







UENF Red: Agronomic potential and advantages of the new guava cultivar

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Abstract: *The UENF Red guava cultivar was developed for the climate of northern Rio de Janeiro. Selected from 17 full-sib families, it showed superior yield and fruit quality compared to Paluma. Distinct morphological traits highlight its potential as a productive, high-quality alternative for regional guava cultivation.*

Keywords: *Productivity, yield, regional agriculture*

INTRODUCTION

Guava (*Psidium guajava* L.) is a tropical fruit tree native to the Americas and widely cultivated in tropical and subtropical regions. In Brazil, it has great economic importance, being consumed fresh or processed into various products. The country is one of the world's main producers, with major cultivation in São Paulo, Pernambuco, and Bahia (IBGE 2019).


Currently, 14 cultivars are registered in Brazil (MAPA 2024), such as 'Paluma', 'Pedro Sato', and 'Cortibel', which differ in fruit quality, pulp color, and disease resistance. Breeding programs focus on improving yield, fruit quality, and tolerance to biotic and abiotic stresses, combining traditional methods with molecular tools (Pommer et al. 2013).

Despite the cultivars already available on the market, none of them are suitable for the northern region of Rio de Janeiro, which has a strong culture of producing guava, which is sold mainly in the form of guava jam. The development of cultivars adapted to the region is crucial for the sustainable and competitive production of guava. This study focuses on the northern and northwestern regions of Rio de Janeiro, aiming to support local genetic improvement efforts and benefit producers.

CULTIVAR DEVELOPMENT

The guava breeding program at the State University of Northern Rio de Janeiro (UENF) began in 2008 to meet the needs of local producers and take advantage of the region's agricultural potential. In the initial phase, Pessanha et al. (2011) evaluated 20 *Psidium guajava* accessions from open-pollinated orchards in São

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João da Barra and Bom Jesus do Itabapoana, RJ. Using cytogenetic and RAPD analyses, superior genotypes were identified for hybridization, leading to crosses among nine selected individuals (Table 1), which generated 17 full-sib families. These families were evaluated from 2011 to 2016 in Campos dos Goytacazes (lat 21° 43' 15.5" S, long 41° 20' 38.3" W), in northwestern Rio de Janeiro (Oliveira et al. 2014, Paiva et al. 2016, Campos et al. 2016, Quintal et al. 2017, Silva et al. 2020, Silva et al. 2021). Figure 1 shows a schematic of the UENF guava breeding program.

The UENF Red cultivar, derived from this program, also served as a base for developing new guava lines with nematode resistance genes and other desirable traits (Ribeiro et al. 2019, Maitan et al. 2023, Souza et al. 2020, Santos et al. 2020, Krause et al. 2021, Ambrósio et al. 2021, Almeida et al. 2023).

The experiments followed a randomized block design with two replicates and 24 individuals per family (12 per block), totaling 408 plants. Standard management practices were applied for weed, pest, and disease control, and drip irrigation was used during dry periods.

Selection of superior individuals was based on fruit traits using the Best Linear Unbiased Prediction (BLUP) method, focusing mainly on the number of fruits and yield. The nine best genotypes were cloned and evaluated in the Value for Cultivation and Use (VCU) test in Campos dos Goytacazes, using 'Paluma' as a control cultivar.

Table 1. Characteristics of the selected guava accessions for crosses carried out at Sítio Providência, Bom Jesus do Itabapoana, RJ, Brazil

Selected accession	Accession characteristics
1 - UENF 1830	Single-bunch fruit, grafted (Paluma)
2 - UENF 1831	Earl-cycle, grafted
3 - UENF 1832	Late-cycle, wrinkled leaf, staked. Exhibits some resistance to rust
4 - UENF 1833	Large, pear-shaped fruits; horizontal growth
5 - UENF 1834	Uniform ripening (simultaneous)
6 - UENF 1835	Thin leaf, uneven size (pruning)
7 - UENF 1836	Horizontal growth
8 - UENF 1837	Cortibel ES; very late-cycle
9 - UENF 1839	White guava; ungrafted (via seeds)

