‘LeahReese’: A New Sugar Apple (*Annona squamosa* L.) Cultivar

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Sugar apple is a member of the Annonaceae, indigenous to the Caribbean Islands and lowlands of Central America (Cordeiro, 2000; Pinto et al., 2005). The fruit is grown on a small scale throughout tropical and warm subtropical areas of the world. Major producers include India, Brazil, and the Philippines. Florida has a small (≈ 13 ha) but expanding sugar apple industry (Crane, 2018). ‘LeahReese’ was a chance seedling evaluated and selected at the University of Florida, IFAS, Tropical Research and Education Center, Homestead, FL. The fruit has excellent physical and chemical characteristics, and is well adapted to South Florida’s edaphoclimatic conditions. Hand-pollinated fruit are large and symmetric. ‘LeahReese’ has excellent flavor and a very low fiber content.

Origin

‘LeahReese’ was selected from a seedling population at the University of Florida, Tropical Research and Education Center during 2011. The cultivar was obtained from mass selection from progenies of half siblings. After selection, the cultivar was grafted onto sugar apple seedling rootstocks (*Annona squamosa* L.) by the full-slit method and evaluated under the edaphoclimatic conditions of Miami-Dade County (lat. 25°30′40.809″N, long. 80°30′3.983″W) (Fig. 1). The 0.15-ha ‘LeahReese’ orchard is 3.8 m above sea level, with a limestone-based crushed rock soil (Krome very gravelly loam; loamy skeletal, carbonatic, hyperthermic Lithic Udorthents) (Ali et al., 2000; Noble et al., 1996). The climate is characterized as marine subtropical with a mean annual temperature of 23.7°C, a mean annual maximum of 28.9°C, a mean

annual minimum of 18.6°C, and 1512 mm of annual rainfall (National Weather Service Forecast Office, 2018). Daylength ranges from 10 h 33 min to 13 h 43 min, with an annual average of 249 d with sun. Trees were planted in 2012 and spaced 6.1 m in row by 4.6 m between rows. Sugar apple trees are deciduous and, in South Florida, the rate of leaf abscission increases during cool fall and winter weather and disease pressure. Four years after planting, the trees were pruned annually at new shoot emergence each March. Pruning consisted of removing dead shoots, one-half to two-thirds of all long shoots, removal of all small (<1 m) lateral shoots, and selective removal of crossed and upright limbs. From 2016 to 2018, trees were fertilized annually with 8–3–9 (four 1.8-kg applications) and 0–0–22 (two to three 1.4- to 1.8-kg applications) of Rainbow[®], five to seven foliar minor element sprays of KeyPlex350[®], and three soil drenches of Sequestrene 138[®] iron. The orchard was irrigated with a high-volume overhead system (≈ 6.4 mm/h) one to two times per week from flowering to the end of the harvest period. Pest control included periodic applications of Pyganic[®] to control the *Annona* seed borer (*Braephlaeloides cubense*), and Abound[®] (azoxystrobin) and Manzate Pro-Stik[™] (mancozeb) to prevent various forms of fruit rot.

Sugar apples are aggregate fruit and the flowers are hermaphroditic, apocarpous, and exhibit a protogynous flowering system (Gottberger, 2012; Kishore et al., 2012). The numerous and centrally located carpels are subtended by numerous stamens. In Florida, natural pollination is affected by nitidulid beetles and results in 0% to 10% fruit set (Nadel and Peña, 1994). This is a result of the highly variable and unreliable nitidulid population during the flowering period (Costa et al., 2017; Jenkins et al., 2015). Without hand-pollination, fruit set of ‘LeahReese’ is usually less than 0.1% (Crane, 2018). Furthermore, incomplete pollination results in asymmetric tuberculate fruit, which is of limited marketability (Lau et al., 2017; Moura

et al., 2019). Therefore, during the late-April-through-June flowering period in 2017 and 2018, ‘LeahReese’ flowers were hand-pollinated during the morning. Hand-pollination resulted in 98% fruit set and symmetric fruit.

