

Quinba R-TC: new variety of Jamaica creole type of high yield

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Abstract

Jamaican growers sow creole genotypes that are harvested in December with low yields averaging 250 to 300 kg ha⁻¹ in association with corn and 500 to 600 kg ha⁻¹ in a single crop. With the purpose of expanding the supply of genotypes, increasing yields and reducing imports, the improved Quinba R-TC variety is offered, which preserves the color, flavor and flowering date of the regional creole and the size of the calyx was improved, therefore it is an option to increase the yields and profitability of this crop in almost 20 thousand hectares that are planted nationwide. Quinba R-TC, is the product of the cross between plants of Jamaica type Sudan (JTS) collected and selected in 2008 from a lot established in the Jamaica producing area of the State of Guerrero and plants from the Tecoanapa variety known as regional creole (CR). With F2, individual selection was started, purifying in each cycle. The purified line was obtained in F7 and in 2013 its evaluation and characterization began. The basic selection descriptors were: uniformity of the plant, size and intense red color of the calyx and yield, the result was a plant with seven days earlier, those with calyxes similar in color to the regional creole and with 70% larger and of minimal pubescence. The average yields were 80% higher than the reference variety; therefore, it is possible to increase production from 4 500 to 8 000 t year⁻¹.

Keywords: *Hibiscus sabdariffa* L., calyx size, improved genotype.

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Jamaica (*Hibiscus sabdariffa* L.) belongs to the Malvaceae family, it is sensitive to the photoperiod, it requires long days for its growth and vegetative development and short days for flower initiation. The jamaica plant is autogamous; however it presents a certain percentage of cross pollination. This percentage ranges from 0.2 to 0.6%, which depends on the variety (Vaidya, 2000).

It is a tetraploid plant and contains 72 chromosomes, it is adaptable to adverse drought conditions (Nnbue *et al.*, 2014), it presents greater genetic segregation and it requires more time to fix its phenotypic characteristics (Wilson, 1994). *Hibiscus sabdariffa* L., is an herbal species that stands out for its nutraceutical properties, since its consumption lowers cholesterol and lowers blood pressure (Ramírez *et al.*, 2011). In Latin America it is used as food and source of dietary fiber (Da Costa *et al.*, 2014). It is generally cultivated in marginal soils of low fertility and with little moisture retention.

Its social importance lies in the fact that the crop is cared for by low-income producers who carry out manual harvesting, which favors occupation but causes increases in production costs. In Mexico, just over 19 thousand hectares of Jamaica are harvested with an average yield of 370 kg ha⁻¹ (SIAP, 2018). In the states of Guerrero and Oaxaca, 84% of the harvested area is cultivated and 76% of the national production is obtained (SIAP, 2018). Currently, more than 98% of the production comes from native varieties, which due to their photoperiod sensitivity are sown only in the spring-summer (S-S) agricultural cycle (Futules *et al.*, 2010).

In the state of Guerrero, creole varieties have average dry calyx yields of 250 to 300 kg ha⁻¹ under planting conditions associated with corn and from 500 to 600 kg ha⁻¹ in unicultural (Barrios *et al.*, 2017). In recent years, producers and marketers of Jamaica mention that due to disease problems and low yields, national production is insufficient and around 50% of Jamaica consumed in Mexico is imported (SIAP, 2018).

Until a few years ago, the acceptance of Mexican jamaica cultivated in Guerrero was greater in international markets and in its internal trade, but its competitiveness has declined rapidly. One of the factors that have contributed to the decline was that from the 1990s, producers in Asia and Africa began to improve the quality of their calyces and significantly lowered their prices.

Despite the fact that the jamaica produced in Guerrero is considered of quality for the local and national markets, the characteristics of color, flavor and size imposed by the international market, generate the need for alternative yielding varieties, of quality and low cost of production, to offer a competitive product in the market.

Origin

Starting in 1998, the National Institute for Agricultural and Livestock Forest Research (INIFAP) promoted external projects aimed at developing high-yielding varieties of dry calyx jamaica for regions with high productive potential for this species in the Mexican Republic. The project began with the introduction of national and international germplasm, to identify useful parents as a source of yield genes and tolerance to 'pata prieta' (*Phytophthora parasitica*).

These donors of yield and tolerance were crossed with creole varieties, of high demand among producers, marketers and consumers, low yielding and susceptible to the mentioned diseases. To generate the Quinba R-TC variety, the genealogical method (pedigree) consisting of hybridization and selection was used. The Giant line, with a large calyx and dark purple color, was used as the donor parent of the yield genes. This line came a selection made in a variety of Jamaica Sudan creolized type, collected in the Costa de Guerrero in 1998.