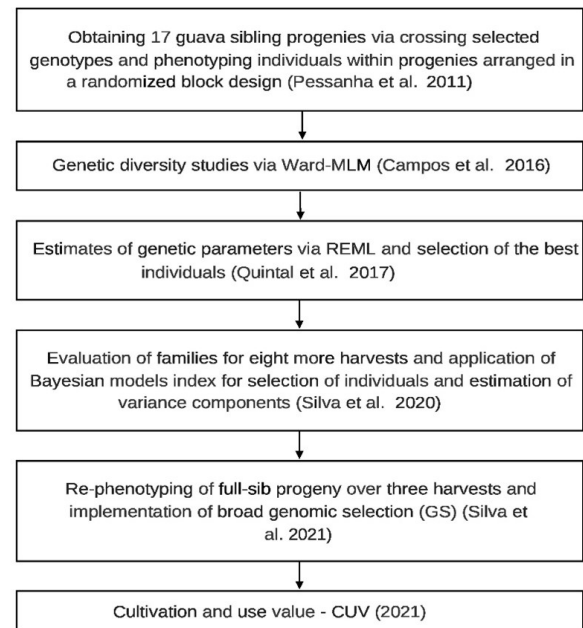


Figure 1. Flowchart of the UENF Red cultivar breeding program.

Table 2. Morphological descriptors of the plant, branches, and leaves of the UENF Red cultivar

Traits	UENF Red
Plant: growth habit	Open
Young branch: color	Yellowish green
Young leaves: anthocyanin coloration	Present
Young leaves: intensity of anthocyanin coloration	Weak
Young leaves: pubescence on the underside	Sparse
Branch: thickness	Medium
Leaf blade: length	Long
Leaf blade: width	Medium
Leaf blade: length/width ratio	Medium
Leaf blade: shape	Oval
Leaf blade: shape of the base	Cordate
Leaf blade: shape of the apex	Apiculate
Leaf blade: color	Yellowish green
Leaf blade: variegation	Absent
Leaf blade: color of the central vein on the underside	Light yellow
Leaf blade: twisting	Absent
Leaf blade: curvature of the central vein	Absent
Leaf blade: curvature in cross-section	Weak
Leaf blade: spacing between secondary veins	Medium
Leaf blade: texture on the upper surface	Smooth
Leaf blade: pubescence on the underside	Sparse
Leaf blade: margin waviness	Present
Leaf blade: intensity of margin waviness	Weak

VCU

The experiment was conducted in the experimental area of the Guava Genetic Improvement Program at UENF, located at the Antônio Sarlo Technical and Agricultural School, in Campos dos Goytacazes, Rio de Janeiro, Brazil (coordinates: lat 21° 44' S, long 41° 33' W, alt 11.2 m asl). The experimental design used was randomized blocks. The treatments consisted of seven individuals selected in the second selection cycle of the program, plus the commercial cultivar 'Paluma' as a control. The experiment had seven replications and three plants per plot, totaling 168 plants. The spacing adopted was 2 x 4 meters.

Orchard management followed the recommended practices for the crop: irrigation was carried out by drip irrigation and fertilization was carried out according to the nutritional needs of the plants. Phenotypic evaluations began two years after planting, covering the 2021, 2022, and 2023 growing seasons, with data collected at the individual plant level.

Cultivar traits

The UENF Red cultivar was evaluated according to the agronomic and morphological descriptors proposed by the National Plant Variety Protection Service (SNPC/MAPA). The characterization included plant architecture, leaf and branch morphology, flower and fruit structure, and seed and maturation traits.

Fruit traits such as size, shape, peel and pulp color, juiciness, sweetness, acidity, and number of seeds were also measured. For each trait, data were obtained from the average of five fruits per plant (Table 2).

These descriptors are essential for identifying and differentiating cultivars, providing a detailed profile of UENF Red. This information supports proper management, facilitates cultivar registration, and contributes to the development of new varieties with desirable agronomic characteristics.

Performance

The UENF Red cultivar outperformed the Paluma cultivar in the three main traits (Table 3). In the first harvest, UENF Red produced an average of 14 fruits per plant, compared to 11 by the Paluma cultivar. This increase was directly reflected in the production per plant, where UENF Red achieved an average production of 3,777.78 g per plant, in contrast to 2,127.32 g per plant for 'Paluma'. The average weight of the fruits

Table 3. Analysis of variance for fruit yield of UENF Red and Paluma cultivars

Sources of variation	df	SS	MS	F	p-value
Cultivars	1	47600833	47600833	6.2948	0.03097*
Residuals	10	75618905	7561891		

Table 4. Mean values of number of fruits, production per plant (g) and fruit weight (g) of the UENF Red cultivar and a commercial control, in the first two harvests in the state of Rio de Janeiro, Brazil

