the national common bean output, and consequently the state with the highest common bean production in Brazil (FEIJÃO 2011), BRS Ametista had a mean yield of 2,226 kg ha⁻¹ and 1,774 kg ha⁻¹, in the rainy and dry growing seasons, respectively, reaching the productivity of the controls when considering the overall average of the two growing seasons in Paraná.

The production potential of BRS Ametista, averaging the five tests in which this cultivar had the highest yields, was 4,265 kg ha⁻¹. This result shows that the cultivar has a high genetic potential and that if the environment is favorable and growing conditions are good, high yields can be achieved.

OTHER TRAITS

With regard to the characteristics of technological and industrial grain quality, BRS Ametista has a regular grain color and size and an average 100-grain weight of 30 grams, with larger grains than those of controls Pérola and IAPAR 81 (Table 2). This trait was decisive for the decision to release this line, since light-colored and larger grains are

desired by consumers (Carbonell et al. 2008). The average cooking time of BRS Ametista is 26 min, slightly shorter than that of the controls (on average 28 min). Regarding the protein percentage, the average content of BRS Ametista was slightly higher (around 23%) than the 21% of the controls.

Artificially inoculated BRS Ametista is resistant to common-mosaic virus and the pathotypes 65, 73, 81, 89, and 453 of *Colletotrichum lindemuthianum*, the causal agent of anthracnose. In field trials, it was moderately resistant to anthracnose, fusarium wilt, bacterial blight, and rust. However, it was susceptible to angular leaf spot, curtobacterium wilt and golden mosaic virus (Table 3).

BRS Ametista has a normal cycle (85-94 days from emergence to physiological maturity), similar to Pérola, BRS Estilo (Melo et al. 2010) and IAC Alvorada (Carbonell et al. 2008). The plants are shrubby, with indeterminate growth habit type III. The plant architecture of BRS Ametista is semi-erect, quite similar to Pérola, adapted only to indirect mechanical harvesting. The flowers are white and at physiological maturity the pods turn yellow. At harvest maturity, the pods are evenly sandy yellow. The Carioca grains (beige with brown stripes) have an elliptical flat shape, are not shiny and larger than those of Pérola and BRS Estilo (Melo et al. 2010), according to the current consumer preference on the market.

SEED PRODUCTION

BRS Ametista was registered by the Ministry of Agriculture, Livestock and Supply, on March 02, 2011, under number 27807 and protection in september 21, 2012, under number 20120174. Embrapa Products and Markets will be in charge of the basic seed production.

Table 2. Characteristics of grain bean cultivar BRS Ametista compared to controls Pérola and IAPAR 81

Cultivar	Cooking time (minutes)	Protein content (%)	100-grain weight (g)
BRS Ametista	26	23	30
IAPAR 81	29	19	25
Pérola	27	22	27

Table 3. Agronomic traits and disease reaction of cultivar BRS Ametista, compared to the controls with Carioca grain Pérola and BRS Estilo

Cultivar	Cycle	W100	ARCH	AN	CBB	RU	ALS	BCMV	BGMV	FW
BRS Ametista	N	30	Semi-erect	MR	MR	MR	S	R	S	MR
Pérola	N	27	Semi-erect	S	S	MS	MS	R	S	MS
BRS Estilo	N	26	Upright	MR	S	MR	S	R	S	S

W100-100-grain weight (gram); ARCH-plant architecture; AN-Anthracnose; CBB-common bacterial blight; RU-Rust; ALS-Angular leaf spot; BCMV -Bean common mosaic virus; BGMV-Bean golden mosaic virus; FW-Fusarium wilt; N-Normal cycle; MM- Medium-maturing cycle; R-Resistant; MR-Moderately resistant; MS-Moderately susceptible; S-Susceptible.

CONCLUSIONS

The common bean cultivar BRS Ametista has a normal cycle, good yield potential, yield stability, light-colored grains larger than those of Pérola and moderate resistance to anthracnose, fusarium wilt and common bacterial blight.

BRS Ametista is well-suited for planting in the following states and growing seasons: rainy, dry and winter in Goiás, Distrito Federal, Bahia, and Sao Paulo; winter and dry in Mato Grosso, rainy and dry in Parana, Santa Catarina and Rio Grande do Sul; winter in Tocantins; dry in Mato Grosso do Sul; and rainy in Maranhão, Pernambuco, Sergipe, Alagoas, Rio Grande do Norte, Ceará, Paraíba, and Piauí.

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