CULTIVAR RELEASE

RB07818: sugarcane cultivar with high sucrose content and light juice color

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Abstract: *Sugarcane cultivar RB07818, developed by RIDESA/UFAL, is characterized by a high sucrose content, clear juice color and high agro-industrial yield. In addition, its adaptability to adverse environmental conditions, resistance to major diseases and yield stability across multiple harvests are outstanding.*

Keywords: Saccharum *spp., plant breeding, sugar conversion efficiency*

INTRODUCTION

The sugarcane breeding program of RIDESA/UFAL (Interuniversity Network for the Development of the Sugar Energy Sector-RIDESA, Federal University of Alagoas – UFAL) released cultivar RB92579 in 2003, notable for its high agro-industrial yield and broad adaptability. Since then, this variety has come to occupy more than half of the sugarcane cultivation area in the Northeast region of Brazil (Diniz et al. 2019, Oliveira et al. 2021). However, the high enzymatic activity of polyphenol oxidase (PPO) in this cultivar induces oxidation of phenolic compounds, forming dark pigments that raise the ICUMSA color of the sugar solution (ICUMSA – www.icumsa.org). This compromises product quality and commercial acceptance, ultimately reducing the profitability of the sugar-energy sector (Azevedo et al. 2019).

To address this challenge, in 2006, RIDESA/UFAL initiated studies using key parental lines with clear juice of the Serra do Ouro germplasm bank. Based on these results, a targeted genetic crossing strategy was implemented in 2007 to combine the high agro-industrial yield of RB92579 with the lighter juice color of selected genotypes. Within 14 years of rigorous evaluation in an improved population, cultivar RB07818 (RNC/MAPA: 46422) was developed and released, in 2021. This new variety combines early maturity, high sucrose content and light juice color, and consequently seems a promising solution to overcome the technological limitations of traditional cultivars (Oliveira et al. 2021).

The RIDESA varietal census for 2023/2024 indicates that cv. RB07818 was the third most cultivated sugarcane variety in Alagoas, underscoring its impact on both quality and productivity of the sugar-energy sector. This achievement reinforces the commitment of RIDESA to develop sugarcane cultivars tailored to meet industrial demands, by focusing on traits such as high agro-industrial yield and resistance to major pests and diseases (Carneiro et al. 2020, Silva et al. 2021). Recent releases, as described by Daros et al. (2017, 2018), Diniz et

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al. (2019), Berton et al. (2020), and Brasileiro et al. (2024), show improved adaptability to challenging environments, yield stability and compatibility with mechanized management (for further details see www.ridesa.com.br). This study presents the main agronomic and technological characteristics of cv. RB07818, highlighting the success of the breeding strategy employed in its development.

PEDIGREE AND BREEDING METHOD

The hybridization of cv. RB07818 (pedigree shown in Figure 3) was undertaken in May 2007, at the Station Serra do Ouro for Flowering and Crossing, in Murici, Alagoas (lat 09°13' S, long 35° 50' W, alt 500 m asl). In a biparental cross, RB92579 flowers were pollinated with RB9629 pollen. The choice of cv. RB9629 as male parent was motivated by previous studies that described its lighter juice color— a desirable trait for addressing the dark juice issue of cv. RB92579.

In July 2007, seeds from this and other RB07 series crosses were germinated in a greenhouse at the Campus of Engineering and Agricultural Sciences (CECA) at UFAL, in Rio Largo, Alagoas (lat 09° 28' S, long 35° 49' W, alt 127 m asl). About 44,000 seedlings were generated and planted in the field in September 2007 at Santo Antônio Mill, in São Luiz do Quitunde (lat 09° 22' S, long 35° 32' W, alt 31 m asl), in single-row plots (row length 11.5 m, row spacing 1.0 m, plant spacing 0.5 m).

In August 2009, the first selection round (T1) was performed by mass selection in the first ratoon cane cycle, based on the following traits: stalk growth, number and diameter; flowering; pithiness; sugar content (brix), and pest and disease incidence. In the T2 clonal stage, 421 clones (0.96% of the initial population) were planted in July 2011. Each plot consisted of two 3.5-m rows, spaced 1 meter apart, with a planting density of 15 buds per meter. Selection in this phase was based on the same traits evaluated in the T1 stage, with the additional criteria plot weight and kilograms of brix per plot.

