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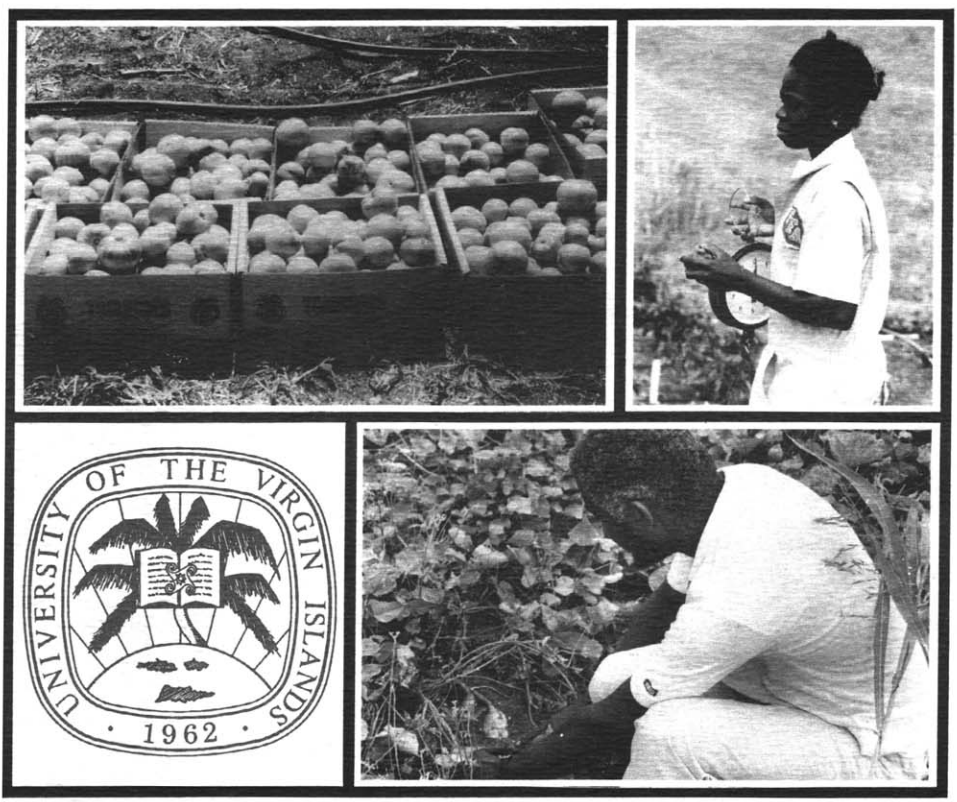
YIELD PERFORMANCE OF SELECTED VEGETABLE VARIETIES IN THE U.S. VIRGIN ISLANDS 1988-1992



Agricultural Experiment Station
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St. Croix, U.S. Virgin Islands

Agricultural aides Nelson Benitez and Rey Vasquez showing fresh harvested bell pepp

On the cover:
Top left: fresh harvest tomatoes from 1992 spring variety trial.
Top right: Chiku Hodge, student assistant, weighing yield samples of bell peppers.
Bottom left: Stafford Crossman, research specialist, examining sweet potato storage roots for size and weevil damage.

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YIELD PERFORMANCE OF VEGETABLE VARIETIES IN THE U.S. VIRGIN ISLANDS 1988-1992

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INTRODUCTION

Present Status of Vegetable Production

The vegetable industry in the U.S. Virgin Islands (USVI) is in a state of slow revival and growth. Since the decline of crop farming in the 1960s and the devastating effect of Hurricane Hugo in 1989, there has been some rapid growth in vegetable production. Although the overall size of farms declined in the past 30 years, there is a trend of increase in the number of small-sized vegetable farms. The number of vegetable farms increased from 32 in 1960 to 46 in 1983 and then decreased to 31 by 1987 (McElroy and Albuquerque, 1985; Moore, 1991). At present there are approximately 36 vegetable farms in the USVI, mainly operated by part-time growers.

These farms grow a variety of crops including tomato (***Lycopersicon esculentum***), eggplant (***Solanum melongena***), pepper (***Capsicum annuum***), okra (***Abelmoschus esculentus***), cucumber (***Cucumis sativus***), green beans (***Phaseolus vulgaris***), onions (***Allium cepa***), lettuce (***Lactuca sativa***) and a variety of herbs. Estimated sales of these crops grossed $239,762 in 1990 (Moore, 1991). Lettuce and tomato had the highest value during the last ten years. Tomatoes alone accounted for about 50 percent of all vegetables sales in 1987, at a total value of $113,664 (Moore, 1991).

Local vegetable production falls short of meeting market demands. It is estimated that local production supplies only five to ten percent of the total produce sold in the market (Mullins and Bohall, 1974; Dominique, 1990). Most vegetables are imported from the U.S. mainland and other countries.

In 1987, the USVI imported 5,865 metric tons of vegetables from the U.S. mainland with a value of $4.78 million (Bureau of Economic Research, 1988). In the same year, about 1,400 metric tons of vegetables from other countries were shipped to the USVI (Pearrow, 1991). The cost of importing vegetables increases retail market prices, which are 17 to 29 percent higher than Puerto Rico and the U.S. mainland.

Constraints to Vegetable Production

The vegetable industry in the USVI is facing major physical, technical and socio-economic constraints. Limited land and water resources, high cost of production inputs and labor, lack of appropriate technology, lack of credit and inadequate marketing systems are the major constraining factors to vegetable production in the USVI (Gerber, 1979; Mullins and Bohall, 1974).

Potential of Commercial Vegetable Production

Despite the major constraints, there is a potential for small to medium-scale commercial vegetable production in the USVI (Gerber, 1979). First, with the land that is available and improved production technology including drip irrigation, most currently imported vegetables can be grown in the islands throughout the year. Secondly, the demand for locally-grown fresh produce by the tourist industry and local population is always high. In these potential markets, higher prices can be obtained for high quality produce. Finally, the present marketing system in the Virgin Islands could be adjusted to accept locally-grown produce if it were available on a regular basis in sufficient quantity.

For commercial vegetable enterprises to become viable and profitable, growers must be able to meet market demands in terms of vegetable variety preferences, volume, quality and seasonal requirements. Currently, little

information on improved vegetable production technology is available to USVI growers. However, information on new and improved vegetable varieties is released every year by seed companies and research institutions in the U.S. and around the world. Some of these varieties are developed for semi-arid, tropical conditions and their performance should be evaluated in the USVI.

There is a need for continuous screening of new vegetable varieties to determine if they would be suitable for the Virgin Islands. These screening trials determine adaptability and yield potentials, efficiency of resource use, production costs and profitability.

Objectives of the Study

The objectives of the vegetable variety evaluation project were:

1. To evaluate the yield performance, quality of production, and pest and disease resistance of new varieties of popularly grown vegetables in the Virgin Islands.
2. To introduce different vegetable crop species and evaluate their horticultural characteristics and market acceptability.
3. To determine the influence of season or planting date on the production of different vegetable crops.

REVIEW OF PREVIOUS VEGETABLE VARIETY EVALUATION STUDIES

Vegetable variety evaluation trials have always been a component of the Vegetable Crops Program at the University of the Virgin Islands Agricultural Experiment Station (AES). The first series of variety trials was conducted in 1978 and 1979. These trials included cucurbits (cucumber, squash, muskmelon, pumpkin and watermelon), seeded crops (okra, beans, spinach, carrots, onion and leek), and the brassicas (cabbage, cauliflower, broccoli, mustard, kohlrabi and collards).

In 1981, Ramcharan published the results of his variety trials with tomato, pepper and eggplant, which included 11 varieties of eggplant, 18 varieties of pepper and 25 varieties of tomato. Most varieties from the U.S. mainland performed well.

Two years later, Navarro (1982) presented a summary of vegetable research at the Experiment Station. Twenty eight varieties of tomatoes from the U.S., Japan, Hawaii and Trinidad were evaluated, and the results showed that varieties from Hawaii and Trinidad performed better than varieties from the U.S. Other vegetable crops evaluated were snap and pole beans, onions, okra and root crops including sweet potato (***Ipomoea batatas***), cassava (***Manihot esculenta***) and yam (***Dioscorea sp.***).

In 1984, Ramcharan and Gerber reported the results of their study on the evaluation of tomato varieties for wet season planting. Varieties from Hawaii were the earliest to flower and fruit, while most of the varieties from U.S. mainland were late-maturing. They reported major problems with tomato fruit worm and fruit rot.

There were no published reports on the adoption by growers of the best varieties identified in the variety trials, but some of these varieties were later observed on local farms.

From 1983 to 1986, a series of vegetable variety trials was conducted at AES, consisting of 13 varieties each of sweet pepper, eggplant and tomato (Petersen, 1987). Results indicated that many varieties performed well under local growing conditions. In terms of marketable yield, the best varieties for sweet pepper were Jupiter, California Wonder and Yolo Wonder. For eggplant, Burpee Hybrid, Midnite, Black Jack and Black Beauty were the best varieties. Most of the hybrid tomato varieties performed well, including Revolution, Liberty, Count II, Celebrity, Mountain Pride, President, Calypso, Floramerica, Duke and Independence. Marketable yields of over 40 t ha^{-1} were obtained from these varieties. There was no report on the degree to which these varieties were adopted by farmers, but varieties like Celebrity and Calypso are now being grown on local farms.

