CARIBBEAN FOOD CROPS SOCIETY

34th Annual Meeting 1998

Rural Agricultural Development Authority
Ministry of Agriculture, Jamaica

"Enhancing Regional Food Security and Exports by Integrating National Strategies"

JAMAICA VOL. XXXIV

PASSION FRUIT EVALUATION IN THE U.S. VIRGIN ISLANDS

Thomas W. Zimmerman and Jacqueline A. Kowalski
University of the Virgin Islands Agrieultural Experiment Station, RR2 Box 10,000, Kingshill, USVI 00850.

ABSTRACT

The drink made from Passion fruit (*Passiflora edulis*) is very popular in the Virgin Islands and can be found at roadside stands and during cultural events. Seven varieties of the yellow passion fruit, *Passiflora edulis* f. *flavicarpa,* were evaluated for growth and produetion on T-trellises in the USVI. During the first 20 days post anthesis, fruit size increases quickly at a rate of 2.7 mm/day followed by reduced growth of 0.35 mm/day from day 21 to 50. Passion fruit vines, established in the field in May, produced the first erop starting in November and lasting through January. 'Noel's Special' had the largest fruits at 81.87 g while the 'UVI Yellow' produced 263.3 fruits/vine. The lowest production, 115 fruits/vine, and smallest fruits, 51.5 g/fruit, were obtained on a Taiwanese hybrid. The high initial investment in establishing passion fruit vines can be offset by income generated from the first years production.

INTRODUCTION

The genus *Passiflora* is indigenous to the American tropics and over 400 species of this perennial woody vine are known to exist (Martin and Nakasone, 1970). Passion fruit is pleasingly aromatic, tart and a good source of vitamin A and niacin (Duke and duCellier, 1993; Chan, 1980).

The appealing flavor of passion fruit juice has lead to its development and use in commercial fruit juices, frozen concentrates, ice cream and frozen juice bars. The source of the eommercial juice is from the purple passion fruit (*Passiflora edulis* Sims.), yellow passion fruit *(P. edulis* f. *flavicarpa* Deg.) and hybrids between the two forms.

Passion fruit is one of the few tropical fruit species with production potential for the U.S. Virgin Islands because of its ability to tolerate the endemic calcareous soils. The semiarid conditions of the USVI benefit passion fruit by deterring the leaf and fruit diseases that are common in the humid tropical areas (Cole et al., 1992; Ploetz, 1991). The yellow passion fruit is self incompatible which accounts for the heterozygosity in plants derived from seed. The loeal population of carpenter bees (*Xylocarpa* spp.) pollinate the flowers to assure fruit set.

In the USVI, passion fruit is grown by small farmers and backyard gardeners for local consumption. Because passion fruit production starts within a year of planting, revenues can be obtained to offset the initial cost of the trellis and plant establishment which is not possible with most tropical fruit species (Knight, 1992; Knight, 1994). The local yellow passion fruit vines have a vigorous amount of growth and foliage but its production hasn't been compared with commereial varieties. For passion fruit to be an economically viable product of the USVI, productive and water use efficient varieties are needed.

Germplasm evaluation and development of high producing passion fruit lines has been done to improve the passion fruit production in Dominica (Bridgemohan, 1993). The objectives of this study are (**a**) to compare local passion fruit to commercial varieties and (**b**) determine the cultivars best suited for production by loeal farmers and backyard gardeners.

MATERIALS AND METHODS

During 1995, data was collected from developing fruits on the locally grown yellow and red passion fruit vines that were established on a fence row. Floral production started in March. Flowers were tagged and measured at anthesis with a calipers. Fruit length and width were recorded on a daily basis from anthesis for 50 days. At maturity, the length, width and mass were recorded.

In May 1997 vines obtained from seeds and cuttings of six (6) yellow passion fruits varieties and a hybrid between the red and yellow form (Table 1) were planted onto a 2-m tall T-shaped trellis system.

T trellises were used since it has been shown that they provide higher yields in Dominica and Puerto Rico than a fence trellis (Velez Colon, 1997; Robin, 1992). Spacing between plants was 3.5 m with 3 m between rows. There were three plants per variety per replication and there were two replications. Drip irrigation was used to supply the water and the plants were fertilized once after establishment with a granular 12-12-12. A wood-chip mulch in and between rows was used to control weeds, conserve soil moisture and cushion the landing of the mature fruits when they drop.

Data was collected on fruit production and fruit quality during the first semiannual production cycle from November, 1997 through January, 1998. Fruits were collected from the ground at two day intervals. The number of fruits and their mass was recorded. Fruit quality data included fruit size, pulp volume, % Brix and pH.