The second clonal phase (T3) was run in July 2012 with 10 clones (2.38%) selected from T2. The experimental design was in randomized complete blocks with two replications, in plots with five 4-m rows and the same bud density as in the previous phase. Selection in this phase included harvest data from the plant cane (2013), first ratoon (2014), and second ratoon (2015) crops, where the same traits as in T2 were evaluated, as well as tons of cane per hectare (TCH), total recoverable sugars (TRS) in kg of sugar per ton of cane, as described by Fernandes (2003), and tons of TRS per hectare (TTRSH).

Between 2015 and 2021, 18 experiments were conducted on 12 farms across the research stations of RIDESA/UFAL (Caeté, Santo Antônio, and Coruripe mills). Each experiment included cv. RB07818 along with other RB clones from the three stations. The experiments used plots with seven 6-m rows and a planting density of 15 buds per meter, in a randomized complete block design with four replications. After harvest, the traits TCH, TRS, and TTRSH were estimated, enabling evaluation of agro-industrial yield and phenotypic adaptability and stability, as proposed by Eberhart and Russell (1966). Throughout all selection phases of cv. RB07818, cv. RB92579 was used as the commercial standard, and the traits development, stalk number and diameter, flowering, pithiness, Brix content, and pest and disease resistance were evaluated, to select the clones with superiority over the standard.

Maturation of cv. RB07818 in comparison with RB92579 was also assessed at the same experimental sites in Alagoas, in harvest periods from September to March, between December 2015 and February 2021. For performance evaluation and recommendation to growers, data from 51 harvests were collected (18 plant cane, 18 first ratoon, and 15 second ratoon).

To evaluate the juice color of cv. RB07818, samples were collected from different fields of the Santo Antônio Mill during the harvests of 2017. The samples were crushed

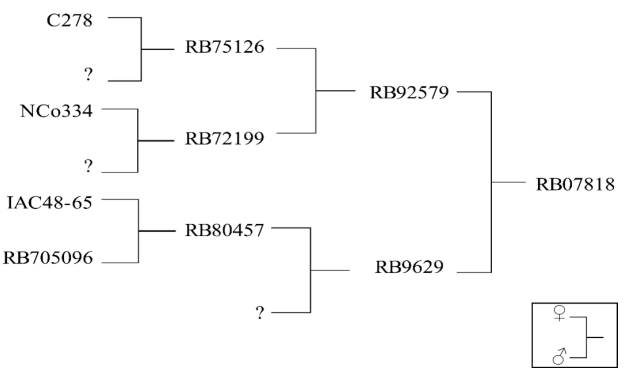

Figure 1. Pedigree of sugarcane cultivar RB07818.

Table 1. Mean values of tons of cane per hectare (TCH) and tons of total recoverable sugar per hectare (TTRSH) for cultivars RB07818 and RB92579, with estimated yield gain of cv. RB07818 over cv. RB92579. Results from 51 sugarcane harvests in Alagoas between December 2015 and January 2021

Crop cycle	TCH				TTRSH			
	RB07818	RB92579	Difference	%	RB07818	RB92579	Difference	%
Plant-cane	141.35	139.45	1.90	1.36	21.60	20.69	0.91	4.40
First-ratoon	109.47	108.29	1.18	1.09	16.59	16.26	0.33	2.03
Second-ratoon	114.04	105.08	8.96*	8.53	17.37	15.92	1.45*	9.11
Mean	122.06	118.35	3.71*	3.13	18.59	17.72	0.87*	4.91

* Significant at 5% by the t-test.

and the juice was extracted by pressing at 250 kgf cm^{-2} for one minute. After filtration, Brix content was measured, and transmittance was determined using high-performance liquid chromatography (wavelength of 420 nm). Juice color was calculated based on the standard ICUMSA unit equation.

Performance

The mean results of agro-industrial yields of 51 harvests in three harvest cycles in experiments conducted in Alagoas from December 2015 to January 2021 highlighted the superiority of cultivar RB07818 over RB92579 across all three cycles (Table 1).

For the characteristics TCH and TTRSH, significant differences were observed in the means of cv. RB07818 compared to RB92579, by the t-test at 5% probability, with percentage gains of 3.13 and 4.91%, respectively (Table 1). The adaptability of cv. RB07818 to different environments, including those with adverse conditions, makes it an ideal option for cultivation expansion into regions as in Alagoas, where irregular rainfall distribution coupled with high evapotranspiration can cause an average water deficit between 286 and 729 mm (Teodoro et al. 2017).