Traits	UENF Red	Paluma
	First harvest	
Fruit number	14	11
Production per plant	3777.78	2127.32
Fruit weight	300.04	292.02
Second harvest		
Fruit number	28	19
Production per plant	7598.57	4538.11
Fruit weight	289.84	269.31

Table 5. Morphological descriptors of flowers and stems of the UENF Red cultivar

Morphological descriptors	
Inflorescence: predominant number of flowers	One to three
Flower: size	Medium
Flower: number of fully developed petals	Medium
Flower: staminoid petals	Absent
Flower: number of staminoid petals	Medium
Fruit: length	Medium
Fruit: width	Medium
Fruit: length/width ratio	Medium
Fruit: shape at the peduncle end	Rounded
Fruit: peel color	Light yellow
Fruit: surface texture	Wrinkled
Fruit: longitudinal grooves	Absent
Fruit: sepal size	Medium
Fruit: diameter of the calyx cavity relative to fruit diameter	Medium
Fruit: ridged collar around the calyx cavity	Conspicuous
Fruit: peduncle length	Short
Fruit: pulp color	Pink
Fruit: uniformity of pulp color	Uniform
Fruit: pulp discoloration after cutting	Absent
Fruit: outer pulp granulation	Absent
Fruit: outer pulp thickness relative to core diameter	Medium
Fruit: hollow (space between the outer pulp and the core)	Absent
Fruit: juiciness	High
Fruit: acidity	Medium
Fruit: sweetness	Medium
Fruit: number of seeds	Medium
Seed: size	Medium
Cycle from flowering to fruit ripening	Medium

was also slightly higher in UENF Red, equal to 300.04 g, compared to 292.02 g for 'Paluma' (Table 4).

In the second harvest, both cultivars showed a significant increase in the number of fruits, with UENF Red maintaining its superiority. This indicates that UENF Red has superior agronomic performance compared to the commercial cultivar Paluma in terms of the number of fruits, production per plant, and fruit weight. This consistent performance across two harvests suggests that UENF Red is a promising option for producers in the Rio de Janeiro state region, offering greater productivity and yield potential.

Other traits

The following table presents the morphological descriptors of flowers and fruits of the UENF Red cultivar, offering a comprehensive overview of the important phenotypic traits specific to this cultivar (Table 5).

Figure 2 displays various characteristics of the cultivar, as the distinctive morphological traits, and illustrate the seasonal variations. This photo board is essential for understanding the diversity and adaptations of the species in their natural habitat.

The morphological descriptors listed for the flowers and fruits of the UENF Red cultivar reveal characteristics that are advantageous for cultivation and commercial sale. The combination of high juiciness, balanced acidity and sweetness, along with pulp that maintains a stable color, makes this cultivar an appealing option for producers.

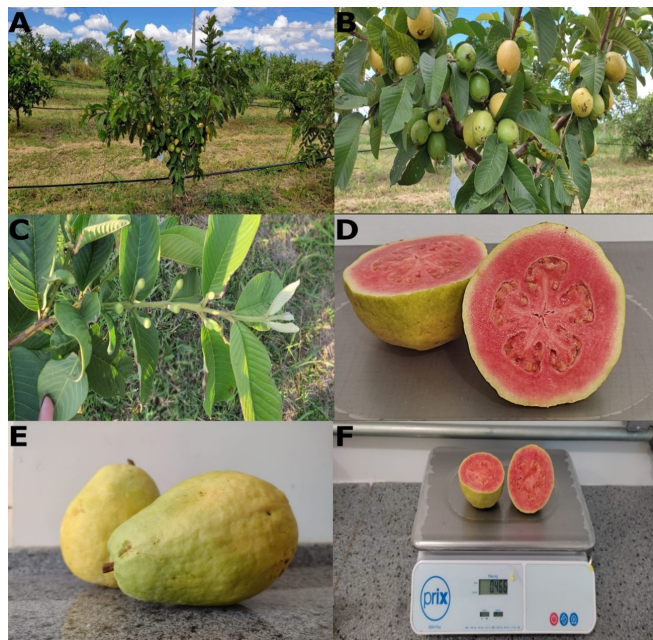


Figure 2. Different characteristics of the cultivar as a plant, fruit, and flowering. A - Vegetative structure; B - Fruit formation; C - Flower bud; D - Fruit pulp color; E - Fruit shape; F - Fruit weight.

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DATA AVAILABILITY

The datasets generated and/or analyzed during the current research are available from the corresponding author upon reasonable request.

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