Well-adapted cultivars with major economic importance are a prerequisite to profitable vegetable production (Maynard, 1986; Stall, 1988). For the Caribbean, cultivars recommended for the Southeast and/or West coast of the U.S. can be be used as a first approximation. Cultivars must be also tested for the best fit into the desired market. Vegetable cultivars may be adapted to local growing conditions, but if consumer preference is low, production will not be profitable.

In the USVI, vegetable crops with major economic importance are tomato, cucumber, pepper, eggplant, okra, lettuce and onion. These crops are always in high demand and constitute the major imports. Feasibility studies conducted by Mullins and Bohall (1974) indicated that profit potential for USVI growers appears best for tomato, okra and onions. However, the profit potential of other crops is high when they are produced during off-seasons, when market price of imported produce is high.

LOCATION OF FIELD EVALUATION TRIALS

The series of field trials to determine yield performance of vegetable varieties were conducted in experimental plots at the University of the Virgin Islands Agricultural Experiment Station in St. Croix. The station is located at latitude 17°43'N, and longitude 64°42'W with elevation of 33.5 m (100 ft). The climate is semiarid with average annual rainfall of 1016 mm (40 inches). Rainfall averages more than 100 mm.month^{-1} from August to November, which is considered wet season. December to July is the dry season. The average temperature is 26°C.

The soil at AES is characterized as Fredensborg loamy, fine, carbonitic, isohyperthermic, shallow, typic Calciustolls (Lugo-Lopez and Rivera, 1980). Topsoil (0-20 cm) is dark grayish-brown with subangular blocky structure, is moderately alkaline (pH 7.90) and has relatively low organic matter content (<2.0%). Because of the high pH, the soil is generally high in calcium and low in sulfur and micronutrients such as iron, manganese and zinc.

PROCEDURES AND RESULTS

TOMATO VARIETY TRIAL

Four tomato field trials were conducted between 1988 and 1992. In 1988, a spring trial was established using eight varieties developed and recommended in the mainland U.S. and Hawaii. This was followed by a summer trial using 12 heat-tolerant tomato lines from the Asian Vegetable Research and Development Center (AVRDC) in Taiwan. During the spring of 1991 and 1992, trials were conducted using five varieties developed in the mainland U.S. and Hawaii.

Spring, 1988

The eight varieties evaluated in this trial were Calypso, Capitan, Duke, Pole King, Luxor, UH-N52, UH-N69 and Tropic. Tomato seeds were sown on 2.54 cm Jiffy pellets on March 1, 1988. Transplants were field-planted on March 30 at a spacing of 91 cm between rows and 61 cm between plants. Each variety was planted in three-row plots measuring 6.1 m x 2.7 m. The trial was established in a randomized complete block design with three replications. The plants were fertilized with complete fertilizer (20% N, 20% P_2O_5, 20% K_2O) at the total rate of 234 kg ha^{-1}. The total fertilizer rate was split-applied, one half a week after transplanting and the remaining half at flowering stage.

Weeds were controlled by hand-weeding. Insect pests and diseases were controlled by using the recommended insecticides and application rates for tomatoes. Pesticides used during the course of the experiment were Guthion, Lannate, Diazinon and Kocide. All plots were drip-irrigated to maintain soil moisture at field capacity.

Table 1. Total marketable yield of tomato varieties grown in spring, 1988, at UVI-AES.

Variety	Marketable yield[1] (t ha^{-1})	Fruit size (g)
Capitan	28.7 a	142
UH-N69	12.6 b	170
UH-N52	12.1 b	142
Luxor	11.6 b	227
Pole King	5.8 c	199
Calypso	4.9 c	199
Tropic	3.9 c	199
Duke	2.7 c	142

[1]Means within a column followed by the same letter are not significantly different by Duncan's Multiple Range Test, (P=0.05).

Tomatoes were harvested at the full ripe or turning stages. Six harvests were performed during the trial. The first harvest was conducted on May 23 and the last on June 21. The harvest period lasted for 31 days. Yields were determined from the center row of each three-row plot.

Data on marketable yield and fruit size are presented in Table 1. Among the eight varieties, Capitan produced the highest yield of 28.7 t ha^{-1}. Calypso, Duke, Pole King and Tropic produced yields lower than 6.0 t.ha^{-1}. Luxor, UH-N52 and UH-N69 produced yields of 11 to 12 t ha^{-1}. The latter two varieties have some resistance to nematodes and were developed by the University of Hawaii. They were expected to perform better in hot dry climates. Variety Luxor produced the largest fruit (227 g), while varieties Calypso, Pole King and Tropic had a fruit that was similar in size (199 g). Although variety Capitan produced the highest yield, the fruits were small (142 g). Varieties UH-N52 and UH-N69 also produced smaller fruits (142 and 170 g, respectively). The data suggest that for the spring tomato growing season, Capitan would be the best variety for the Virgin Islands in terms of total yield.

Summer, 1988

This trial was conducted with the main objective of evaluating heat-tolerant tomato varieties developed by the Asian Vegetable Research and Development Center (AVRDC) in Taiwan. Twelve heat-tolerant tropical tomato lines were tested during the summer of 1988. These advanced lines carry additional good traits such as resistance to diseases (other than bacterial wilt), fruit firmness, cracking resistance and improved fruit size.

The 12 tomato lines were planted along with a check variety, Capitan. Similar experimental procedures and cultural practices were followed as in the spring trial, except that tomato seeds were direct-seeded instead of transplanted. Seeds were planted on June 27, 1988. Tomato fruits were harvested for fresh market when the blossom end turned pinkish or reddish. The first of five harvests was performed on September 6; the last was on September 28. The plants grew for 71 days from seeding to first harvest and 93 days to last harvest.

Total marketable yields of the varieties evaluated are presented in Table 2. Of the 12 varieties, only one produced a yield which was statistically similar with Capitan (the check variety). Variety CL 5915-390D_4-1-2-0 yielded 15.6 t ha^{-1} compared with 18.4 t ha^{-1} for Capitan. Variety CL 5915-153D_4-3-3-0 ranked third with a yield of 10.0 t ha^{-1}. The other lines produced yields lower than ten tons. The lowest yield of 2.2 t ha^{-1} was obtained from FMTT 6. Most heat-tolerant lines produced fruits smaller than 100 g. Only $FMTT_3$ produced fruit with average weight of 106 g, but this was still smaller than Capitan with average fruit weight of 131 g.

No serious diseases occurred during the trial, but leaf miner, stink bugs and tomato fruit worm were the common insect pests that affected the crop.

Table 2. Total marketable yield of heat-tolerant tomato varieties grown during summer, 1988, at UVI-AES.

Variety	Marketable yield[1] (t ha^{-1})	Fruit size (g)
Capitan	18.4 a	131
CL5915-390D_4-1-2-0	15.6 a	67
CL5915-153D_4-3-3-0	10.0 b	39
CL5915-93D_4-1-0-L-2	9.0 c	54
CL5915-223D_4-2-1-0	8.9 c	49
$FMTT_3$	8.9 c	106
CL5915-206D_4-2-4-0	7.9 c	78
CL5915-93D_4-1-0	7.8 c	71
CL5915-206D_4-2-2-0	7.4 c	47
CL5915-93D_4-1-0-C-1	6.7 c	62
CL5915-206D_4-2-5-0	6.1 c	86
CLN65-349D_5-0-2-0	3.7 c	44
$FMTT_6$	2.2 c	80

[1]Means within a column followed by the same letter are not significantly different by Duncan's Multiple Range Test,(P=0.05).

The yield data indicate that at least one heat-tolerant line has potential for tomato production in the Virgin Islands. A repeat of the evaluation trial is required before varieties are recommended for spring or summer planting.

Spring, 1991

The objective of this trial was to evaluate tomato varieties for spring planting. The varieties were selected from seed catalogs and included Floradade, Celebrity Hybrid, Calypso, Caraibo and UH-N69.

Seeds were planted in Jiffy-7 pellets on February 5, 1991. Twenty eight days later, seedlings were transplanted to well-prepared plots measuring 5.5 x 3.7 m. Each plot consisted of three rows spaced at 1.2 m. The plants were spaced 46 cm apart within rows. The experimental design used was randomized complete block with four replications.

Plants were fertilized with 104 kg ha^{-1} of N, P_2O_5 and K_2O using a 12-12-12 commercial mixture. The fertilizer was applied twice, immediately after transplanting and after the first harvest.

Weeds were controlled by hand-weeding, while insect pests were controlled by spraying with recommended rates of Guthion, Dipel and insecticidal soap. Benlate was sprayed to control fungal diseases. The plots were drip-irrigated to maintain adequate soil moisture.