Regarding the maturation curve (Figure 2), it was found that under the environmental conditions of Alagoas, cv. RB07818 produced a higher amount of TRS between September and December than cv. RB92579. During this period, the highest TRS increases of cv. RB07818 compared to RB92579 were recorded in September and November (differences of 6.07 and 8.23 kg per ton of TRS, respectively), suggesting greater sugar accumulation in the early stages of the cycle. This characteristic defines cv. RB07818 as early-maturing, making it ideal for early-season harvests. Its high sugar content from the start of the milling cycle, combined with plant resilience, makes it a suitable choice for producers.

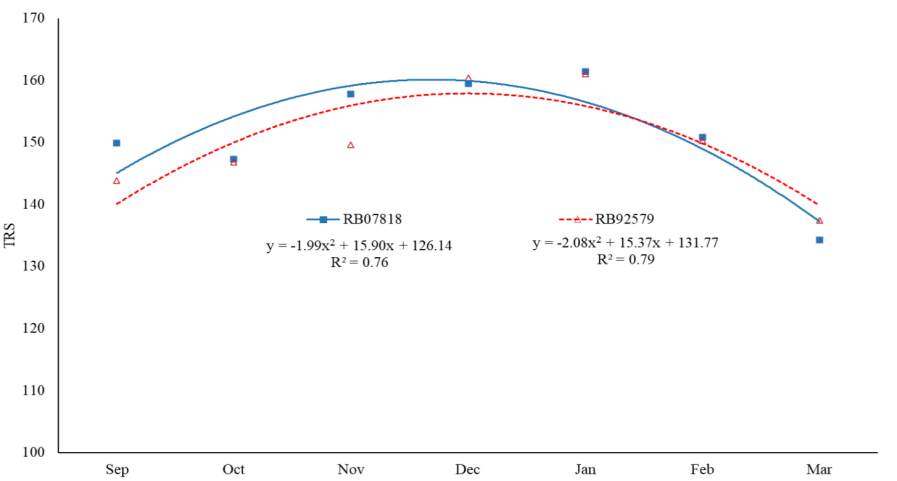

Figure 2. Maturation curves of cultivars RB07818 and RB92579 (standard) for the variable total recoverable sugar (TRS) in kg per ton of cane in Alagoas. Results from sugarcane harvests in Alagoas between December 2015 and January 2021.

Following the methodology of Eberhart and Russell (1966), it was noted that cv. RB07818 exhibited wide adaptability, with a regression coefficient (b) close to unity for both TCH and TTRSH, indicating that the cultivar performs well in different environments. Furthermore, the high determination coefficients (R^2) reinforce the predictability of yield performance of cv. RB07818, emphasizing its stability (Figure 3). According to these authors, cultivars with a regression coefficient (b) near unity and high yields are desirable in breeding programs, in view of their versatility in diverse environments.

The ICUMSA color values were found to be relatively lower for cv. RB07818, for raw as well as decanted juice, than for cv. RB92579, with statistically significant differences by the t-test ($p < 0.01$), indicating reductions of 29.12 and 40.82%, respectively (Figure 4). A lighter juice color requires less treatment to meet sugar quality market standards, which reduces operational costs and increases production efficiency (Azevedo et al. 2019).

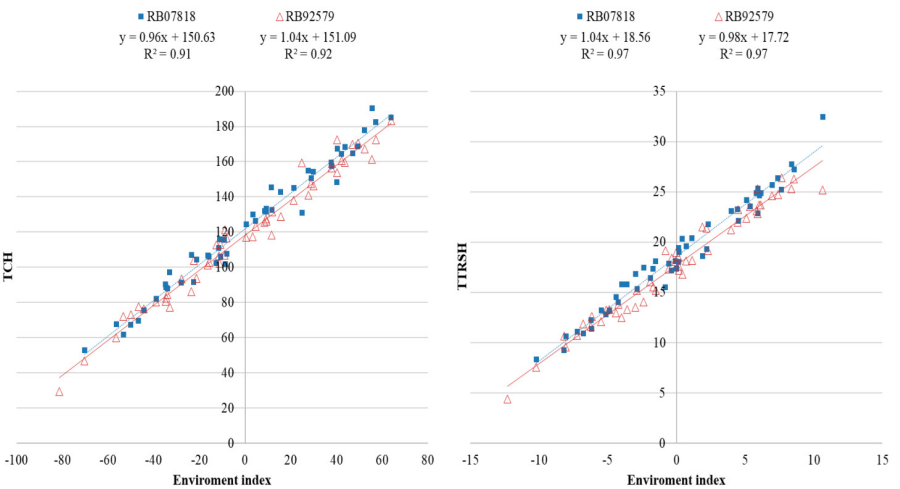

Figure 3. Mean values of tons of cane per hectare (TCH) and tons of total recoverable sugar per hectare (TTRSH) for cultivars RB07818 and RB92579. Linear regression analysis adjusted according to the environmental index, based on 51 harvests in 12 trials conducted in Alagoas between December 2015 and January 2021.

