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CULTIVAR RELEASE

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RB975952 – Early maturing sugarcane cultivar

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Abstract – *RB975952 is an early maturing sugarcane cultivar released for the South-Central region of Brazil. It should be harvested between April and May, and it is recommended for planting in environments with medium to high production potential. RB975952 has high resistance levels to the main diseases of the crop, it also has a good shoot development after mechanical harvesting, and high sucrose yields.*

Key words: Saccharum spp.*, selection, improvement.*

INTRODUCTION

The Genetic Improvement Program of the Federal University of Sao Carlos – PMGCA/UFSCar (www.pmgca.ufscar.br) is part of the Inter University Network for the Development of Sugar and Energy Sector – RIDESA (www.ridesa.com.br), a network of 10 public Federal Universities with the purpose to develop improved sugarcane cultivars. PMGCA/UFSCar is responsible for developing RB cultivars for the South-Central region of Brazil, in the states of Sao Paulo and Mato Grosso do Sul. This region has the largest sugarcane area, and the highest sugarcane production in Brazil. The process for release of new cultivars of sugarcane is performed in several locations and crop years (Mattos et al. 2013). The development of cultivars with an early maturity cycle is one of the main objectives of PMGCA/UFSCar.

BREEDING PROGRAM

RB975952 cultivar was obtained from a biparental cross between RB835486 and RB825548 (Figure 1). The cross was carried out at the sugarcane flowering and crossing station Serra do Ouro, *in Murici, state of Alagoas* (lat 09° 18' S, long 35° 56' W, alt 450 m asl). The obtained seeds were germinated and then planted in the field, establishing the first selection stage (T1). At this stage, clones from a single clump were selected by mass selection in the first sugarcane ratoon cycle (Breaux et al. 1963), based on criteria of important industrial and morphological characteristics, such as brix and stalk number (Hogarth 1987, Berding et al. 2004), flowering, pithiness and resistance to the main diseases (Matsuoka et al. 1999). Clones were compared to standard commercial varieties with early and medium/late maturity.

Clones selected in T1 with brix equal to or higher than early-maturing standard varieties constituted the second selection stage (T2), together with early-maturing standard varieties. In this stage, clones were established in Araras (lat 22° 21' S, long 47° 23' W, alt 620 m asl) and Valparaiso (lat 21° 13' S, long 50° 52' W, alt 450 m asl), state of Sao Paulo, in an augmented block design (Federer 1956). Plots

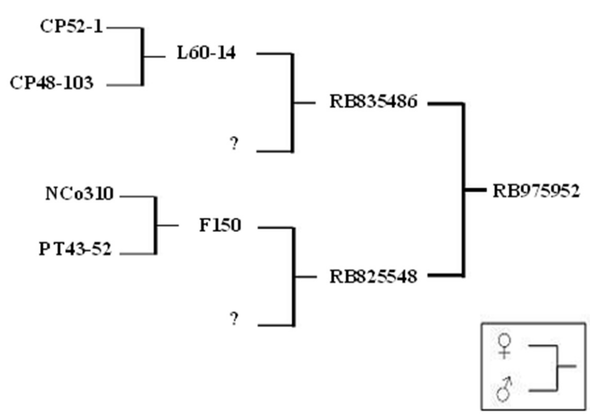

Figure 1. Pedigree of RB975952 sugarcane cultivar.

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consisted of a 7-m row with no replication. Clones were evaluated in plant-cane, and in first and second ratoon cycles, based on the same criteria as in stage T1, together with the parameters stalk weight per plot and kilogram of brix per plot – KBP (Kang et al. 1983). The third selection stage (T3) and final experimental stage of selection (FE) were carried out according to Carneiro et al. (2011). The variables evaluated were cane yield (TCH), sucrose content (PC in %), tons of pol per hectare (TPH - sucrose yield), and fiber content (%). The coefficient of environmental variation, the effects of genotype-environment interaction, and clone adaptability and stability were estimated by individual (of each location) and combined analysis of variance (of all locations) (Steel and Torrie 1960). The maturation curve of the FE promising clones was evaluated to identify the best harvest time in terms of PC% level. The best-performing genotypes were multiplied and evaluated in the partnership units to observe the performance under production conditions (Barbosa et al. 2001, Barbosa et al. 2004, Melo et al. 2014).