The first harvest was May 3. Harvesting frequency increased as the number of ripe fruits increased. The last of 14 harvests over 39 days was performed on June 11. Towards the end of the harvesting period, a severe infestation of white flies and leaf miners almost damaged the crop. Fruit cracking was also observed in all varieties.

As shown in Table 3, variety UH-N69 produced the highest total yield (45.0 t ha^{-1}). This was followed by Floradade (41.7 t ha^{-1}) and Celebrity (40.3 t ha^{-1}). The yields of these three varieties were not significantly ($P<0.05$) different. Calypso and Caraibo produced the lowest yields of 36.8 and 37.3 t ha^{-1}, respectively. Variety UH-N69 also produced the highest marketable yield (41.8 t ha^{-1}), followed by Floradade (38.2 t ha^{-1}). Although Celebrity ranked third in total yield, the percentage of marketable yield (77 percent) was the lowest. Marketable yields of Caraibo, UH-N69 and Floradade were higher than 90 percent.

The largest fruit (174 g) was produced by Floradade, while Caraibo produced the smallest fruit (125 g). Fruit size did not differ significantly among varieties Calypso, Celebrity, Floradade and UH-N69. The highest soluble solid content of the fruits occurred in Celebrity (4.7 percent) and Calypso (4.5 percent). Soluble solids were less than 4.0 percent in the other varieties (Table 3).

The results of this evaluation trial indicate that for late spring planting, varieties UH-N69 and Floradade are suitable for the U.S. Virgin Islands.

Table 3. Total and marketable yields, and fruit quality of tomato varieties grown in spring, 1991, at UVI-AES.

Variety	Yield (t ha^{-1})[1]		Fruit size[1] (g)	Soluble solids (%)
	Total	Marketable		
UH-N69	44.9 a	41.8 a	163 a	3.6
Floradade	41.7 ab	38.2 ab	174 a	3.4
Celebrity	40.3 ab	31.1 c	170 a	4.7
Caraibo	37.3 bc	35.8 bc	125 b	3.6
Calypso	36.8 c	33.0 c	169 a	4.5

[1]Means within a column followed by the same letter are not significantly different by Duncan's Multiple Range Test,(P=0.05).

Spring, 1992

The same varieties were planted in spring, 1992. Similar procedures were followed as in spring, 1991. The crop was planted in January and harvested in May. Yield samples were taken from a total of ten harvests.

Total marketable yields for all varieties were generally lower in 1992 compared to yields in 1991. A severe infestation of whiteflies and tomato pinworms together with secondary disease infection affected the yield potential

of all varieties. Variety UH-N69 and Celebrity produced marketable yields of 32.3 and 30.0 t ha^{-1}, respectively (Table 4). Fruits of Caraibo were significantly smaller than the other varieties. The percentage total soluble solids was lower in 1992 compared to 1991.

The five tomato varieties can be separated on the basis of their weekly production levels. Calypso, Caraibo and UH-N69 produced higher yields during the second and third week of harvest. Floradade and Celebrity produced higher yields after the third week. The late-yielding characteristic of Celebrity and Floradade contributes to higher susceptibility to pest and diseases during the latter part of the growing season. Harvesting of Caraibo fruits demanded more labor than other varieties due to a large number of small fruits and shorter plant height.

Based on this trial, Celebrity, Floradade and UH-N69 are the best varieties for fresh market tomato production in the Virgin Islands.

Table 4. Total and marketable yield and fruit quality of tomato varieties grown during spring, 1992, at UVI-AES.

Variety	Yield (t ha^{-1})[1]		Fruit size[1] (g)	Soluble solids (%)
	Total	Marketable		
UH-N69	36.0 a	32.3 a	148.0 a	3.4 a
Celebrity	34.7 a	30.0 a	182.5 a	3.5 a
Caraibo	29.6 a	26.5 a	113.5 b	3.1 a
Calypso	27.9 a	23.8 a	181.0 a	3.2 a
Floradade	26.0 a	22.4 a	157.8 a	3.3 a

[1]Means within a column followed by the same letter are not significantly different by Duncan's Multiple Range Test, (P=0.05).

Summary

The four evaluation trials identified promising varieties suitable for spring and summer plantings. Yields from spring and summer, 1988, trials were generally lower than spring, 1991, and 1992 trials. This can be explained by varietal differences and the number of harvests. The harvest period for spring, 1991, and 1992 trials was longer than the 1988 trials; thus, yields were higher. For spring planting, varieties Capitan, Celebrity, UH-N69 and Floradade are suitable, whereas Capitan and CL 5915-390$_4$-1-2-0 looked promising for summer production.

The results of these trials are insufficient for varietial recommendations since data represent only the spring (three trials) and summer (one trial) growing season. Tomatoes can be grown all year in the Virgin Islands, but the best season for yield and quality is the fall-winter growing season when cool temperatures are ideal for flower and fruit development. A repeat of the spring and summer season trials will increase the reliability of overall trial results. In addition, a fall and winter evaluation trials may identify different varieties that are suitable and high-yielding.

Charles Collingwood, research analyst, shown tying tomato vines on bamboo stakes to prevent lodging.

CUCUMBER VARIETY TRIAL

Five variety trials were conducted for cucumber during the 1988-1991 period. A trial in 1988 evaluated six varieties for winter-spring planting. No trials were conducted in 1989. In 1990, two trials were conducted, one during the spring-summer and the other during the summer-fall season. This was followed by a fall-winter, 1990-91, trial and a spring, 1991, trial. The four trials conducted during 1990-1991 evaluated only four varieties. Overall, a total of seven varieties were evaluated.

Winter-Spring, 1988

Seeds of six cucumber varieties were planted directly in trial plots on January 29, 1988. Varieties were Dynasty, Dasher II, Marketmore, Marketsett, Tropicuke and Victory. These varieties are of the slicing type and seeds were obtained from U.S. seed companies and distributors.

Varieties were planted at a 1.5-m row spacing and a 91-cm plant spacing with three rows per plot. Each variety was planted in plots measuring 4.5 x 2.73 m. The trial was laid out using a randomized complete block design with three replications. All plots were drip-irrigated to maintain soil moisture at field capacity. The first harvest was made on March 14, 1988, and the last harvest was on April 4, 1988. The crop was harvested nine times during the harvest period.

Data in Table 5 show that Victory, Dasher, Dynasty and Tropicuke produced 40.6, 30.1, 27.7 and 22.8 t ha^{-1} of marketable yield, respectively. Differences among these varieties were not significant. Marketmore and Marketsett produced lower yields of 12.6 and 7.9 t ha^{-1}, respectively. There were no significant differences in fruit size among varieties, but Dynasty produced the largest fruit of 309 g followed by Victory with 298 g. The results suggest that the four cucumber varieties performed equally well during the winter-spring season.

Table 5. Total marketable yield of slicing cucumber varieties grown in winter-spring, 1988, at UVI-AES.

Variety	Marketable yield[1] (t ha^{-1})	Fruit size (g)
Victory	40.6 a	298
Dasher II	30.1 ab	263
Dynasty	27.7 ab	309
Tropicuke	22.8 ab	270
Marketmore	12.6 c	209
Marketsett	7.9 c	192

[1]Means within a column followed by the same letter are not significantly different by Duncan's Multiple Range Test, (P=0.05).

Spring-Summer, 1990

Three of the four best varieties from the 1988 trial were evaluated in spring-summer, 1990. Because of lack of seed, Dynasty was replaced by Gemini 7. The varieties were field-planted on April 26, 1990. Plots contained three rows that were 7.3 m long. Plants were spaced 1.5 m between rows and 61 cm along the row. A fertilizer equivalent to 130 kg.ha^{-1} of N was applied two weeks after transplanting.

All plots were covered with black plastic mulch to control weeds and reduce irrigation water use. To control insect pests, regular spraying was performed at recommended rates of dipel, diazinon and malathion. All plots were drip-irrigated to maintain adequate soil moisture.

A total of 13 harvests were conducted during the growing season. The first harvest was performed on June 15 and the last on July 19, 1990.

Varieties Victory, Tropicuke and Dasher II produced the highest yields of 21.2, 18.3 and 17.6 t ha^{-1}, respectively, although yields were not as high as those obtained during the winter-spring growing season (Table 6). These yields were not significantly different. Gemini 7 produced only 13.1 t ha^{-1} of marketable yield, but had the largest fruit (288 g) among the varieties.

Table 6. Total marketable yield of cucumber varieties grown during spring-summer, 1990, at UVI-AES.

Variety	Marketable yield[1] (t ha^{-1})	Fruit size[1] (g)
Victory	21.2 a	238 b
Tropicuke	18.3 ab	228 b
Dasher II	17.6 ab	220 b
Gemini 7	13.1 b	288 a

[1]Means within a column followed by the same letter are not significantly different by Duncan's Multiple Range Test, (P=0.05).

Summer-Fall, 1990

Varieties were evaluated again during the summer-fall seasons of 1990. The varieties were planted on August 17, 1990, using a similar plot layout and experimental design as in the previous trial. The crop was harvested 18 times during the period from September 28 to November 26, 1990.