RESULTS AND DISCUSSION

Passion fruit has two major floral cycles in the USVI. The first is from mid-March through May and the second from September through November. The developing fruit of the passion fruit grows very quickly during the first 20 days following anthesis. The daily rate of size increase was 2.7 mm/day during this time. From day 21 to 50 post anthesis the daily fruit growth rate was 0.35 mm/day (Figure 1). The rapid growth following pollination and fertilization is similar to the development observed in *Datura* (Hartmann et al., 1990). Seed growth and embryo development is associated with the time following the rapid fruit growth.

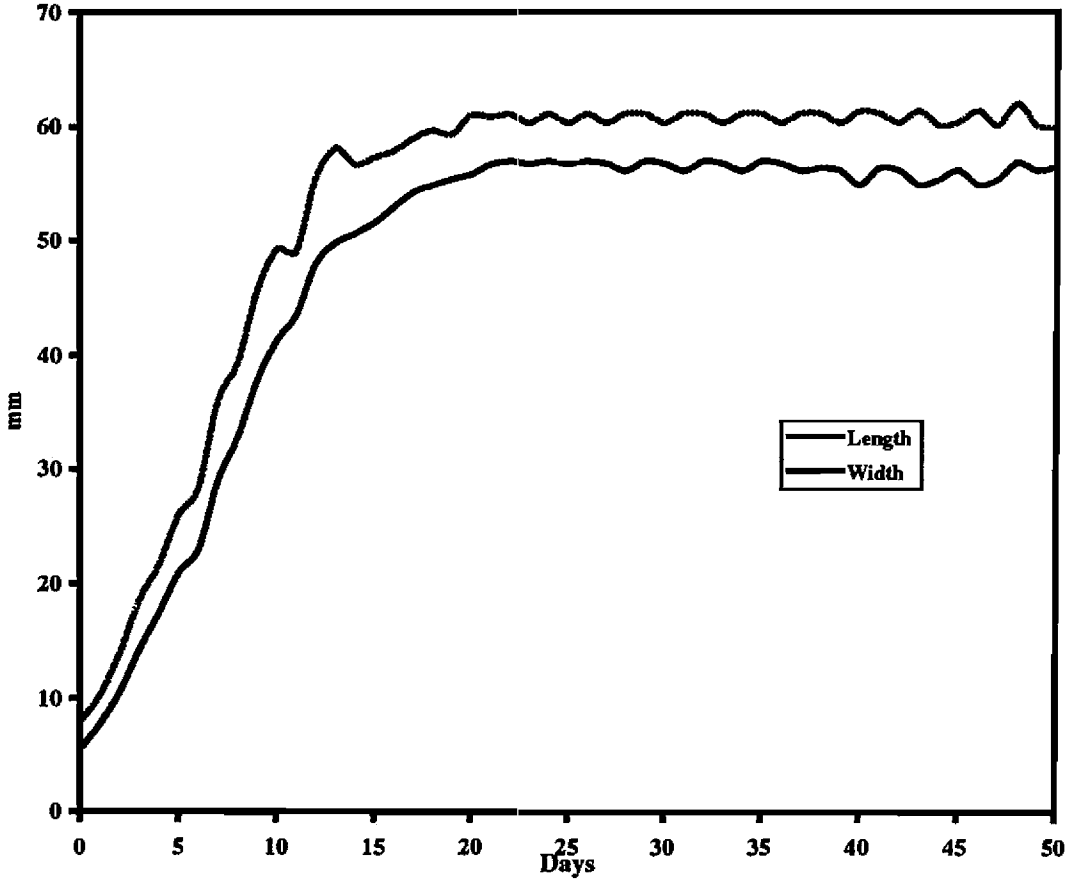

Figure 1: The changes in the development of passion fruit length and width from anthesis to the fiftieth day.

Table 1. Passion fruit varieties evaluated, fruit color and their source.

Variety	Fruit Color	Source[z]
UVI	Yellow	USVI
Columbia Market	Yellow	PSI
Espino Strain	Yellow	PSI
Taiwan	Yellow	USDA
Noel's Special	Yellow	USDA
HPAS	Yellow	USDA
TWZ (Yellow x Red Hybrid)	Redorange	USVI

[z]USVI, Locally grown on St. Croix; PSI, Passiflora Society International Seed Bank; USDA Tropical Germplasm Repository, Hilo, Hawaii.

The 'UVI' variety produced the greatest number of fruits per vine (263) which corresponded to the greatest total fruit mass per vine (21.3 kg, Table 2). Since the 'UVI' variety has been grown for years in the USVI, its greater production over the other varieties is an indication that it is more "well adapted" to the soil and climate than the other passion fruit varieties. The production of the yellow x red hybrid 'TWZ' had a low number of fruits per vine but tied for the third greatest in the total mass of fruit produced.

'Noel's Special' had the lowest fruit production which may be due the fact that it was established in the field a month after the other varieties were planted. 'Noel's Special' is a hybrid developed in Hawaii and propagated by nodal cuttings.