As a tolerant parent to 'pata prieta' (*Phytophthora parasitica*), the creole variety registered under the name of Tecoanapa (Figure 1) (Ariza *et al.*, 2014) was used, which has demand in the local and national market, but with the disadvantage of having a small calyx and poor yield (Barrios *et al.*, 2016). The hybridizations to obtain the simple cross were carried out in the years 2003 and 2004 and from 2004 to 2008 the generational advance was carried out and individual selections were made in the segregating populations, each selection was massively reproduced to eliminate the out-of-type plants.



Figure 1. Comparison of plants and fruits of the Jamaican varieties Quinba RTC and Tecoanapa (creole from Guerrero) in physiological maturity.

Jamaica plants planted in potential areas are highly sensitive to photoperiod, which is why all the work was done in the S-S cycles (July to December) in the INIFAP Experimental Fields of Iguala and the Higher Agricultural College of the Estado de Guerrero (CSAEGRO).

Adaptation and yield

The uniform line named Sel-22 that gave rise to the Quinba R-TC variety, was obtained in 2007. The first evaluations of the line for adaptation and yield were made in the mentioned experimental fields; as of 2011, they were made in producer fields, due to their good agronomic behavior and similar to the creole, it was named 'improved creole'. The line was evaluated in a regional yield trial in 2011 and 2012 along with other high yield materials of different types, colors, plant and calyx sizes (Table 1).

Table 1. Comparison of three varieties of Jamaica according to agronomic variables and dry calyx yield, evaluated in locations in the state of Guerrero. Sowing date 03 July 2016.

Genotype	FF	AP (m)	NR	NF	TC	Tol	CC	CE 2016 (kg ha ⁻¹)	4 loc. (kg ha ⁻¹)
Quinba R-TC	01-nov	1.56	20	50	Large	+	Intense red	1 310	1 100
Tecoanapa (selection of creole from Guerrero) (T)	03-nov	1.49	25	78	Small	+	Intense red	714	700
Creole from Guerrero (T)	03-nov	1.45	23	78	Small	-	Intense red	699	700

FF= flowering date; AP= plant height; NR= number of branches; NF= number of fruits (calyxes); TC= calyx size; Tol= + tolerant= - susceptible, to *Phytophthora parasitica*; CC= calyx color; CE2013= yield in the Iguala Experimental Field; average yield of four localities, years or environments; T= control variety.

The variety develops under the same conditions as the creole, preferably with average temperatures ranging from 25 to 38 °C with a rain regime of 900 to 1 400 mm per year, it also tolerates little precipitation (between 600 and 900 mm) and average temperatures below and above the recommended, due to its rusticity, it adapts to a wide variety of soils, since it is an undemanding crop, but it is more productive in deep soils where it can freely develop its root system.

During its vegetative development, sandy loam soils, hot and dry climates, low humidity and a lot of sunlight are preferred it does not tolerate waterlogged soils. Under the optimal conditions described, the Quinba R-TC variety can double its yield (Barrios *et al.*, 2016; 2017).

Plant characteristics

The plants of the Quinba R-TC variety are tall (Figure 2), of a late biological cycle (they bloom from November), they are tolerant to ‘pata prieta’ (*Phytophthora parasitica*) and with a larger calyx but with a color similar to of the Tecoanapa (creole) variety, which gives it preference in the market (Figure 3). Under storm conditions in the coastal regions of the Mexican Pacific, the Quinba RTC variety should be sown preferably at the beginning of the storm and until July 15, since as it is a variety that responds to the photoperiod, the longer it lasts in the field, the more the plant grows, which favors higher yields (Barrios *et al.*, 2017). The characterization of the line was made, based on the descriptors proposed in the guide published by SAGARPA-SNICS (2014) for this species.

In 2016, the National Seed Inspection and Certification Service (SNICS) was requested to register a new variety of Jamaica, granted under number 3572-JAM-006-010218/C and the official name of Quinba R-TC, derived from the cross from the Gigante x Tecoanapa lines (creole from Guerrero). In the Iguala de Guerrero Experimental Field, basic seed of this new variety is available.



Figure 2. Jamaica: Quinba R-TC variety.



Figure 3. Plant of the improved variety Quinba R-TC(a) and branches with calyxes of the regional creole (b) compared to Quinba R-TC and others.

Conclusions

A new highly productive variety of jamaica was generated, which exceeded the yield of the control variety by 80%, the attributes of the new variety are: growing four days earlier, calyx color similar to the regional creole and calyx 70% larger and with little pubescence.

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