Data in Table 7 show that all varieties produced similar yields and fruit size. Victory, Tropicuke and Dasher II produced yields of more than 35 t ha^{-1}, while Gemini 7 produced 28.9 t ha^{-1} and had the largest fruit size (420 g).

Table 7. Total marketable yield of cucumber varieties grown during summer-fall, 1990, at UVI-AES.

Variety	Marketable yield[1] (t ha^{-1})	Fruit size[1] (g)
Tropicuke	36.7 a	305 a
Victory	36.4 a	290 a
Dasher II	35.0 a	275 a
Gemini 7	28.9 a	420 b

[1]Means within a column followed by the same letter are not significantly different by Duncan's Multiple Range Test, (P=0.05).

A field showing UVI-AES cucumber variety trial with drip irrigation.

Fall-Winter, 1990-1991

The four varieties were evaluated during the fall-winter season. The trial was planted on December 12, 1990, using similar field procedures as in the summer-fall trial. The crop was harvested eight times between January 23 and February 10, 1991.

Yields were generally lower than those obtained in the summer-fall planting (Table 8). All varieties produced yields of less than 17 t ha^{-1}. Tropicuke, Victory and Dasher II produced similar yields. Although Gemini 7 produced the lowest yield, it maintained the largest fruit size (434 g).

Table 8. Total marketable yield of cucumber varieties grown during fall-winter, 1990-91, at UVI-AES.

Variety	Marketable yield[1] (t ha^{-1})	Fruit size[1] (g)
Tropicuke	16.5 a	298 a
Victory	15.5 a	301 a
Dasher II	14.9 a	301 a
Gemini 7	11.6 a	439 b

[1]Means within a column followed by the same letter are not significantly different by Duncan's Multiple Range Test, (P=0.05).

Spring, 1991

A spring trial was planted on April 18, 1991, to evaluate yield performance of four varieties. Since Gemini 7 produced lower yields than the other varieties in previous trials, it was replaced by Calypso. Varieties Victory, Tropicuke and Dasher II were included in this trial. Field design and procedures were followed as in previous trials.

The crop was harvested four times between May 30 and June 11, 1991. As shown in Table 9, marketable yields were generally low. All varieties produced yields of less than 10 t ha^{-1}. There were no significant differences in yield among the varieties, but there were differences in fruit size. Dasher II, Victory and Tropicuke produced larger fruits than Calypso. Heavy disease infection, particularly powdery mildew, reduced the yield of all varieties.

Table 9. Total marketable yield of cucumber varieties grown during spring, 1991, at UVI-AES.

Variety	Marketable yield[1] (t ha^{-1})	Fruit size[1] (g)
Calypso	7.9 a	274 b
Tropicuke	7.4 a	298 ab
Victory	6.8 a	315 a
Dasher II	6.4 a	312 a

[1]Means within a column followed by the same letter are not significantly different by Duncan's Multiple Range Test, (P=0.05).

Summary

Results of the trials have shown that varieties Victory, Dasher II and Tropicuke maintained high yields. These varieties appear to be suitable for the Virgin Islands. Summer-fall and winter-spring planting seemed to be the best seasons for high cucumber yields in the Virgin Islands.

HOT PEPPER VARIETY TRIAL

Six varieties of hot pepper (*Capsicum frutescens*) were evaluated during the summer-fall season of 1988. The varieties were Anaheim, Ancho, Cayenne, Habanero, Jalapeno and Red Cherry. Seeds were sown on May 20, 1988, and seedlings transplanted on July 6, 1988.

Plots consisted of three rows spaced 90 cm apart. Rows were 7.6 m long and plants in the row were spaced 46 cm apart. The trial was arranged in a randomized complete block with three replications.

All plots were fertilized with 145 kg ha^{-1} of NPK using a 20-20-20 fertilizer formulation. The fertilizer was applied in bands about 10 cm from the base of the plants 17 days after transplanting. The plots were drip-irrigated to maintain soil moisture at field capacity. Yield samples were harvested six times between August 19 and November 10, 1988.

The highest yield of 7.78 t ha^{-1} was produced by Anaheim (Table 10). Anaheim also produced larger fruits than other varieties. Jalapeno produced the second highest yield. Cayenne, Habanero and Red Cherry all produced similar yields, while Ancho produced the lowest yield. Anaheim and Jalapeno are the two hot pepper varieties with potential for high production in the Virgin Islands.

Table 10. Total marketable yield of hot pepper varieties grown during summer-fall, 1988, at UVI-AES.

Variety	Marketable yield[1] (t ha^{-1})	Fruit size[1] (g)
Anaheim	7.78 a	26
Jalapeno	5.96 b	14
Habanero	3.57 c	6
Red Cherry	3.54 c	15
Cayenne	2.93 c	11
Ancho	1.40 d	15

[1]Means within a column followed by the same letter are not significantly different by Duncan's Multiple Range Test, (P=0.05).

EGGPLANT VARIETY TRIAL

Eggplant is a popular and important vegetable crop in the Virgin Islands. There is always a demand for eggplant since it is widely used in local dishes. It can be grown throughout the year in the Virgin Islands. In the summer-fall of 1988, a field trial was conducted to evaluate the yield performance of six eggplant varieties: Black Bell, Black Nite, Epic, Imperial, Jersey King and Midnite.

Seeds of these varieties were direct-seeded in the field on June 30, 1988. Plant spacing was 90 cm between rows and 46 cm between plants along the row. The plants were fertilized with 145 kg ha^{-1} of NPK using 20-20-20 commercial fertilizer on July 7. Each variety was planted in three rows that were 2.73 m long. The plots were arranged in a randomized complete block with three replications.

All plots were drip-irrigated to maintain soil moisture at field capacity. There were five harvests during the growing season. The first harvest was on August 9 while the last harvest was on October 5.

Black Bell, Midnite and Jersey King were the highest-producing varieties (Table 11). These varieties produced 30 t ha^{-1} of marketable fruits. Black Nite and Epic were the next highest-producing. The largest fruits were found in Black Bell and Midnite. Imperial had the smallest fruit, averaging 189 g.

The data show that eggplant varieties Black Bell, Midnite and Jersey King perform well during the summer-fall season and, therefore, are suitable for production in the Virgin Islands.

Table 11. Total marketable yield of eggplant varieties grown during summer-fall, 1988, at UVI-AES.

Variety	Marketable yield[1] (t ha^{-1})	Fruit size (g)
Black Bell	30.8 a	350
Midnite	30.7 a	350
Jersey King	29.9 a	275
Black Nite	20.8 b	269
Epic	20.4 b	278
Imperial	16.1 b	189

[1]Means within a column followed by the same letter are not significantly different by Duncan's Multiple Range Test, (P=0.05).

OKRA VARIETY TRIAL

Although it is not a major crop, okra (***Abelmoschus esculentus***) is becoming important in the Virgin Islands. It is one of the favorite crops of West Indians and is grown in many backyard gardens. During the summer of 1991, an okra variety trial was conducted to evaluate the yield performance of four varieties. The varieties tested were Blondy, Clemson Spineless, Emerald Green and Perkins Mammoth.

Seeds were directly sown on May 5, 1991 at a spacing of 1.2 m between rows and 61 cm between plants along the row. The crop was fertilized with NPK at a total rate of 160 kg ha^{-1}. Each plot consisted of three rows that were 7.3 m long. The experiment was arranged in a randomized complete block with four replications.

All plots were drip-irrigated to maintain optimum soil moisture. Because of non-uniformity in plant growth, plants matured at different periods. This resulted in an extended harvest period. The first harvest was conducted on July 2 and the last harvest on September 27, 1991.

The four varieties produced similar yields, as shown in Table 12. Marketable yield ranged from 17.1 t ha^{-1} for Perkins Mammoth to 20.5 t ha^{-1} for Clemson Spineless. Fruit size varied from 20 to 24 g. The four varieties are equally suitable for summer planting.

Table 12. Total marketable yield of okra varieties grown during summer, 1991, at UVI-AES.

Variety	Marketable yield[1] (t ha^{-1})	Fruit size[1] (g)
Clemson Spineless	20.5 a	21 a
Blondy	18.5 a	20 a
Emerald Green	18.2 a	21 a
Perkins Mammoth	17.1 a	24 a

[1]Means within a column followed by the same letter are not significantly different by Duncan's Multiple Range Test, (P=0.05).

CANTALOUPE VARIETY TRIAL

A previous variety trial on cantaloupes (***Cucumis melo***), particularly muskmelon, indicated that most of the varieties tested were not suitable for local conditions as evidenced by low production of marketable fruits (Ramcharan, 1979). Most varieties were affected by downy mildew, a high incidence of ground rot and infestation by melon worms. Among the 14 varieties that were evaluated, Planters Jumbo and Resistant Joy were the only two varieties that gave reasonably good yields of 9 to 10 t ha^{-1}.

A trial was conducted during the spring season of 1989 using four varieties. They were Dixie Jumbo, Hymark, Magnum 45 and Planters Jumbo. Seeds were sown in the greenhouse on February 8 and transplanted in the field on February 13. The plants were spaced 1.52 m between rows and 1.5 m between plants in a row. Each variety was planted in three rows 7.6 m long.