The 'UVI' variety yielded fruits with the greatest mass per vine per harvest (Table 3). Both 'UVI' and 'Taiwan' produced about 10 fruits per vine per harvest. However, the average mass per fruit was equal for the varieties 'UVI', 'Noel's Special' and 'TWZ' indicating that the fruit size of these varieties is the same. The variety 'Taiwan' had the lightest and smallest fruits. The 'UVI' variety had the most vigorous vine growth while the 'Taiwan' variety appeared to indicate mineral stress from the high pH calcareous soils.

Table 2. Total number of fruits and their mass produced per passion fruit vine during the first fruiting cycle from November through January.

Variety	Fruits/Vine	Kg/Vine
UVI	263.3	21.3
C Mkt	220.7	14.2
Esp	123.7	8.7
Twn	115.7	6.1
Nl Spl	29.7	2.4
HPAS	115.5	7.1
TWZ	108.7	8.7

Table 3. Average passion fruit production per vine at each harvest during the first fruiting cycle from November through January.

Variety	Fruits/Vine/ Harvest	Grams/Vine/ Harvest	Grams/ Fruit
UVI	10.12	820.3	81.1
C Mkt	8.49	545.3	66.9
Esp	7.73	545.1	65.4
Twn	9.64	508.4	51.5
Nl Spl	1.56	126.7	81.2
HPAS	5.50	337.9	62.8
TWZ	4.18	332.8	82.2

Passion fruit is grown for the juice extracted from the pulp of mature fruits. The local USVI varieties 'UVI' and 'TWZ' produced the largest amount of pulp that also had the highest % brix reading indicating a sweeter juice than the other varieties (Table 4). The pH of the juice was in a range from 3.19 to 3.65. This pH range falls between the pH for vinegar 3.0 and tomato juice 3.7. Because of the strong flavor of the passion fruit juice, it is used at a 6x dilution.

Table 4. Average fruit pulp and juice quality measurements of passion fruit during the first fruiting cycle from November through January.

Variety	Pulp Vol. (ml)	% Brix	pH
UVI	41.6	17.3	3.56
C Mkt	26.6	16.2	3.19
Esp	34.2	16.3	3.39
Twn	28.0	15.2	3.42
Nl Spl	38.2	16.0	3.65
HPAS	34.4	16.2	3.37
TWZ	40.5	16.6	3.52

Establishing passion fruit vines is expensive due to the initial investment in the trellis. However, some of the initial investment costs are recovered by the sale of the fruit produced the first year. The yellow variety 'UVI' found in the USVI is very productive during its first fruiting cycle indicating its adaptability to the local soils and climate. Its large fruit size and high pulp content was sweeter than the other six passion fruit varieties evaluated. Because these are only results from the first fruiting cycle, further data needs to be collected to determine if this variety maintains its production capability over time.

REFERENCES

Bridgemohan, P (1993) The performance of selected high yielding passionfruit lines in Dominica. Tropical Fruits Newsletter. 8:10-11.

Chan, HT (1980) Passion Fruit. In S Nagy, PE Shaw eds. Tropical and Subtropical Fruits Composition, Properties and Uses. AVI Publishing, Inc. Westport, CT pp. 300-315.

Cole, DL, TR Hedges, T Ndowora (1992) A wilt of passion fruit (*Passiflora edulis* f. *edulis* Sims) caused by *Fusarium solani* and *Phytophthora nicotianae* var. *parasitica*. Trop. Pest Man. 38:362-366.

Duke, JA, JL duCellier eds. (1993) CRC Handbook of Alternate Cash Crops. CRC Press Boca Raton, FL pp. 353-364.

Hammer, LH (1987) The pollinators of the yellow passionfruit—Do they limit the success of *Passiflora edulis* f. *flavicarpa* as a tropical crop? Proc. Fla. State Hort. Soc. 100:283-287.

Knight, RJ (1992) Characters needed for commercially successful passion fruit. Proc. Fla. State Hort. Soc. 105:280-282.

Knight, RJ (1994) Problems and opportunities in passion fruit culture and development. Fruit Var. J. 48:159-162.

Martin, FW, HY Nakasone (1970) The edible species of *Passiflora*. Econ. Bot. 24:333-343.

Ploetz, RC, (1991) Sudden wilt of passionfruit in southern Florida caused by Nectria haematococca. Plant Dis. 75:1071-1073.

Robin, G (1992) The effect of type of trellis and pruning on passion fruit yields in Dominica. Proc. Caribbean Food Crops Soc. 28:455-467.

Ruggiero, C, A Lam-Sanchez, DA Banzatto (1976) Studies on the natural and controlled pollination in yellow passion fruit (*Passiflora edulis* f. *flavicarpa* Deg.). Acta Hort. 57:121-123.

Smith, NJH, JT Williams, DL Plucknett, JP Talbot eds. (1992) Tropical Forests and their Crops. Cornell University Press, Ithaca, NY pp.178-185.

Velez Colon, R (1997) Passion fruit production using two different trellis systems. Proc. Caribbean Food Crops Soc. 33: (in press)