Research Note

*PRELIMINARY EVALUATION OF GUAVA (*PSIDIUM GUAJAVA*) GENOTYPES ON THE SOUTH COAST OF PUERTO RICO*[1]

Rubén Vélez-Colón[2], *Santos A. Henríquez*[3] *and Raúl Macchiavelli*[4]

J. Agric. Univ. P. R. 87(3-4):149-153 (2003)

For more than two hundred years, sugar cane was grown extensively in Puerto Rico, occupying thousands of hectares. However, sugar cane became an unprofitable industry and alternatives for the use of land are necessary. On the south coast, which is the driest area of Puerto Rico, much of the land formerly devoted to sugar cane production now stands idle. Guavas (*Psidium guajava*) are an alternative for the south coast growers.

The guava originated in the American tropics. The Aztecs named it Xalxocotl. It is known as goyabe in French, guajava in German, goiaba in Portuguese and aracá o guacú in Brazil (Toro-Toro, 1993). Wilson Popenoe suggested that it originated in Haiti (Toro-Toro, 1993). Today, it is commercially grown in South Africa, Taiwan, the French Antilles, Hawaii, Florida, California, Brazil, Mexico, and other parts of the world.

The guava tree is small (up to 6 m high) with a broad spreading top, branching freely close to the ground. It has opposite, oblong leaves, seven to 18 cm in length, with prominent veins. The flowers are white, about 2.5 cm in diameter, borne in axils of leaves of recent growth. The fruit may be round, ovoid or pear shaped. It may weigh from 28 to 454 g. The skin color is usually light green. The flesh may range from white, yellow, pink to red. Flavor may range from sweet to highly acidic. It has a distinctive aroma, which may range from mild and pleasant to strong and penetrant (Le Bourdelles and Estanove, 1967; Toro-Toro, 1993). It may be susceptible to various pests and diseases (Vargas, 1974) throughout its range, which encompasses the whole tropical world.

In Puerto Rico, guava has proven to be enduring, stress resistant and disease tolerant, except for *Glomerella* disease, which causes mummification and blackening of the fruits (Singh Dhaliwal and Serapión, 1981). The disease is caused by *Glomerella cingulata* (Stonem.) Spauld. & Schnenk., known in its anamorphic or imperfect state as *Colletotrichum gloesporioides* Penz. (Tong Kwee and Khay Chong, 1990). However, the small colorless fruits produced by the wild types are not adequate for the food processing industry. The nectars prepared from wild fruits require the use of artificial color and have a short shelf life at room temperature (Rodríguez and Iguina, 1971). Nonetheless, the relative abundance of wild fruits and the lack of commercial orchards of selected varieties formerly favored their almost exclusive use as a raw material in the processing of guava products. Today, imported guava pulp is preferred. Cultivars with pink or red color pulp, high acidity levels and high solid and pectin contents do exist and are available, many locally. These cultivars have been used commercially, both locally and abroad, for a long time (Bolt, 1984a, 1984b; Bolt and Alberts, 1984; Du Preer, 1986; Grech, 1985). They re-

[1]Manuscript submitted to Editorial Board 1 April 2003.

[2]Associate Researcher, Department of Horticulture, Agricultural Experiment Station, HC-01 Box 11656, Lajas, PR 00667.

[3]Research Associate, Agricultural Experiment Station.

[4]Researcher, Department of Agronomy and Soils.

quire adequate management practices (Grech, 1985; Shingema and Bullock, 1976; Toro-Toro, 1993) and sound scientific scrutiny in order for them to be reproduced and eventually recommended and supplied to local growers.

Le Bourdelles and Estanove (1967) emphasize guava's high ascorbic acid content (four or five times that of oranges), along with vitamins A and B, iron, phosphorus and calcium. Rodríguez and Iguina (1971) evaluated several cultivated guava clones and recommended some on the basis of organoleptic evaluations, storage periods and keeping qualities, and flavor quality and nectar yield. Malo and Campbell (1981) mentioned nine "superior" cultivars and hybrids suited for the state of Florida. Grech (1985) recommended six white cultivars commercially apt for Taiwan.

In Puerto Rico, Rodríguez and Iguina (1971) recommended seven clones capable of producing lasting nectars (nine-month storage period at 30° C): 57-9-114 (Rico 18); 58-3-71 (Rico 13); 57-4-30 (Rico 21); 57-2-142 (Rico 19); 57-2-51 (Rico 20); D-13 (Rico 4); and Trujillo 2 (Rico 2). Clone 57-2-142 rated particularly high in flavor quality and nectar yield.