The experiment was conducted using a randomized complete block with four replications. All plots were drip-irrigated to maintain adequate soil moisture. Fruits were harvested eight times between April 24 and May 12, 1989. Fruits were graded into marketable and non-marketable categories, weighed, and the soluble solids were determined using a hand refractometer.

As shown in Table 13, marketable yield ranged from 5.20 t ha^{-1} for Magnum 45 to 7.65 t ha^{-1} for Planters Jumbo. These yields are similar to those obtained in the 1979 trial. Marketable yields of Dixie Jumbo, Hymark and Planters Jumbo were not significantly different. Magnum 45 produced the lowest yield. Planters Jumbo produced the largest fruit (1.7 kg), followed by Dixie Jumbo (1.4 kg). Magnum 45 produced the smallest fruit (1.1 kg), but contained the highest soluble solids.

The result of this trial demonstrated that yields of the cantaloupe varieties tested are generally low. There is a need to screen more varieties for the Virgin Islands.

Table 13. Total marketable yield and fruit quality of cantaloupe varieties grown during spring, 1989, at UVI-AES.

Variety	Marketable yield[1] (t ha^{-1})	Fruit size (kg)	Soluble solids (%)
Planters Jumbo	7.65 a	1.69	6.5
Dixie Jumbo	6.85 a	1.38	7.5
Hymark	6.13 ab	1.22	8.5
Magnum 45	5.20 b	1.05	11.3

[1]Means within a column followed by the same letter are not significantly different by Duncan's Multiple Range Test, (P=0.05).

WATERMELON VARIETY TRIAL

The previous watermelon (***Citrullus lanatus***) variety trial was conducted in 1978-79. Of the 12 varieties evaluated in that trial, Golden Dragon from AVRDC, Taiwan, was the best-yielding variety. The marketable yield in this trial ranged from 0 to 5.03 t ha^{-1}. Some varieties produced no fruit because of poor germination and low fruit set. Other problems observed were immature fruits and blossom end rot.

The 1987-88 trial was conducted to evaluate five varieties during the winter-spring season. The varieties were Crimson Sweet, Dixie Lee, Royal Sweet, Royal Charleston and Sugar Doll.

The trial was planted in the field on December 16, 1987. Seeds were sown at spacings of 1.5 m between rows and within rows. Each variety was planted in three rows that were 7.6 m long. The experiment was arranged in a randomized complete block design with three replications.

The plots were drip-irrigated to provide adequate soil moisture. Three harvests was performed beginning on March 24, 1988. Marketable yield and fruit size were determined from harvest samples.

Marketable yield ranged from 5.00 t ha^{-1} for Crimson Sweet to 18.2 t ha^{-1} for Royal Charleston (Table 14). Blossom end rot was observed in Royal Charleston. Crimson Sweet produced the largest fruit with an average weight of 6.5 kg, followed by Hybrid Royal Sweet (6.1 kg). Sugar Doll produced the smallest fruit.

In general, yields from this trial were higher than those obtained in 1979. In the 1979 trial, Royal Charleston, Sugar Doll and Crimson Sweet produced about 2.0 t ha^{-1}. Results of the 1987 trial clearly indicate that Royal Charleston, Royal Sweet and Dixie Lee are watermelon varieties with potential for the Virgin Islands.

Table 14. Total marketable yield and fruit quality of watermelon varieties grown during winter-spring, 1987-88, at UVI-AES.

Variety	Marketable yield[1] (t ha^{-1})	Fruit size[1] (kg)	Soluble solids (%)
Royal Charleston	18.2 a	4.80 ab	-
Hybrid Royal Sweet	12.9 ab	6.11 a	8.5
Dixie Lee	11.2 ab	4.74 ab	11.0
Sugar Doll	7.3 ab	3.37 b	-
Crimson Sweet	4.9 b	6.53 a	-

[1]Means within a column followed with the same letter are not significantly different by Duncan's Multiple Range Test, (P=0.05).

A fully-developed watermelon fruit ready for harvesting.

SWEET POTATO VARIETY TRIAL

Sweet potato (***Ipomoea batatas***) is a popular crop in the Virgin Islands, and local consumption is steadily increasing. Sweet potato is one of the easiest crops to grow because it produces fairly good yields under low level of management.

There are many varieties available both commercially and from agricultural research centers. The growing period may vary from three to seven months, but most varieties produce good yields in four to five months.

In 1988 a series of sweet potato germplasm evaluation trials was initiated at UVI-AES to identify high-yielding varieties adapted to the growing environment of the Virgin Islands. An additional objective of the trial was to evaluate consumer acceptability of sweet potato varieties. Since sweet potato weevil is a serious insect pest and a threat to sweet potato production, data on the degree of infestation were also collected.

Six trials were conducted over a period of eight months (April-November). Two trials were conducted in spring-summer and another two during the summer-fall season. In 1991 and 1992, trials were established to evaluate more promising varieties. Planting materials were obtained from various sources including Puerto Rico, St. Croix, St. Kitts and Florida.

Spring-Summer, 1988

An unreplicated trial was planted on April 6, 1988, using five varieties: Station Vine, King Crown, Manicou, Antigua and Santo Domingo. Vine cuttings 30-38 cm in length were planted at a 1 m row spacing and a 50 cm plant spacing within rows. Rows were 10 m long, and each variety was planted in three-row plots.

The plots were drip-irrigated to ensure good crop establishment and development. The crop was harvested on September 1, 1988, approximately five months after planting.

Total yields ranged from 11.5 to 36.3 t ha^{-1} (Table 15). Santo Domingo produced the highest total yield, followed by Station Vine. Manicou produced the lowest total yield. Marketable yields ranged from 1.3 to 6.3 t ha^{-1}. Low marketable yield was attributed to weevil damage which reached up to 94 percent of the crop in variety Station Vine. No variety showed resistance to weevil infestation, but King Crown had less than 50 percent weevil damage.

This unreplicated trial indicates that the weevil is a major pest of sweet potato and screening varieties for resistance and evaluating effective control methods should be given high priority.

Table 15. Total and marketable tuber yield of sweet potato varieties grown during spring-summer, 1988, at UVI-AES.

Variety	Yield (t ha^{-1}) Total	Marketable	Marketable yield (%)	Weevil Damage (%)
Santo Domingo	36.3	6.3	17.4	82.1
Station Vine	21.1	1.3	6.2	93.8
Antigua	19.5	3.8	19.5	80.5
King Crown	11.8	6.1	51.7	48.3
Manicou	11.5	4.0	34.8	65.2

Note: Weevil damage is based on marketable yield.

During the same growing season a replicated trial was conducted using ten entirely different varieties. The trial was planted on May 6, 1988. Vine cuttings 30-40 cm in length were planted in three-row plots 6 m long. Plant spacing was 1 m between rows and 50 cm between plants within rows. A randomized complete block design was used with three replications. The crop was harvested on September 23, 1988.

There were differences in yield and weevil damage among varieties (Table 16). In general, both total and marketable yields were low, ranging from 0.2 to 16.6 t ha^{-1} and 0.2 to 7.1 t ha^{-1}, respectively (Table 16). Twelve Prime was the highest-yielding variety. Weevil damage was greater than 50 percent in five varieties. Varieties EAS 10 and Mont Blanc were highly susceptible, while Trompo Negro and St. George appeared to be resistant. The results of this trial indicate that Twelve Prime and Trompo Negro are promising sweet potato varieties for the Virgin Islands.

Table 16. Total and marketable tuber yield of sweet potato varieties grown during spring-summer, 1988, at UVI-AES.

Variety	Yield (t ha^{-1}) Total	Marketable	Marketable yield (%)	Weevildamage[1] (%)
Twelve Prime	16.6 a	7.1 a	46.4	55.9 ab
Mont Blanc	7.4 b	1.7 b	23.0	80.2 a
Trompo Negro	6.0 bc	5.3 a	88.3	7.4 b
EAS - 15	3.7 bc	2.2 b	59.2	49.9 ab
EAS - 13	3.6 bc	2.6 b	72.2	38.2 ab
EAS - 10	3.5 bc	1.3 b	37.1	72.2 a
Black Rock	3.2 bc	1.8 b	56.3	51.2 ab
Ninety Nine	1.8 c	0.8 b	44.4	79.6 a
St. George	0.6 c	0.4 b	66.7	11.1 b
Margarita	0.2 c	0.2 b	100.0	33.3 ab

[1]Means within a column followed by the same letter are not significantly different by Duncan's Multiple Range Test, (P=0.05).

Summer-Fall, 1988

During the summer-fall season of 1988, two germplasm evaluation trials were established. In the first trial, varieties included Agata, Amarista, Bonaro, Colorette, Dune, EAS 11, Perla, Suabor, Suabor 2 and Viola. The second trial included nine varieties: EAS 12, Labino Red, Limonette, Miguela, Squish, Tano, Tapato Fine, Viola and Whity Thany. The first trial was planted on May 16 and harvested on October 3, while the second trial was planted on May 24 and harvested on October 11. Experimental procedures, planting and cultural practices were similar to those in the previous trial.