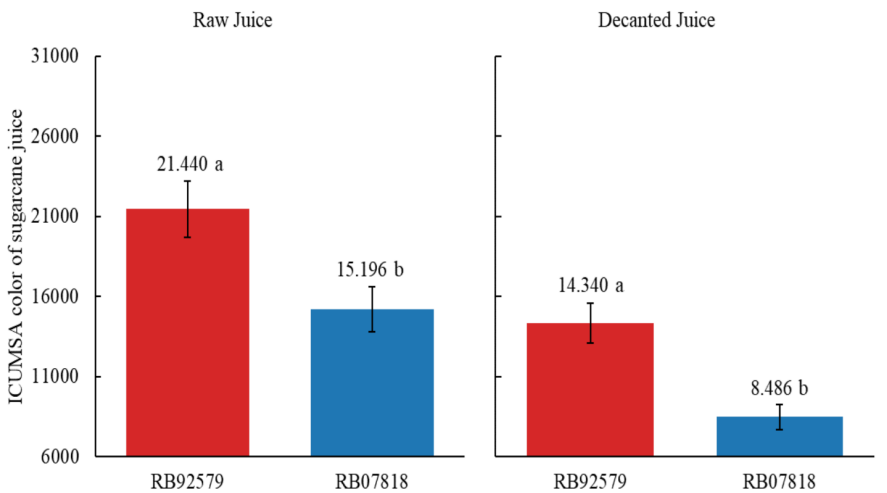

Figure 4. Comparison of ICUMSA color of raw and clarified juice between cultivars RB07818 and RB92579, by the t-test at 1% probability. Mean ICUMSA juice color values followed by the same letter do not differ significantly from each other by the t-test at 1% probability.

These results highlight the superior technological characteristics of cultivar RB07818, particularly in terms of agro-industrial yield and juice quality. These aspects make it preferable for use in industrial processes, for making clear sugar production more efficient and sustainable. Moreover, the findings confirm the success of the breeding strategy adopted by RIDESA/UFAL, which combined reduced juice color with the maintenance of high agro-industrial yield of cv. RB92579.

Other traits

Morphology

Cultivar RB07818 has good sprouting and tillering capacity in both plant cane and ratoon cane; rapid growth rate and effective row closure; rare flowering; a semi-erect growth habit and regular leaf sheath shedding. The canopy is sparse, with a medium green tone; the leaves have curved tips, narrow width, and serrated margins. It has a prominent ligule; lanceolate-shaped auricles of medium size; and the dewlap is green-purple and triangular (with convex upper margin). The sheaths are hairy on the dorsal side and green-purple. The shoot apex (pith) is medium-sized, with an oval cross-section and moderate waxiness. The stalks have spiral internodes, with a circular cross-section, arranged in a slight zigzag pattern, without bud groove. Plant height and stalk diameter are medium, and the stalk surface is smooth. Stalks are yellow-green under the leaf sheath and green-purple when exposed to the sunlight. The growth crack is absent or very shallow, with a moderate amount of waxiness and no signs of stalk lodging. The growth ring is yellowish-green, wide, and prominently raised. The root band is narrow, with no aerial rooting. Root primordia are yellowish-green. The bud is round, slightly protruding, and never exceeds the growth ring. It has a narrow cushion, with hairs at the apex and an apical germ pore.

Disease resistance profile

Cultivar RB07818 has robust disease resistance. It is resistant to brown rust (*Puccinia melanocephala*) and orange rust (*Puccinia kuehnii*), two prevalent fungal diseases affecting sugarcane-producing areas. In addition, it is moderately resistant to smut (*Sporisorium scitamineum*) and tolerant to leaf scald (*Xanthomonas albilineans).* These traits contribute to sustained productivity and high cane quality under natural infection conditions.

Germplasm maintenance and distribution of basic seedlings

RB07818 plants are maintained at the clonal garden of RIDESA/UFAL (BR 104, Norte, km 85, 57100-000, Rio Largo, Alagoas). Annually, seedlings are produced from BASIC PLANT stock registered with RENASEM/MAPA (National Seed and Seedling Registry/Ministry of Agriculture of Brazil). This ensures compliance with official standards for genetic quality and traceability, allowing distribution to producers.

DATA AVAILABILITY

The datasets generated and/or analyzed in this study are available from the corresponding author upon reasonable request.

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