PERFORMANCE

RB975952

The growth habit of this cultivar is slightly decumbent, and leaves (trash) can be easily removed; it has good canopy cover and excellent ratoon regrowth from green and burnt sugarcane, sparing an early replanting of sugarcane fields. Tillering capacity in both plant and ratoon cane is good. RB975952 has medium fiber content, early maturation, rare flowering and low pithiness. In the South-Central region, RB975952 is indicated for harvesting between April and May (Figure 2). The constant sucrose content of this variety allows harvesting until mid-June. TCH of RB975952 in unfavorable environments is higher than that of RB855453, and yields are more stable under favorable conditions (Figure 3). For commercial production, RB975952 is recommended for planting in environments of medium to high fertility. The high agricultural productivity (TCH above 114.9 t ha^{-1}) and sucrose content of about 14.5% of RB975952 indicate an equivalent or higher TPH than of the early-maturing commercial standard varieties (Figure 3). Experiments were carried out at 13 different locations in São Paulo state during three harvests.

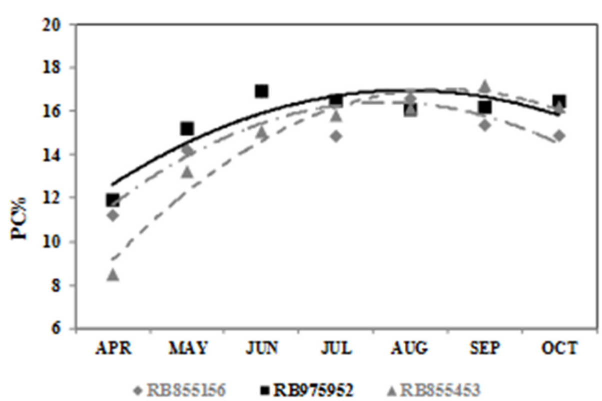

Figure 2. Maturation curve of RB975952 cultivar, compared to RB855156 and RB855453 standard commercial cultivars, for sucrose content (%) in cane.

OTHER FEATURES

Disease reaction

RB975952 was subjected to natural disease infection and artificial inoculation tests, along with other genotypes. These tests are carried out to verify the reaction of varieties and clones regarding the major diseases of sugarcane in the South-Central region of Brazil (Table 1). Tests were carried out in regions with high inoculum pressure, favorable to

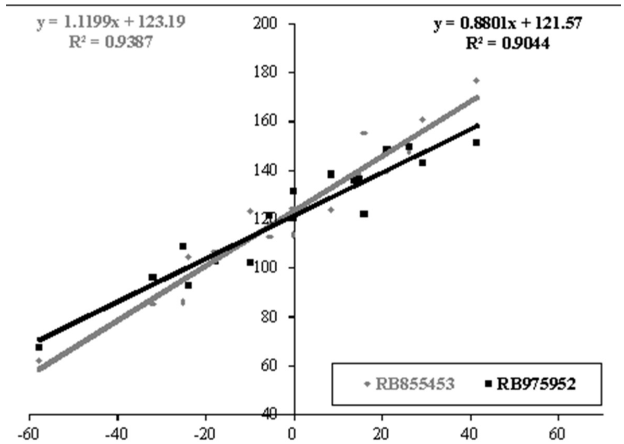

Figure 3. Adaptability and stability of RB975952 cultivar, compared to RB855453 standard commercial cultivar. The average data of sugar yield (TCH) in 17 field trials in first ratoon cane cycle were adjusted based on regression analysis.

Table 1. Disease reactions and presence (+) or absence (-) of the *Bru*1 gene in RB975952 and RB855453 sugarcane cultivars, in South-Central of Brazil

Disease	Cultivar RB975952	Cultivar RB855453
Smut	R	R
Brown rust	R	R
Bru1	+	+
Orange rust	R	R
Mosaic	R	R
Leaf Scald	R	R

R= resistant
+ = presence of Bru1 molecular marker

natural infection of various diseases, such as brown rust (*Puccinia melanocephala*), orange rust (*P. kuehnii*), smut (*Sporisorium scitamineum*), mosaic (Sugarcane Mosaic Virus - SCMV), and leaf scald (*Xanthomonas albilineans*). RB975952, as the others, was evaluated based on the number of infected tillers (infection %) for smut, mosaic and leaf scald, and based on the leaf area with symptoms for brown rust and orange rust (Amorim et al. 1987, Klosowski et al. 2013). Taking into account the presence of the *Bru1* gene, and the lack of naturally infected plants (rating = 0), RB975952 was determined to be resistant to brown rust.

In the greenhouse artificial test, RB975952 plants were inoculated with the causal agents of smut and mosaic, according to the methods described by Matsuoka (1979). Cultivars were evaluated based on a rating scale for each disease, where the number of infected tillers is counted (% infection), and the genotypes are classified as resistant, intermediate and susceptible. Based on natural infection and artificial inoculation tests, RB975952 was considered resistant to brown rust, orange rust, smut, mosaic and leaf scald.

