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EVALUATION OF PAPAYA GERM PLASM IN THE U.S. VIRGIN ISLANDS

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ABSTRACT

Demand for locally produced papaya (*Carica papaya*) fruits far outweighs supply in the U.S. Virgin Islands. Due to constraints such as mealybug infestation and the high incidence of papaya ringspot virus, farmers are in need of varieties which are suitable for local growing conditions. Two papaya germplasm evaluation trials were conducted during 1996-97 and 1997-98. These varieties were evaluated for yield and fruit characteristics, and quality. In both trials, 'Cariflora' set the highest number of fruits and 'Yuen Nong' the lowest. In the first trial, 356-3 was the sweetest with brix of 13.42 % and 'Criolla' the lowest with a brix of 9.42 %. In the second trial, 'Cartegena' had the heaviest fruits (1510) and 'PR665 dwaf' was the lightest (405 g). The height at first fruit set from both trials ranged from 40 cm 'Sunrise x Cariflora' to 221 cm, 'Trini Yellow'. Productive papaya varieties can be recommended for fresh market production in the USVI to fulfill the characteristics the consumers desire..

INTRODUCTION

Papaya is one of the most widely grown fruits in the Caribbean basin. It is a favourite of both commercial growers and backyard farmers in the USVI. Its fruits are used for a variety of purposes in both green and ripe forms. Demand for the ripe fruit is high in local markets, restaurants and hotels. But over the past twenty five years production has declined dramatically due to high incidences of papaya ringspot virus, mealybugs infestation and low rainfall.

Papaya ringspot virus reduces fruit quality and quantity and eventually kills the tree. Symptoms of PRSV include water soaked lesions of the stems and petioles, ringspots on the fruits and mottled and distorted leaves. Most papaya varieties are very susceptible to this virus and die before marketable fruits are obtained. It is estimated that production in Puerto Rico has declined 60-70% as a result of PRSV (Zimmerman, 1994). No natural resistance to PRSV has been found, but some varieties have shown tolerance, in which, plants and fruits show symptoms of the virus but the productive life of the plant remains. Most Hawaiian varieties are very susceptible to the virus and do not adapt well to the high pH soils and semi-arid climate of the USVI. Aphids are the primary vector of PRSV, but are non-persistent on papaya.

Mealybugs colonize the underside of leaves, fruits and around the apex of shoot tips. Symptoms of mealybugs include crinkled leaves, deformed fruits and blackened leaves from the sooty mold which forms on the exudate from the mealybug.

During dry seasons the mealybugs also go onto roots of the plant. The insects are extremely difficult to control, particularly when the leaves curl, and provide a natural hiding place, and among the fruit where they are protected from insecticide spray.

Papaya trees are extremely sensitive to drought. In the Virgin Islands where evapotranspiration exceeds precipitation 10 months out of the year, it is difficult to produce papayas without some type of irrigation. Also, stressed plants are more susceptible to disease and insect damage.

This study evaluated several papaya varieties from around the world, for growth and production, tolerance to PRSV, height at first fruit set, and fruit quality in USVI.

MATERIALS AND METHODS

The experiments were conducted at the Agricultural Experiment Station, University of the Virgin Islands, St. Croix. The soil is a Fredensborg loamy, fine carbonatic, isohyperthermic, shallow, typic calciustoll (Lugo-Lopez, 1980). The soil contains relatively low organic matter content (<2.0%) and the pH is approximately 8.5. The average rainfall is 1016 mm with highest precipitation occurring between October and November.

