Preliminary Evaluation of 21 Certified Virus-free Citrus Clones[1]

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ABSTRACT

Twenty-one clonal varieties of citrus were evaluated at the Gurabo Substation fruit yield and characters. Average fruit production during the 3-year study of Pineapple and Temple clones and the majority of the Valencia clones was higher than the ones reported from commercial orchards in Puerto Rico. The clones of Pineapple, Temple and Orlando Tangelo have the most seedy fruits with 18, 13 and 13 seeds per fruit, respectively. For most of the clonal varieties, seed content was lower and acceptable. Lue Gin Gong and most of the Valencia clones produced the highest percentages of juice per fruit.

INTRODUCTION

In Puerto Rico, citrus fruits are second among the fruits grown in the Island. Our search for new citrus cultivars, higher in yields, resistant to pests and diseases and of superior fruit characteristics is a continuous task. Introduction, propagation and evaluation of citrus cultivars are important in obtaining new or improved varieties.

This paper presents the results obtained from a preliminary evaluation of 21 citrus clones planted at the Gurabo Substation.

MATERIALS AND METHODS

Certified virus-free (tristeza, exocortis, psiloporosis) citrus budwood was introduced from Florida in 1962 and 1963. This selected material was grafted on sour orange (*Citrus aurantium* L.) and rough lemon—*Citrus limon* (L.) Burm.f.—rootstocks and planted at the Gurabo agricultural experiment substation from 1962 to 1965. The planting distance between trees was 7.6 × 7.6 m. The soil at the experimental area is Mabí, Vertic Entropepts, fine, motmorillonitic, isohypertemic. The average annual rainfall is around 1650 mm, and maximum and minimum temperatures are around 30° C and 18° C, respectively.

The trees were maintained properly as a farm orchard until 1976. From there on they were managed following recommendations of the Puerto Rico Agricultural Experiment Station.[3] From 1976 through 1980, when

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[3] Conjunto Tecnológico para la Producción de Cítricas. 1977, Esta. Exp. Agric. Univ. P. R. Publ. 113.

the trees were 11 to 14 years old, data on fruit production was collected from each tree. Fruits were harvested yearly from each clonal variety and a sample was analyzed for pH, ascorbic acid, citric acid and juice content. A 10-fruit sample of each clonal variety was picked to determine mean fruit weight, fruit size and number of seeds per fruit. Juice was extracted with a hand squeezer, weighed, juice percentages, and Brix values were determined. The data obtained was not analyzed statistically because of the lack of randomization of the planting and unequal number of trees per clonal variety.

RESULTS AND DISCUSSION

Table 1 presents data on average fruit production, fruit size, number of seeds per fruit, mean weight of fruits and juice and percentage of juice yield of the 21 clonal varieties evaluated during the 3 years (1977–78 to 1979–80). The Orlando Tangelo N produced the highest number of fruits per tree with an average of 771 fruits per tree. Temple 15-4-278, Pineapple N, Temple 15-4275 and Valencia 10-12-7 were the best yielders among the sweet oranges with 480, 436, 334 and 331 fruits per tree, respectively. Data published by Troche-Ducot and González-Villafañe[4] shows that the average production in Puerto Rico in commercial orchards is 124 fruits per tree. In 1969 Espinet[5] reported that the average production for Valencia and Washington Navel in Puerto Rico was about 86 fruits per tree, and that the average production in Florida for Valencia was 320 fruits. In our evaluations most of the sweet oranges produced very good yields, higher than those reported previously.

Seed content was variable and distinctive of each clonal variety. Pineapple, Temple and Orlando Tangelo were the most seedy with 18, 13 and 13 seeds per fruit, respectively. Among the Valencia oranges, the number of seeds ranged from 3 to 7, which is quite low if compared with Pineapple. Lue Gin Gong and most of the Valencia clones had a higher juice content than other clones. Table 2 presents the juice analysis of the 21 clonal varieties. According to Moscoso and Capó[6], Brix, pH, ascorbic acid and citric acid content are important juice characters useful for identification of citrus fruits. In the orange group, Brix varies from 14.5 in Pineapple 1-9-31 to 11.0 in Lue Gin Gong 9-14-23. Tahiti lime 31-1-8 had the lowest Brix, 9.00. Ascorbic acid (mg/100 ml) content was higher

[4] Troche-Ducot, J. L. y E. González-Villafañe, 1982. Costos e Ingresos en la Producción Comercial de Chinas Valencia y Nebo en Puerto Rico, Esta. Exp. Agric. Univ. P. R. Publ. 145.

[5] Espinet-Colón, G., 1969. Producción y Estructura del Mercadeo de Cítricas en Puerto Rico, Esta. Exp. Agric. Univ. P. R. Bol. 215.