Total yield ranged from 5.2 to 21.2 t ha^{-1}, while marketable yield ranged from 3.6 to 11.0 t ha^{-1} (Table 17). Colorette produced the highest total yield. Differences in marketable yield were not significant among varieties. Viola produced one of the lowest yields, but the percent of marketable yield was the highest (84.9 percent). Viola and Suabor 2 had the lowest weevil damage.

Table 17. Total and marketable tuber yield of sweet potato varieties grown during summer-fall, 1988, at UVI-AES, from May 10 to October 3.

Variety	Yield (t ha^{-1})[1] Total	Marketable	Marketable yield (%)	Weevil damage[1] (%)
Colorette	21.2 a	11.0 a	51.9	48.7 ab
Perla	12.6 ab	8.0 a	63.5	44.3 ab
Agata	12.2 b	5.8 a	47.5	78.9 a
Amarista	11.4 ab	6.4 a	56.1	73.9 a
EAS - 11	8.0 b	5.6 a	70.0	36.6 b
Suabor 2	7.1 b	4.7 a	66.2	26.8 b
Suabor	6.2 b	4.0 a	64.5	42.9 ab
Dune	5.8 b	4.7 a	81.0	32.7 b
Viola	5.3 b	4.5 a	84.9	26.9 b
Bonaro	4.2 b	3.6 a	69.2	46.3 ab

[1]Means within a column followed by the same letter are not significantly different by Duncan's Multiple Range Test, (P=0.05).

In the second trial, total yield ranged from 0.3 to 9.4 t ha^{-1}, and marketable yield ranged from 0.04 to 3.8 t ha^{-1} (Table 18). These yields are generally lower than those in the first set. Miguela, Toquesita, Squish, Whity Thany, Vida and EAS 12 were the best-yielding varieties. Varieties with high percentage of marketable yield were Limonette (100 percent), Tano (84.6 percent) and Vida (80.9 percent). Tapato Fine and Limonette had the lowest percentage of weevil damage.

Table 18. Total and marketable tuber yield of sweet potato varieties grown during summer-fall, 1988, at UVI-AES, from May 24 to October 11.

Variety	Yield (t ha^{-1})[1] Total	Marketable	Marketable (%)	Weevil damage[1] (%)
Miguela	9.4 a	2.0 abc	21.3	79.2 ab
Toquesita	9.0 ab	4.8 a	53.3	49.0 bc
Squish	5.7 ab	2.6 abc	45.6	51.2 bc
Whity Thany	5.4 ab	3.4 ab	63.0	37.8 cd
Vida	4.7 ab	3.8 ab	80.9	23.3 cd
EAS - 12	4.2 ab	2.4 abc	57.1	42.0 cd
Tapato Fine	1.9 b	1.8 abc	94.7	4.4 d
Tano	1.3 b	1.1 bc	84.6	10.4 d
Limonette	0.9 b	0.9 bc	100.0	5.1 d
Sabino Red	0.3 b	0.04 c	13.3	87.8 a

[1]Means within a column followed by the same letter are not significantly different by Duncan's Multiple Range Test, (P=0.05).

Spring-Fall, 1991

During the spring-fall of 1991, seven varieties were evaluated in a replicated trial. The varieties included Viola, Tapato, Sunny, Eda, Picadito, Mc and Three Months. Similar procedures were followed as in previous trials. The varieties were harvested at 120 days after planting. Total and marketable yield data were collected for storage root size and yield per plant.

Consumer preference was determined by presenting boiled slices of each cultivar to a panel. The slices were assessed for color, appearance, softness, mouthfeel, sweetness, fiber and flavor.

Total marketable yields were generally good, due to the low incidence of weevil damage. Viola, Tapato and Sunny were the best-yielding varieties in terms of production of total and marketable storage roots (Table 19). Picadito produced the largest marketable tuber weighing an average of 438 g.

A consumer preference panel rated Viola, Tapato and Sunny as having good culinary qualities, despite their relatively low sugar content. These three varieties were bred to produce in heavy soils in Puerto Rico.

There was a negligible sweet potato weevil damage in all varieties. This was not attributed to weevil resistance or tolerance, but probably due to an escape mechanism. The plot was located in an area where sweet potato had not been established for a number of years.

Table 19. Storage root yield and size of sweet potato varieties grown during spring-fall, 1991, at UVI-AES.

Variety	Yield (t ha^{-1})[1]		Root size[1] (g)	Roots/plant[1]
	Total	Marketable		
Viola	19.5 a	16.2 a	266 bc	1.8 a
Tapato	16.4 a	14.2 a	275 bc	1.5 ab
Sunny	14.3 a	13.1 a	212 bc	1.6 ab
Eda	12.3 ab	10.5 ab	286 b	1.7 a
Picadito	12.2 ab	11.3 ab	438 a	1.2 ab
Mc	3.8 b	3.3 b	188 c	0.8 ab
Three Months	3.1 b	2.6 b	205 bc	0.6 b

[1]Means within a column followed by the same letter are not significantly different by Duncan's Multiple Range Test, (P=0.05).

Spring-Fall, 1992

This trial was conducted to evaluate additional sweet potato varieties, including the highest-yielding varieties from the spring-fall, 1991, trial. Similar procedures were followed as in the previous trials, but the crop was harvested at 150 days after planting. In addition, observations were made on ease of propagation, plant vigor and ability to smother weeds.

Plant foliage was harvested by cutting the main stem at ground level. Total foliage fresh weight was recorded and sub-samples were oven-dried at 70°C to a constant weight, for dry matter determination. Marketable storage roots were examined for sweet potato weevil damage. After harvest, sub-samples of storage roots were peeled, sliced and dried at 70°C to constant weight for dry matter determination.

Results presented in Table 20 show that varieties SKB-4, CS-2 and SKB-2 produced large quantities of fresh foliage. The fresh and dry matter yields of foliage from these varieties were significantly higher than those of the other varieties. The foliage of Perla had the highest percent dry matter, but this variety produced the least foliage. Foliage yield was directly related to plant growth vigor and the ability to smother weeds which is important because vigorous vine growth can considerably reduce the number of weedings. Sweet potato foliage can be consumed as a leafy vegetable, fed to livestock or used as planting material.

Table 20. Foliage yield of sweet potato varieties grown during spring-fall, 1992, at UVI-AES.

Variety	Fresh matter[1] (t ha^{-1})	Dry matter[1] (%)	Dry matter[1] (t ha^{-1})
SKB-4	34.3 a	19.0 b	6.6 a
CS-2	28.1 a	21.1 ab	6.0 a
SKB-2	27.2 a	19.5 b	5.3 a
Sunny	16.9 b	19.3 b	3.2 b
Viola	14.8 b	18.8 b	2.7 b
Black Rock	14.4 b	20.0 ab	2.8 b
Tapato	13.4 b	20.0 ab	2.6 b
Trompo Negro	12.2 b	17.8 b	2.2 b
Perla	9.2 b	23.2 a	2.1 b

[1]Means within a column followed by the same letter are not significantly different by Duncan's Multiple Range Test, (P=0.05)

Varieties from USDA-TARS (Perla, Viola, Tapato and Sunny) produced the highest total and marketable yields (Table 21). These are similar to the results obtained from the 1991 trial. Perla, Viola, Tapato and Sunny produced higher total and marketable yields than all other varieties. Trompo Negro and Black Rock produced the lowest total and marketable yields.

The highest-yielding varieties displayed weevil damage equivalent to 2.0 t ha^{-1}, with the exception of Tapato (0.4 t ha^{-1}). Tapato had the largest tuber with average weight of 446 g (Table 21). In Puerto Rico this cultivar produces large roots that are considered useful for industrial purposes. Black Rock and Trompo Negro produced the smallest sweet potatoes.

Table 21. Storage root yield, size and weevil damage of sweet potato varieties grown in spring-fall, 1992, at UVI-AES.

Variety	Total yield[1] (t ha^{-1})	Roots of Marketable Size			
		SPW[2] (t ha^{-1})	Yield[1] (t ha^{-1})	Size[1] (g)	Dry matter[1] (t ha^{-1})
Perla	28.6 a	2.0	24.5 a	306 b	7.3 a
Viola	26.8 a	2.0	21.9 a	238 bcd	7.3 a
Tapato	22.9 ab	0.4	21.4 a	446 a	6.0 ab
Sunny	22.8 ab	2.0	17.3 ab	260 bc	5.1 bc
SKB-2	18.3 b	1.6	12.9 bc	275 bc	4.2 bc
CS-2	15.3 bc	0.8	9.2 cd	192 cd	3.4 cd
SKB-4	15.0 bc	1.7	10.3 cd	213 bcd	3.8 cd
Trompo Negro	8.1 cd	1.3	5.1 de	167 d	2.0 de
Black Rock	6.5 d	0.8	1.7 e	129 de	0.7 e

[1]Means within a column followed by the same letter are not significantly different by Duncan's Multiple Range Test, (P=0.05).
[2]SPW - Sweet potato weevil damaged storage roots of marketable size.