These varieties evaluated were:

Trial	Code	Trial	Code
Cariflora-G	CFL	Cariflora-G	CFL
Criolla-II	CRL	Cartegen-G	CRT
Guanica-II	GNC	Guanica-H	GNC
356-3-G	356-3	Solo 64-H	S54
PR 665-II	P65	Pr665 Dwarf	PRD
Solo Sunrise -II	SS	Solo Sunrise -H	SS
Solo Sun X Carif-II	SXC	Tommy-G	TOM
Trini Yellow-II	TYL	Trini Yellow-H	TYL
Washington-G	WSH	Washington-G	WSH
Yuen Nong 1-II	YN1	Yuen Nong 1-H	YN1

Flower type: G=gynocious H=hermaphrodite

The trees were established in the field in August 1996 and August 1997. The experiments were conducted in two rows per plots with 1.83 m between plants and 2.44 m between rows. The plot was 32.9 m by 12.7 m wide. Water was supplied as needed through ¾ polyethylene tubing. Dynamax 12-12-12 fertilizer was applied monthly at a rate of 1-2 cups per plant. Granular Diazinon was sprinkled around the trees to control ants and Malathion along with Ultra-Fine Spray Oil were sprayed as needed to control mealybugs. Data collected were height at first fruit set, number of fruits produced, fruit weight, length and width, flesh thickness and brix.

RESULTS AND DISCUSSION

Gynocious plants produced only female floral parts and required pollen from a staminate male or hermaphrodite plants to set fruit. Hermaphroditic plants have complete flowers with both male and female floral parts. Fruits from Gynocious plants are generally round while hermaphroditic plants produce elongated to pear shaped fruits. 'Washington', originating in India has anthocyanin in the petioles and stems to give it a characteristic purple colour. Compact plant structure, short internodes are identifying features of 'Dwarf Puerto Rico 6-65'.

HEIGHT AT FIRST FRUIT

The height at which the first fruit sets is an important characteristic, because the lower the fruit, the earlier is set in plant development. Earlier fruit set allows for production before infection by PRSV reduced plant vigour and sustained fruit set.

In 1997, height of first fruit set ranged from 43 cm 'Solo Sunrise' X 'Cariflora' to 118 cm 'Solo Sunrise' (Table 1). The variety with fruit at the lowest height set in 1998 was 'PR 665 dwarf', 53 cm, and 'Solo Sunrise', 121 cm (Table 1). The rule as a hermaphroditic plants set fruits at a much later age corresponding to height, than Gynocious varieties. However, the 'Solo Sunrise' X 'Cariflora' hybrid incorporated the lower fruit set characteristic to this hermaphroditic selection (Table 1).

Table 1: Average height at first fruit set 1996/97 and 1997/98.

Variety	Height (cm) 1996/97	Height (cm) 1997/98
Cariflora	79	64
Cartegena	-	102
356-3	37	-
Solo 64	-	70
Tommy	-	90
Washington	72	57
Criolla	94	-
Guanica	114	111
Puerto Rican 6-65	72	-
Puerto Rican 6-65 Dwarf-	53	-
Solo Sunrise	121	118
Solo Sunrise X Cariflora	82	42
Trini Yellow	114	82
Yuen Nong 1	105	96

NUMBER OF FRUITS PER PLANT

In both trials, 'Yuen Nong 1', a hermaphrodite, set the lowest number fruits (40 and 41, 1997 and 1998 respectively (Table 2). Also in both trails, 'Cariflora', a Gynoeccious plants, set the most fruits, 80 in 1997 and 82 in 1998 (Table 2). Varieties with smaller fruit tended to set higher amounts of fruit.

MASS

'Trini Yellow' had the heaviest fruits, 1.9 kg in 1997. The lightest fruits came from 'Solo Sunrise' (638 g) (Table 3). In the second trial, 'Cartegena' bore the heaviest fruits, 1.5 kg per fruit and 'Guanica' had the lightest fruit 687 g in 1998 (Table 3).

Table 2: Average number of fruits produced per plant 1996/97 and 1997/98.

Variety	#Fruit/Plant 1996/97	#Fruit/Plant 1997/98
Cariflora	80	82
Cartegena	-	64
356-3	56	-
Solo 64	-	70
Tommy	-	68
Washington	51	55
Criolla	41	-
Guanica	57	52
Puerto Rican 6-65	64	-
Puerto Rican 6-65 Dwarf	-	54
Solo Sunrise	66	67
Solo Sunrise X Cariflora	79	72
Trini Yellow	56	56
Yuen Nong 1	40	41

Table 3: The average weight of the papaya fruits during 1996/97 and 1997/98.