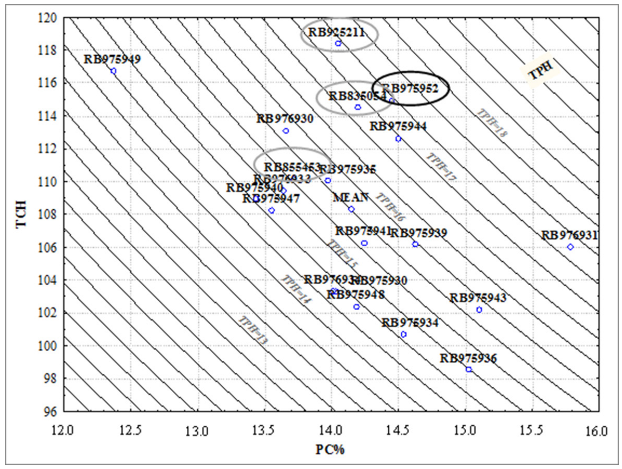

Figure 4. Isoquants of average data of sucrose content (PC%), and cane yield (TCH) in 13 field trials and three cycles in different production environments. The diagram shows RB975952 cultivar (black circle) for comparison with standard commercial cultivars (gray circles) and clones.

Characterization by microsatellite genotyping and Bru1 marker

SSR markers used to molecular fingerprints of RB975952 were generated with a panel of 383 microsatellite markers derived from sugarcane expressed sequence tags (EST-SSRs), developed by Oliveira et al. (2009) and Marconi et al. (2011), and were compared with those of eight other cultivars (RB925211, RB835054, RB855453, SP91-1049, RB835486, RB855156, RB825548 and RB966928). The 27 EST-SSR loci amplifications revealed high levels of polymorphism among the nine sugarcane genotypes, and detected 360 alleles polymorphic, with a range of 5 (ESTC19) to 23 (ESTB 432), and sizes ranging from 142 to 278 base pairs (bp). The Polymorphic Information Content (PIC) value was calculated by Pinto et al. (2004) and had an average value of 0.84, ranging from 0.92 (ESTB 423) to 0.50 (ESTB99). The information of discriminatory power (DP) was calculated based on Tessier et al. (1999), and ranged from 1 and 0.89, with an average value of 0.99. Polymorphic bands were used to construct a binary matrix to evaluate the genetic similarity among all the genotypes (Santos et al. 2014). The EST-SSR-based genetic similarity (SSR-GS) among all of the genotypes was estimated according to the Simple Matching similarity coefficient. The corresponding genetic similarity matrix was used to generate a dendrogram based on the Unweighted Pair Group Method with the Arithmetic Average

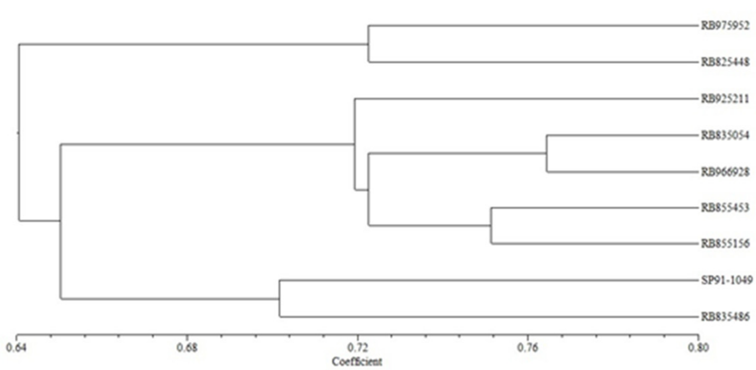

Figure 5. Dendrogram of nine sugarcane cultivars revealed by UPGMA cluster analysis of SSR genetic similarity (Simple Matching's coefficient) estimates, using 360 SSR polymorphic bands obtained by 27 primer combinations.

(UPGMA) algorithm (Figure 5). All analyses were carried out using NTSYSpc 2.11X (Rohlf 2000). Results indicate that the genetic similarities based on the Simple Matching coefficient varied from 0.58 to 0.76 with RB966928 and RB835054, meaning that these cultivars were genetically closer to each other than to the others.

BASIC SEED MAINTENANCE AND DISTRIBUTION

RB975952 has been produced by PMGCA/UFSCar and is available for research purposes at the Agricultural Science Center (CCA/UFSCar), in Araras, state of Sao Paulo, where it will be maintained for at least five years from the date of publication.

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