Description

Tree size is medium, ≈ 2.5 m in height by ≈ 2.5 m in diameter, with a globose canopy at 4 years (Fig. 1). Leaves are deciduous, green, and lanceolate; acute at the base and acuminate at the apex; and 5 to 17 cm in length and 3 to 7 cm in width, with an acuminate apex. Flowers are green and emerge on new growth from 1- to 3-year-old wood and are held singly or in clusters of two to three. In general, one flower is larger and more vigorous than the others; small flowers rarely set commercially viable fruit. Flowers are green, 1.0 to 3.0 cm in length, and have three sepals above three fleshy petals. During the early to late morning, the gynoecia are viable and may be recognized by the slightly open petals and sticky secretion atop the stigmatic surfaces (Kishore et al., 2012; Lau et al., 2017; Nadel and Peña, 1994). By early morning on day 2, the numerous stamens dehisce pollen and may be recognized by the fully reflexed petals. In general, by day 2, the stigmatic surfaces have dried and are no longer viable. Subsequently, the nonpollinated flowers abscise whereas the petals and anthers abscise in pollinated flowers.

Forty mature ‘LeahReese’ fruit were harvested from 2017 and 2018 and held at room temperature ($\approx 25^\circ\text{C}$ and $\approx 45\%$ relative humidity) until ripe. Hand-pollinated ‘LeahReese’ fruit are symmetric and broadly cordate, with a mean longitudinal diameter of 119.52 mm and an equatorial diameter of 116.21 mm (Table 1). The peel is mamillated (pronounced protrusions). Mean fruit mass was 638.73 g, peel mass was 282.14 g, and seed mass was 39.30 g, with a mean of 90 seeds. Compared with other sugar apples, ‘LeahReese’ is generally larger (Crane et al., 2016; Moura et al., 2019, 2021; Neto et al., 2010; Pinto et al., 2005; Silva et al., 2007). The fruit has a mean of 50.43% pulp, 25.48°Brix, a pH of 5.01, an acidity of 0.228 g citric acid/40 g of pulp, and a °Brix-to-acid ratio of 119.04 (Table 1). At maturity, the peel is light green, with the individual areoles slightly separated and faintly outlined in yellow-white. As the fruit ripens, the areoles continued to separate and the pulp softens (Fig. 1). The pulp is creamy white, with almost no sclereids (stone cells), and it contrasts with the brown seeds. The pulp had a sweet, subacidic, excellent flavor. Ripe fruit may be stored for 3 to 5 d at 5 to 10 d before losing quality.

In general, ‘LeahReese’ fruit are significantly larger and have a greater °Brix value and percentage of pulp content compared to most other described seedlings and cultivars (Bomfim et al., 2014; Brandão and Santos, 2016; Pinto et al., 2005). This is, in

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Fig. 1. (A) 'LeahReese' trees, (B) fruit in-tree, (C) fruit weight, (D) longitudinal diameter, (E) transversal diameter, and (F) pulp with seeds.

part, because of hand-pollination. However, fruit of comparable quality from natural pollination have been observed (Crane, 2018).

The previous description is based on the International Board of Plant Genetic Resources descriptors for cherimoya (*Annona cherimola* Mill.) (Bioversity International and CHERLA, 2008).

Availability

'LeahReese' is not patented and limited budwood may be obtained from the University of Florida, Institute of Food and Agricultural Sciences, Tropical Research and Education Center, 18905 SW 280 Street, Homestead, FL 33031.

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Table 1. Mean physical and physicochemical characteristics of the fruit of sugar apple (*Annona squamosa* L.), cultivar LeahReese.

Parameter	2017 (n = 30)		2018 (n = 30)		2017–18 Mean
	Mean ± SD	Range	Mean ± SD	Range	
Longitudinal diameter (mm)	118.79 ± 3.10	16.51	120.25 ± 3.47	8.66	119.52
Equatorial diameter (mm)	114.05 ± 1.59	8.84	118.37 ± 1.96	4.97	116.21
Whole-fruit mass (g)	650.18 ± 22.38	21.77	627.27 ± 25.48	12.19	638.73
Peel mass (g)	273.14 ± 11.98	27.75	291.14 ± 23.81	24.53	282.14
Seed mass (g)	45.77 ± 1.27	17.54	32.83 ± 2.84	25.98	39.30
Pulp (%)	51.09 ± 0.58	7.23	49.77 ± 1.56	9.58	50.43
Pulp soluble solids (°Brix)	25.40 ± 0.43	10.68	25.55 ± 0.48	5.66	25.48
Pulp acidity (g citric acid/40 g pulp)	0.226 ± 0.009	24.31	0.230 ± 0.01	24.11	0.228
°Brix-to-acid ratio	120.91 ± 6.05	31.63	117.16 ± 10.47	26.83	119.04
Pulp pH	5.19 ± 0.02	2.82	4.83 ± 0.04	2.28	5.01
Seeds (n)	106 ± 3.29	19.61	74 ± 7.62	20.86	90