Variety	kg 1996/97	kg 1997/98
Cariflora	1.23	1.05
Cartegena	-	1.20
356-3	1.14	-
Solo 64	-	.96
Tommy	-	1.38
Washington	.75	.77
Criolla	.84	-
Guanica	.84	-
Puerto Rican 6-65	1.27	.40
Puerto Rican 6-65 Dwarf	-	-
Solo Sunrise	.64	.84
Solo Sunrise X Cariflora	1.20	.1
Trini Yellow	.88	.73
Yuen Nong 1	1.16	1.51

FRUIT SIZE

The length, width and ratio of length to width give an indication of the fruit shape. The fruit shape varied from the almost perfectly round fruits of the gynecious varieties to elongated fruits of the hermaphroditic varieties. A length to width ratio close to 1.0 indicates a round fruit. In 1997, 'Trini Yellow' had the highest length to width ratio (3:31) (Table 4). The fruits from this variety were long and thin. 'Solo Sunrise' X 'Cariflora' had the lowest ratio (1:09) (Table 4). 'Trini Yellow' had the highest length to width ratio with 2:69 and 'Washington' had the lowest (1:17) (Table 4) in 1998.

PERCENT BRUX

The percent brix is a measurement of the soluble sugar content. The higher brix value indicates a sweeter fruit. The percent brix will change over time as the plant becomes stressed from insects, disease and drought. A stressed papaya plant loses its leaves which reduces the production of sugar that accumulates in the developing fruit. The cultivar which had the sweetest fruits were '356-3' with a brix of 13.42 (Table 5). The fruits with the lowest brix were 'Trini Red' (8.47) (Table 5). The hermaphroditic cultivar tended to have lower brix than the gynecious ones. The lower brix found in the hermaphroditic cultivar may relate to later fruit set. The later the fruit set in plant development, the greater that of infection with PRSV and other stresses.

Table 4: Average length to width ratio of the papaya fruits.

Variety	Ratio
Cariflora	1.29
Cartegna	1.37
356-3	1.37
Solo 64	1.32
Tommy	1.55
Washington	1.19
Criolla	1.56
Guanica	2.06
Puerto Rican 6-65	1.40
Puerto Rican 6.65 Dwarf	1.17
Solo Sunrise	1.64
Trini Yellow	3.00
Yuen Nong 1	2.29

PSRV TOLERANCE

The plants showed a wide variety of tolerance to the virus. In both trials virus symptoms were observed within months of planting. None of the varieties were productive for over a year.

Table 5: Papaya fruit quality characteristic.

Variety	% Brix Flesh	Thickness (cm)	Colour
Cariflora	11.3	2.71	Orange
Cartegna	11.6	2.77	Orange
356-3	13.4	2.57	Orange
Solo 64	11.3	2.45	Orange
Tommy	11.1	2.63	Yellow
Washington	11.4	2.38	Yellow
Crilloa	9.4	2.49	Yellow
Guanica	10.4	2.46	Red
Puerto Rican 6-65	10.9	2.46	Yellow
Puerto Rican 6.65 Dwarf	11.3	1.87	Yellow
Solo Sunrise	11.0	2.54	Yellow
Solo Sunrise X Cariflora	9.8	2.88	Orange
Trini Yellow	8.9	2.34	Yellow
Yuen Nong 1	10.3	2.85	Orange

CONCLUSIONS

PSRV will continue to be the constraint to papaya production in the U.S.V.I. By planting varieties such as '365-3' and 'Cariflora' that set fruit early, farmers can get some production out of the plants before they are weakened by diseases and pests. Future research should include continued trials to identify varieties suitable for the soil type and climate of the U.S.V.I.

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REFERENCES

Lugo-Lopez, M.A. and L.H. Rivera (1980) Updated Tasonomic classification of the soils in the U.S. Virgin Islands. *J.Agric. Univ. of Puerto Rico* 64:131-137