Guavas may survive and even thrive in a variety of environments. A wide range of pluvial precipitation is acceptable; an excess of humidity may, however, negatively affect fruit production and quality (Toro-Toro, 1993). For this reason, in Puerto Rico it is advisable to plant this crop on the dry south coast, with supplementary irrigation.

Planting distances of 6 × 6 m, 6 × 7.5 m, or 7.5 × 7.5 m are usually recommended, depending on pruning practices (Greech, 1985; López-García and Pérez-Pérez, 1977). Pruning may play an important role in bringing trees into bearing early, as well as producing heavy crops, but intensive pruning regimes may contribute to shortened lifespan of the orchard (Grech, 1985). Such practices, plus the prevalence of diseases, are blamed for the short lifespan of the Taiwanese orchards, only 10 to 12 years at the time of this study; in contrast, the South African orchards may last 20 to 25 years or more. It should be noted that an intensive pruning regime is necessary in Taiwan precisely because of the prevalence of diseases, particularly wilting, or *Likubin*, disease. This dreaded disease does exist in South Africa as well. Obviously, other factors are involved.

The environmental conditions at the Juana Díaz Experiment Substation (annual rainfall of approximately 800 mm, an elevation of 21 m above sea level, 31° C average maximum temperature, 21° C average minimum temperature) are ideal for the study of management practices. Fourteen selected clones were grafted onto an appropriate rootstock in 1997. The rootstock was a selection from Aibonito, Puerto Rico, chosen for its vigor and the reddish color of its leaves, all of which makes it easier for a grower to identify undesired shoots. The clones chosen were 57-1-28, 57-4-30, R-258, 57-10-137, 57-7-19, 57-6-71, M-184, 57-2-95, R-264, G-864, 57-8-163, Q-241, G-447, and 57-1-42. These clones were chosen mostly on the basis of previous organoleptic tests (Vélez-Colón et al., 1994). Clones that showed outstanding vigor as well as acceptable fruit quality for processing were also included. The clones were planted in a San Antón soil (fine-loamy, mixed, superactive, isohyperthermic Cumulic Haplustolls) (USDA, 1979) with drip irrigation 11 February 1998. Three replications were used, each containing four trees of every clone, planted in a single row in randomized complete blocks. Planting distances were 7 m in the row × 5 m between rows. Clones from the old orchard located at the Juana Díaz Substation were planted around the new replicated one as guard rows. These clones were collected from different sources in the late 1960s and field planted June 1971.

All selected clones have proven to be fast growing and resistant to disease and other environmental stresses. It is presumed that the high natural fertility of the soil and the constant supply of water have contributed to this resistance. Pesticide use has been negligible, with the exception of herbicides. Chemical fertilizers have not been used so far. The trees were pruned for the first time in June 2000.

TABLE 1.—*Guava clone yields for a period of 25 months at Juana Díaz Substation (average of three replications).*[1]

Clone	Mean Yield (kg)
R-264	370.85 a
G-447	335.36 ab
57-1-28	330.13 ab
57-4-30	324.62 abc
57-1-42	318.98 abcd
Q-241	316.35 abcde
57-8-163	298.57 abcde
M-184	245.80 bcdef
G-864	237.69 bcdef
57-10-137	227.57 bcdef
R-258	215.01 cdef
57-2-95	210.93 def
57-6-71	208.32 ef
57-7-19	187.39 f

[1]Means with the same letter are not significantly different (LSD test, $\alpha = 0.05$).

The first fruits were harvested in December 1998, barely 10 months after field planting. This report includes 25 months of harvesting, from December 1998 to December 2000.

For each clone, statistical analyses were performed for total fruit weight (yield), number of fruits, and average fruit weight. The highest yields (total fruit weight) were produced by clones R-264, G-447, 57-1-28, 57-4-30, 57-1-42, Q-241 and 57-8-163 (Table 1). These seven clones were not significantly different from one another. The most prolific clones (in number of fruits) were 57-1-42, 57-8-163, R-264, 57-1-28, G-447, 57-4-30, 57-10-137 and Q-241 (Table 2). These eight clones were not significantly different from one

TABLE 2.—*Number of fruits of guava clones for a period of 25 months at Juana Díaz Substation (average of three replications).*[1]

Clone	Mean number of fruits
57-1-42	3,783.7 a
57-8-163	3,440.7 ab
R-264	3,344.3 ab
57-1-28	3,193.0 abc
G-447	3,182.0 abc
57-4-30	3,128.3 abc
57-10-137	3,044.3 abc
Q-241	2,988.3 abc
M-184	2,694.7 bc
57-6-71	2,571.0 bc
R-258	2,446.0 bc
G-864	2,415.7 bc
57-7-19	2,212.7 c
57-2-95	2,178.3 c

[1]Means with the same letter are not significantly different (LSD test, $\alpha = 0.05$).

