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TOMATO GERMPLASM EVALUATION FOR GROWTH AND PRODUCTIVITY IN THE VIRGIN ISLANDS.

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ABSTRACT

Five tomato (*Lycopersicon esculentum*) cultivars, Calypso, Celebrity, Caraibo, Floradade and UH-N69, were field grown during two seasons (spring of 1991 and 1992) to evaluate their growth characteristics and productivity in the U.S. Virgin Islands. In 1991, highest total yields of 44.9, 41.7 and 40.3 ton/ha were produced by UH-N69, Floradade and Celebrity; respectively. Cultivars UH-N69 and Floradade produced the largest quantity of marketable fruits (41.8 and 38.2 ton/ha, respectively). The mean fruit size of Floradade (174 g), Celebrity (170 g), Calypso (169 g) and UH-N69 (163 g) were all significantly larger than fruits of Caraibo (125 g). Fruits of Celebrity and Calypso contained the highest percentage of total soluble solids of 4.5 and 4.7%, respectively. In 1992, yields of all cultivars were generally lower than those obtained in 1991 due to severe infestation of whiteflies and disease infection. Cultivars UH-N69 and Celebrity produced high marketable yields of 32.3 and 30.0 ton/ha, respectively. These cultivars displayed more vigorous growth resulting in plants that were taller than other cultivars. Fruits produced by Celebrity, Calypso and Floradade were larger than Caraibo. In these trials, Celebrity, Floradade and UH-N69 were the best cultivars for fresh market tomato production in the Virgin Islands.

INTRODUCTION

Tomato (*Lycopersicon esculentum*) is one of the most important cash crops in the world. An estimated 45 million tons are produced on 2.2

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million hectares annually, of this only 15% are produced in the tropics (Villareal, 1980). Tomato is the highest value crop in the United States after potato (McCollum and Ware, 1968). Compared to other fruits and vegetables, tomatoes are not very nutritious and they do not rank high in the concentration of any particular dietary components. However, because of the large consumption of tomatoes in the United States, tomato ranks 3rd in the actual source of vitamins A and C (Adams and Richardson, 1977). In the Virgin Islands and the wider Caribbean, tomato is the most popular vegetable and its culinary uses, including fresh and processed, are endless.

Tomato, unlike many other vegetables requires many costly inputs therefore selecting the best cultivars is a very important step in increasing the returns of these inputs. Many cultivars are available for the fresh market, each with its own characteristics and value, therefore it is very important that farmers select cultivars that will bring the best economic returns. Although tomato is classified as a warm season crop it requires warm days (25-30°C) and cool nights (15-20°C). Two of the most limiting factors in tomato production in the tropics are the high (above 20°C) night temperature and the seasonal rainy conditions. High temperatures severely limit the fruit setting process which results in poor yield (Villareal, 1980). Heavy tropical rains can cause fruit cracking or checking unless fruits are tolerant to these disorders (Scott and Jones, 1991). Hot, rainy conditions are also ideal for the development of several tomato diseases including bacterial spot and bacterial wilt (Pilgrim and Francis, 1984). In the Virgin Islands tomato is usually grown during the winter months of December through April when climatic conditions (near optimum temperatures and low rainfall) are most favorable. The selection of tomato cultivars by local farmers is subject to the availability of seeds in the local market. Presently the most commonly grown varieties in the Virgin Islands are Calypso and Celebrity. These varieties have been traditionally grown by farmers in the Virgin Islands. There is a need to evaluate new and improved cultivars for seasonal adaptability and production in the Virgin Islands.

The objective of this two year study was to determine the best cultivars for the Virgin Islands at the most favorable growing period of the year.

MATERIALS AND METHODS

This study was conducted at the University of The Virgin Islands Agricultural Experiment Station on St. Croix. The soil is a Fredensborg clay loam. This series consists of a well drained soil formed over limestone or marl (Rivera et al., 1970).

Tomato seeds of five cultivars (Celebrity, Floradade, Caraibo, Calypso and UH-N69) were planted in Pro mix (Premier brands Stamford Ct.) in February 1991 and January 1992. Seedlings were transplanted in the field plots thirty days after seeding. The experimental design was a randomized complete block with four replications. Each replication contained three rows 5.5 m long with plant spacing of 45 cm between plants and 1.2 m between rows. A trellis system made of "goat wire" and metal fencing post were used as plant support. Tomatoes were tied, suckered and pesticides applied based upon standard commercial recommendations. The irrigation system consisted of submains of 19 mm polyethylene hose and laterals of bi-wall (15) tubing (Hardie Irrigation El Cajon, Ca.). Soil moisture levels were maintained at field capacity. A complete fertilizer of 12-12-12 was band applied in a split application at the rate of 215 kg/ha, one at transplant and the other at the first harvest. Fruits were harvested at the turning-to-ripe stage, with the first harvest approximately eight weeks after transplanting. In the first year, fourteen harvests were made and in the second year, due to a heavy infestation of pin worms and whiteflies, ten harvests were made. Total and marketable yield data were collected along with plant height, stem diameter, fruit size, total soluble solids and juice acidity (pH). All data were analyzed using the ANOVA and GLM procedures of SAS (SAS Institute, Cary N.C.).