Trompo Negro and Black Rock produced less fresh and dry biomass than the other cultivars (Table 22). The biomass produced by SKB-4, SKB-2, Viola and CS-2 was over 40 t ha^{-1} (fresh) and 11.0 t ha^{-1} (dry), twice the amount produced by the lowest-yielding varieties Trompo Negro and Black Rock.

Perla, Tapato and Sunny produced vines that make propagation, handling and crop establishment more tedious than for the other varieties. However, these varieties along with Viola, which produced a similar quantity of foliage,

gave the highest root yields. Thus, there is an inverse relationship between foliage and storage root production. However, excessive top growth may result in low root yield. There was a tendency for low-yielding varieties to have a higher percentage of dry matter in their storage roots, compared to high-yielding varieties.

The 1991 and 1992 trials suggest that varieties from USDA-TARS are well-adapted for sweet potato production in the Virgin Islands in terms of yield and sweet potato weevil tolerance.

Table 22. Biomass production of sweet potato varieties grown during spring-fall, 1992, at UVI-AES.

Variety	Biomass Production (t ha^{-1}) Fresh	Dry
SKB-4	49.3 a	12.1 a
SKB-2	45.5 a	11.3 a
Viola	41.6 a	11.6 a
CS-2	40.9 a	11.5 a
Sunny	39.7 a	9.9 a
Perla	37.8 a	10.6 a
Tapato	36.3 a	9.1 a
Black Rock	20.9 b	5.3 b
Trompo Negro	20.2 b	5.3 b

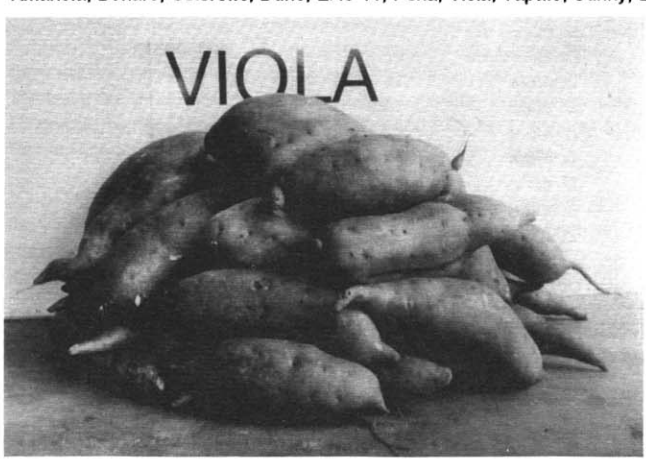
[1]Means within a column followed by the same letter are not significantly different by Duncan's Multiple Range Test, (P=0.05).

Summary

This series of trials provided useful research information on the field performance of sweet potato varieties. One important observation was the reaction of sweet potato varieties to weevil infestation. A variety may produce high total yields, but it can also be highly susceptible to weevil damage. A high percentage of weevil damage significantly reduces marketable yield.

In terms of total yield, promising sweet potato varieties for the Virgin Islands include Santo Domingo, Station Vine, Antigua, Twelve Prime, Agata, Amarista, Colorette, Miguela, Perla, Viola, Tapato, Sunny, SKB-2, CS-2, Picadito and SKB-4.

In terms of marketable yield, the promising varieties are King Crown, EAS 12, EAS 15, Margarita, St. George, Amarista, Bonaro, Colorette, Dune, EAS 11, Perla, Viola, Tapato, Sunny, Eda, SKB-2 and SKB-4.



Viola, a high-yielding sweet potato cultivar with good culinary qualities.

YAM VARIETY TRIAL

Yam is a popular crop in the Caribbean. Yams are frequently used in intercropping systems. In the Virgin Islands, yams are interplanted with corn, pigeonpea, and cassava. Although yields of both crops are reduced in intercropping, total productivity is higher than that obtained with monoculture of either crop.

Yields of local yam varieties are relatively lower than those of the improved varieties. To determine the potential of improved yam varieties, a trial was conducted in the summer of 1988. The varieties were planted on June 1, 1988, in an unreplicated trial. The varieties came from three species: ***Dioscorea alata, Dioscorea esculenta*** and ***Dioscorea rotundata.*** Varieties of ***D. alata*** were Binugus, Gunung, Seal Top, Gemelos, Forastero and Florido. Varieties of ***D. esculenta*** were: Doli, Kombi and Seti. Habanero was the only variety in the ***D. rotundata*** species.

The varieties were planted using cut tubers weighing approximately 115 g. Plant spacing was 1 m between rows and 50 cm between plants within rows. Each plot measured 12 m and consisted of only one row. The plots were fertilized with 50N, 50P and 25K, all in kg ha^{-1}. The fertilizer was applied two months after germination. To correct the symptoms of iron deficiency, Ferromec was applied two months after planting.

All plots were drip-irrigated to ensure good crop establishment. Weeds were controlled by hand-weeding while insect pests were controlled by two sprayings of malathion. To protect the plants from fungal diseases one spraying of Dithane M45, four sprayings of kocide and two applications of Bordeaux mixture were performed.

The crop was harvested on March 1, 1989, approximately ten months after planting. Data on Table 23 indicate that yields ranged from 8.9 to 33.8 t ha^{-1} for the varietes in the ***D. alata*** and 5.3 to 20.1 t ha^{-1} for the ***D. esculenta*** varieties. The lowest yield (2.6 t ha^{-1}) was obtained from the ***D. rotundata*** variety. Among the ***D. alata*** varieties, Binugus produced the highest yield followed by Seal Top and Forastero. Gemelos and Gunung both produced yields of 12.0 t ha^{-1}. Among the ***D. esculenta*** varieties, Seti was the best-yielding variety, followed by Doli.

The result of this unreplicated trial would indicate that improved yam varieties of ***D. alata and D. esculenta*** species may perform better than the ***D. rotundata***, although more varieties should be included from the later group in future trials. Replicated trials are needed to verify these results.

Table 23. Yield of yam varieties grown during summer 1988, to spring, 1989, at UVI-AES.

Variety	Species	Yield (t ha^{-1})
Binugus	***D. alata***	33.8
Seti	***D. esculenta***	20.1
Doli	***D. esculenta***	17.1
Seal Top	***D. alata***	16.7
Forastero	***D. alata***	13.3
Gemelos	***D. alata***	12.1
Gunung	***D. alata***	12.0
Florido	***D. alata***	8.9
Kombi	***D. esculenta***	5.3
Habanero	***D. rotundata***	2.6

Note: Unreplicated trial.

SUMMARY AND CONCLUSIONS

The results of this five-year vegetable variety evaluation trial show that most varieties are adapted to the growing conditions of the Virgin Islands. The following conclusions can be drawn from this study:

1. For tomato, the best-yielding varieties for spring planting are Celebrity, Capitan, UH-N69 and Floradade. For summer planting, Capitan and CL5915-390$_4$-1-2-0, a heat-tolerant variety from Taiwan looked promising. Overall yield varied according to variety and number of harvests. Yield was also affected by insect pests and diseases. Tomato pinworm and whiteflies appeared to be the serious pest problems. Heavy insect infestation contributed to the secondary development of tomato diseases.

2. In five trials, cucumber varieties Victory, Dasher II and Tropicuke maintained good yields. These varieties appear to be suitable for year-round production in the Virgin Islands. However, summer-fall and winter-spring production seemed to be the best season for high yields and good quality cucumbers.

3. The result of one trial on hot pepper indicated that Anaheim and Jalapeno were the best yielding varieties. These varieties performed better than Cayenne, Habanero, Ancho and Red Cherry.

4. Of the six eggplant varieties evaluated during the summer-fall season of 1988, Black Bell, Midnite and Jersey King demonstrated outstanding yield performance. These varieties produced an average yield of 30.0 t ha^{-1}.

5. Four varieties of okra (Blondy, Clemson Spineless, Emerald Green and Perkins Mammoth) produced similar yields in the 1991 summer season. Marketable yields ranged from 17.5 t ha^{-1} for Perkins Mammoth to 20.5 t ha^{-1} for Clemson Spineless.

6. For cantaloupes, all varieties evaluated performed poorly during the spring season. Yields were generally low, ranging from 5.2 t ha^{-1} for Magnum 45 to 7.65 t ha^{-1} for Planters Jumbo. Low yields were attributed to poor fruit set and high incidence of downy mildew and ground rot. Infestation of melon worms was also a problem.

7. For watermelon, the best yielding-varieties for winter-spring production were Royal Charleston, Hybrid Royal Sweet and Dixie Lee. Yields obtained from these varieties ranged from 11.2 t ha^{-1} for Dixie Lee to 18.2 t ha^{-1} for Royal Charleston.