TABLE 3.—*Average fruit weight of guava clones for a period of 25 months at Juana Díaz Substation (average of three replications).*[1]

Clone	Mean (g)
R-264	110.9 a
Q-241	105.6 ab
G-447	105.4 ab
57-1-28	103.5 abc
57-4-30	103.1 abc
G-864	98.4 abcd
57-2-95	96.8 abcde
M-184	90.8 bcdef
R-258	87.9 cdef
57-8-163	86.7 cdef
57-1-42	85.2 def
57-7-19	84.8 def
57-6-71	80.9 ef
57-10-137	75.1 f

[1]Means with the same letter are not significantly different (LSD test, $\alpha = 0.05$).

another. The clones with the highest average fruit weight were R-264, Q-241, G-447, 57-1-28, 57-4-30, G-864 and 57-2-95, in that order (Table 3). These seven clones were not significantly different from one another.

We found that clones R 264 and 57-1-28 had a tendency to produce many big heavy fruits, whereas clones 57-1-42 and 57-18-163, although prolific, had a tendency to produce smaller lighter fruits. Since these are processing types, it is presumed that farmers will be interested in high yield, regardless of fruit size. However, these are preliminary results that may change over time. Furthermore, a study is needed to determine the economical feasibility of guava production on the island.

LITERATURE CITED

Bolt, L. C., 1984a. Planting distances for guava trees. Guavas D-1. Department of Agriculture of the Republic of South Africa, Pretoria.

Bolt, L. C., 1984b. Propagation of the guava. Guavas D-2. Department of Agriculture of the Republic of South Africa, Pretoria.

Bolt, L. C., and A. J. Alberts, 1984. Pruning of guava trees. Guavas G-1. Department of Agriculture of the Republic of South Africa, Pretoria.

Du Preer, R. J., 1986. Origin of the guava. Guavas A-1. Department of Agriculture of the Republic of South Africa, Pretoria.

Grech, N. M., 1985. Aspects of guava cultivation in Taiwan. 1SSN 0257-2095. CSFRI, Private Bag X, 11208, Nelspruit, Republic of China.

Le Bourdelles, J. and P. Estanove, 1967. La goyave aux Antilles. *Fruits d'Outre Mer.* 22:9.

López-García, J. and R. Pérez-Pérez, 1977. Effect of pruning and harvesting methods on guava yields. *J. Agric. Univ. P.R.* 61:148-51.

Malo, S. E. and C. W. Campbell, 1981. The guava. Fruit Crops Fact Sheet #4. University of Florida, IFAS, Subtropical Experiment Station, Homestead, FL.

Rodríguez, A. J. and L. M. Iguina, 1971. Evaluation of some processing characteristics of cultivated guava clones. *J. Agric. Univ. P.R.* 55:44-51.

Singh-Dhaliwal, T. and J. L. Serapión, 1981. Progress in guava selection in Puerto Rico. *J. Agric. Univ. P.R.* 65:73-4.

Shingema, G. T., and R. M. Bullock, 1976. Management of guava: cycling fruit set for continuous production. *Am. Soc. Hort. Sci. Proc. Trop. Reg.* 24:166-74.

Tong Kwee, L., and K. Khay Chong, 1990. Guava in Malaysia: Production, pests and diseases. Tropical Press SDN-BHD, Malaysia.

Toro-Toro, E., 1993. El cultivo de la guayaba. Agricultural Extension Service. University of Puerto Rico.

USDA, 1979. Soil Survey of Ponce Area of Southern Puerto Rico. USDA, San Juan, PR.

Vargas, E., 1974. Principales plagas y enfermedades del guayabo: Sintomología de Daños y Calendario de Control. Gaceta Agrícola. 10.

Vélez-Colón R., I. B. Caloni, O. Parsi, S. Martínez-Garraztazú and E. Caraballo-Torres, 1994. Variation in fruit characteristics among selected guava (*Psidium guajava*) genotypes. *Proc. Carib. Food Crops Soc.* 30:313-22.

BLANK PAGE USED IN PAGE COUNT