[6] Moscoso, C. G. and B. G. Capó, 1973. Characteristic (Descriminant Function) indices of chironja, orange and grapefruit, J. Agr. Univ. P. R. 57 (1):

TABLE 1.—*Number of fruits per tree, fruit size, number of seeds per fruit, average fruit and juice weight and percentage of juice yields per fruit of 21 citrus clonal varieties. Mean of 3 years (1977–80)*

Clonal variety		Number of fruits/tree	Fruit size		Number of seeds/fruit	Mean weight		Juice yield
			Diam	Length		Fruit	Juice	
			cm			*g*		%
Marsh Seedless	(G)[1]	170	9.7	8.6	6	450	182	40.4
Red Blush	(G)	340	9.3	8.9	6	387	159	46.7
Parson Brown	(O)	120	6.6	6.6	8	148	64	43.2
Washington Navel N	(O)	222	8.2	7.9	3	284	113	39.8
Pineapple N	(O)	436	7.3	7.0	18	185	79	43.8
Pineapple 1-9-31	(O)	134	6.8	6.8	18	116	69	39.6
Lue Gin Gong 9-14-16	(O)	170	7.3	7.0	2	212	120	56.6
Lue Gin Gong 9-14-23	(O)	178	7.4	7.2	5	211	117	55.4
Temple 15-4-275	(O)	331	7.1	6.7	13	180	90	49.9
Temple 15-4-278	(O)	480	7.0	6.2	13	181	90	49.7
Valencia 10-12-7	(O)	344	7.0	6.8	7	210	103	49.0
Valencia 51-1-9X	(O)	127	6.7	6.5	7	158	86	54.4
Valencia N	(O)	188	7.8	7.5	6	235	123	52.2
Valencia 9-14-18	(O)	125	7.2	7.0	4	213	107	50.2
Valencia 16-14-22X	(O)	130	7.8	7.5	6	250	140	56.0
Valencia 9-27-15	(O)	118	7.1	6.7	5	200	106	53.0
Valencia 26-1-1XE	(O)	121	7.5	7.4	3	240	131	54.6
Valencia 47-8-35X	(O)	141	7.3	6.9	7	205	111	54.1
Orlando Tangelo N		771	7.8	6.4	13	246	109	44.3
Dancy 9-14-1	(Tn)	598	6.7	5.2	8	140	47	33.6
Tahiti 31-1-8	(L)	306	5.3	6.4	1	109	61	56.0

[1] G = grapefruit; O = orange; Tn = tangerine; L = lime; N = nucellar.

in Pineapple 1-9-31 and Pineapple N and very low in Tahiti lime 31-1-8. The highest content of citric acid was found in the Tahiti lime 31-1-8, whereas the lowest content was obtained in the Parson Brown cultivar.

Red Blush was superior to Marsh Seedless in fruit production among the grapefruit varieties. An average yield of 340 fruits per tree was

obtained from the Red Blush cultivar, whereas 170 fruits per tree were obtained from the Marsh Seedless. Marsh Seedless was higher in citric acid content than Red Blush. In general, the grapefruits were lower in Brix, pH and ascorbic acid content than the oranges.

Evaluating all the citrus fruits as a whole with regard to size and weight these might be classified as follows: 1) grapefruits-medium, 2) tangelos and sweet oranges—medium small to medium—and 3) tangerines and limes small.

There are some cultivars that seem very promising and should be

TABLE 2.—*Brix, pH, ascorbic and citric acid contents in the juice of 21 clonal varieties. Mean of 3 years (1978–80)*

Clonal variety	Brix	pH	Ascorbic acid	Citric acid
			mg/100 ml	*mg/100 ml*
Marsh Seedless	9.8	3.1	37.9	1330
Red Blush	10.8	3.4	33.8	984
Parson Brown	14.0	4.4	54.2	470
Washington Navel N	13.1	4.1	44.8	509
Pineapple N	13.6	3.7	71.7	926
Pineapple 1-9-31	14.5	4.1	76.5	950
Lue Gin Gong 9-14-16	11.5	3.5	49.1	1076
Lue Gin Gong 9-14-23	11.0	3.5	48.0	1031
Temple 15-4-275	13.1	3.3	63.4	1229
Temple 15-4-278	13.1	3.4	62.5	1155
Valencia 10-12-7	11.6	3.7	52.7	1175
Valencia 51-1-9X	12.1	3.6	52.7	1114
Valencia N	11.6	3.6	49.9	913
Valencia 9-14-18	12.6	3.4	46.8	927
Valencia 16-14-22X	11.8	3.4	47.6	1149
Valencia 9-27-15	12.1	3.4	48.1	1015
Valencia 26-1-1XE	11.3	3.3	45.5	1035
Valencia 47-8-35X	12.1	3.3	49.5	1181
Orlando Tangelo N	13.0	3.9	28.3	779
Dancy 9-14-1	11.6	3.3	34.0	1001
Tahiti 31-1-8	9.0	3.2	21.0	6868

recommended for further study and for planting on a large scale. These are sweet orange—Pineapple N, Valencia 10-12-7, Temple 15-4-278, and Tangelo—Orlando N.

RESUMEN

Se evaluó la producción y las caracterésticas de la fruta de 21 variedades clonales de cítricas (chinas[7], toronjas, mandarinas, tangelos y limas). La producción media en 1977–80 para clones de Pineapple, Temple y la

[7] Naranja dulce.

mayoría de los de Valencia fue mucho más elevada que la informada de huertos comerciales en Puerto Rico. Los clones de Pineapple, Temple y Orlando Tangelo tuvieron el mayor número de semillas por fruta con 18, 13 y 13, respectivamente. El número de semillas por fruta fue aceptable en la mayor parte de las variedades clonales evaluadas. Los clones de Lue Gin Gong y la mayor parte de los Valencia produjeron el mayor porcentaje de jugo por fruta.