RESULTS AND DISCUSSION

In 1991, UH-N69, Floradade, and Celebrity produced total yields of 44.9, 41.7, and 40.3 ton/ha, respectively. The total yield from UH-N69 was significantly higher ($P < 0.05$) than the total yield of Caraibo. UH-N69 produced significantly higher ($P < 0.05$) marketable yields than all cultivars except Floradade (Table 1). Celebrity had the highest amount of non-marketable fruits (23%) due to a high

incidence of fruit cracking. Fruits from the cultivar Caraibo with a mean weight of 124.7 g were significantly smaller than the other cultivars (Table 1). No differences were observed in pH or total soluble solids content (Table 4).

Total marketable yields for all cultivars were generally lower in 1992 due to a severe infestation of whiteflies and pinworms. UH-N69 and Celebrity produced marketable yields of 32.3 and 30.0 ton/ha, respectively (Table 2). Fruits of Caraibo with a mean weight of 113.5 g were significantly smaller than the other cultivars (Table 2). Plants of cultivar Celebrity and UH-N69 were taller than the other cultivars (Table 3). UH-N69 had the smallest stem diameter; however, this characteristic did not affect yield. In 1991, fruits of Celebrity and Calypso had the highest percent of total soluble solids of 4.5 and 4.7%, respectively (Table 4). Percent total soluble solids were lower in 1992 compared to 1991. Increased percentage of total soluble solids is responsible for improved flavor in fruits of tomato cultivars (Casas Diaz et al., 1987). The five tomato cultivars can be separated based on their weekly production levels. Calypso, Caraibo and UH-N69 produce higher yields in week two and three, while Floradade and Celebrity produce higher yields after week three. This late yielding characteristic of Celebrity and Floradade makes them very susceptible to pests and diseases which becomes more severe in the latter part of the growing season. Harvesting of Caraibo fruits demanded more labor than other cultivars due to a combination of larger number of significantly ($P < 0.05$) smaller fruits and shorter plants (Tables 1, 2 and 3).

Based on this study UH-N69, Celebrity and Floradade can be recommended as the best cultivars for fresh market production in the Virgin Islands.

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Table 1. Yield and fruit size of tomato cultivars (1991)

Cultivar	Total yield (ton/ha)	Marketable yield (ton/ha)	Fruit size (g)
Calypso	36.9 c	33.0 c	168.5 a
Caraibo	37.3 bc	35.8 bc	124.7 b
Celebrity	40.3 ab	31.1 c	169.5 a
Floradade	41.7 ab	38.2 ab	173.5 a
UH-N69	44.9 a	41.8 a	163.2 a

Mean separation by Duncan's multiple range test, P=0.05.

Table 2. Yield and fruit size of tomato cultivars (1992).

Cultivar	Total Yield (ton/ha)	Marketable Yield (ton/ha)	Fruit size (g)
Calypso	27.9 a	23.8 a	181.0 a
Caraibo	29.6 a	26.5 a	113.5 b
Celebrity	34.7 a	30.0 a	182.5 a
Floradade	26.0 a	22.4 a	157.8 a
UH-N69	36.0 a	32.3 a	148.0 a

Mean separation by Duncan's multiple range test, P=0.05.

Table 3. Plant height and stem dia. of tomato cultivars (1992)

Cultivar	Plant ht. (cm.)	Stem dia. (cm.)
Calypso	83.2 ab	15.2 ab
Caraibo	70.5 c	15.1 ab
Celebrity	88.5 a	15.9 a
Floradade	74.8 bc	15.7 a
UH-N69	86.1 ab	13.6 b

Mean separation by Duncan's multiple range test, P=0.05.

Table 4. Total soluble solids and pH of tomato cultivars.

Cultivar	Total Soluble (1991)	Solids (%) (1992)	pH
Calypso	4.5 a	3.2 a	4.3 a
Caraibo	3.6 a	3.1 a	4.2 a
Celebrity	4.7 a	3.5 a	4.0 a
Floradade	3.4 a	3.3 a	4.2 a
UH-N69	3.6 a	3.4 a	4.2 a

Mean separation by Duncan's multiple range test, P=0.05.