8. Sweet potato variety trial results indicated that in terms of total yield, the promising varieties included Miguela, Toquesita, Colorette, Perla, Agata, Amarista, EAS-11, Twelve Prime, Viola, Tapato and Sunny. In terms of marketable tuber yield, the promising varieties were Toquesita, Colorette, Perla, EAS-11, Viola, Tapato and Sunny. The last three varieties have also good culinary qualities. Varieties with less weevil damage were Colorette, Viola, Limonette, Tapato, Tano, Toquesita, Suabor and EAS-11. In general, most of the varieties from USDA-TARS in Puerto Rico are well-adapted for production in the Virgin Islands.

9. The preliminary trial on yam varieties showed that varieties of ***D. alata*** and ***D. esculenta*** are promising for the Virgin Islands. Of the six ***D. alata*** varieties, Binugus was the best-yielding variety with an average yield of 33.8 t ha^{-1}. Among the ***D. esculenta*** varieties, Seti was the highest-yielding variety, averaging 20.0 t ha^{-1}. There is a need to screen more varieties in the ***D. rotundata***.

This five-year study provided research information that can be used by local growers. The results will also help us focus our next research in identifying and selecting the best varieties suitable for the Virgin Islands.

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Appendix 1.
Description of vegetable varieties and sources of seeds
(see Appendix 2 for key to vegetable diseases).

A. Tomato

1. **Capitan** - determinate, medium size for bush or short stake, early-maturing, some tolerance to bacterial wilt (Caribbean strain), F, ASC and St. Fresh market, does well in tropical areas, fruit deep globe, jointed, sets well under high temperatures and high humidity. Source: Peto Seed, P.O. Box 4206, Saticoy, CA 93004-0206.

2. **Calypso** - determinate, matures in 83 days. Resistant to V, F_1, F_2, ASC and St. Large firm fruit, deep oblate, jointless fruit for fresh market and shipping. Source: Peto Seed.

3. **Celebrity** - determinate, hybrid, matures in 72 days. Mid-early variety for main season crop, widely adapted with wide spectrum disease resistance. Large, red, deep oblate fruits are firm, flavorful, crack resistant. Resistant to F_1, F_2, V, TMV, N, ASC and St. Source: Twilley Seed Co., P.O. Box 65, Trevose, PA 19053.

4. **Caraibo** - determinate, matures in 80-85 days. High-yielding variety adapted for tropical areas, medium size fruit, jointless, deep red for fresh market and shipping. Resistant to V, F_1, F_2, ASC and St. Source: Graines Tezier France, Guadeloupe Branch.

5. **Duke** - a determinate hybrid that matures in 74 days. Large fruit, mid-maturity. Jointless, firm, 224 g. Red fruits have excellent flavor, medium to large determinate plants, vigorous, resistant to V, F_1, F_2, ASC, St. Source: Twilley Seed Co.

6. **Floradade** - an open-pollinated, commercial or fresh market tomato which matures in 77 days. Determinate, medium to large, firm, jointless fruits in concentrated set. Fine for hand-pick or mechanical harvest. Resistant to St., V, F_1, F_2 and ASC. Source: Twilley Seed Co.

7. **Pole King** - a hybrid that matures in 75 days. Proven indeterminate variety. Consistently shows exceptional ability to set large fruits all the way up the vine. Large fruits average 224 g, very firm, green shouldered with thick walls and good keeping quality. Resistant to F_1, F_2, and V. Sets well under adverse conditions. Source: Twilley Seed Co.

8. **Tropic** - an indeterminate variety developed by the University of Florida. Matures in 80 days. Fruits average 224 g, thick-walled, tends to set high in the vine under protective cover of foliage. Recommended for hot, humid, disease-prone areas. Resistant to V, F_1, ASC, N, AEB, CLM, GW, St, TMV and Su. Source: Peto Seed Co.

9. **UH-N52** - a tropical hybrid developed by the University of Hawaii. Very well-adapted to tropical and subtropical conditions. Large fruit average 200-300 g. Deep oblate, green shoulder, good shelf life. Resistant to heat, F, St and N. Source: Hawaii Foundation Seed Facility, University of Hawaii Waimanalo Research Station, 41-698 Ahiki St., Waimanalo, HI 96795 or American Takii, Inc., 301 Natividad Rd., Salinas, CA 93906.

10. **UH-N69** - a tropical hybrid developed by the University of Hawaii. Resistant to multiple diseases and heat. Very well-adapted to tropical and subtropical conditions. Large fruit average 200-230 g, deep oblate, green shoulder, good shelf life. Resistant to F, St and N. Source: Same as UH-N52.

11. **CL5915/FMTT** - various heat-tolerant tomato lines developed by the Asian Vegetable Research and Development Center (AVRDC) in Taiwan. Most lines are heat-tolerant, suitable for growing in areas with high temperature and humidity. Fruits are relatively small to medium in size. Some resistance to bacterial wilt. Source: AVRDC, P.O. Box 42, Shanhua, Taiwan.

B. Cucumber

1. **Dasher II** - a hybrid maturing in 58 days. Uniform, straight, dark-green fruits of high quality. Early gynoecious hybrid plants are productive and vigorous. Tolerant to ALS, A, DM, PM, S and CMV. Source: Twilley Seed Co.

2. **Dynasty** - a hybrid that matures in 55 days. Uniform and extremely smooth fruits are dark green and very straight. Very productive gynoecious plants tolerant to ALS, A, DM, PM, S, and CMV. Source: Twilley Seed Co.

3. **Gemini 7** - good for commercial market garden. Matures in 64 days with vigorous vine. Fruit gynoecious, dark green, blocky with slender stem and taper, 20 x 6 cm. Tolerant to CMV, S, PM, DM and A. Source: Peto Seed Co.

4. **Marketmore** - an open-pollinated slicing type that matures in 66 days. Developed at Cornell University in Ithaca, New York. Well-known variety for planting both in North and South. Tolerant to CMV, S, DM and PM. Source: Twilley Seed Co.

5. **Marketsett** - open pollinated variety that matures in 65 days. Dark-green, long fruits characteristic of hybrids and an impressive range of disease tolerance. Also grows better during cool weather than other varieties. Recommended for early spring and late summer planting. Resistant to ALS, A, CMV, DM, PM, S and TLS. Source: Peto Seed Co.

6. **Tropicuke** - a gynoecious, uniform variety recommended for tropical areas. Vigorous vine and matures in 60 days. Fruits are uniform, green, cylindrical and taper at blossom end. Holds color under high temperature. Resistant to CMV, S, A, PM, DM and ALS. Source: Peto Seed Co.

7. **Victory** - a gynoecious hybrid that matures in 50 days. Fruits average 20 cm in length, deep green in color. Tolerant to CMV, A, DM, PM and S, as well as many other diseases. Source: Stokes Seed Co., Inc., Box 548, Buffalo, NY 14240.

C. Hot Pepper

1. **Anaheim** - a selection developed near Anaheim, California in 1907. Matures in 80 days, pods 18 cm long and 4 cm wide. Very popular for stuffing when red ripe. Plants 71-86 cm tall provide good fruit protection. Good for processing, drying, fresh market and home garden. Source: Twilley Seed Co.

2. **Ancho** - large fairly hot pods used for stuffing or heating and layering with sour cream. Triangular-shaped about 10-13 cm long and 5-8 cm across, with a characteristic indent around the stem. Source: Peto Seed Co.

3. **Cayenne** - matures in 74 days, bright red pods (fruits) 15-18 cm long, 3 cm across, with medium hot flesh. Upright, vigorous plants 61-66 cm tall. Good for processing, drying, sauces, fresh market or home garden. Source: Twilley Seed Co.

4. **Habanero** - *Capsicum chinense*, square to heart-shaped fruit 5 cm long, very hot, turning orange when ripe. Fruit has an unusual apricot flavor and scent when ripe. Reputedly the hottest pepper in the world. Source: Peto Seed Co.

5. **Jalapeno** - matures in 72 days. Fruits 9 cm x 4 cm are bright red with thick, pungent flesh. Upright plants 66-92 cm tall. Good for processing and fresh market. Source: Twilley Seed Co.

6. **Red Cherry** - large hot peppers, mature in 77 days, cherry type medium-thick green fruits 4-5 cm across, mature to bright red. Strong upright plants to 51 cm. Heavy yields. Good for pickling, processing and fresh market. Source: Twilley Seed Co.

D. Eggplant

1. **Black Bell** - a hybrid that matures in 68 days. Outstanding yields, large oval-to-round fruits 15 cm x 8 cm. Fruits purple-black extending all the way to blossom end. Excellent quality, long shelf life, green calyx. Vigorous and sturdy plants 71-76 cm tall. Tolerant to TMV, prolific bearers. Source: Twilley Seed Co.

2. **Black Nite** - a hybrid that matures in 69 days. Improved Florida market type. Uniform, attractive fruits are long, slender, 20 cm x 8 cm and deep purple-black with large green calyx. Vigorous upright plants 81 cm tall. Tolerant to TMV. Source: Twilley Seed.

3. **Epic** - a hybrid that matures in 64 days. Especially good fresh market type. Oval, teardrop-shape fruits of deep purple-black, 21 cm x 10 cm with green calyx. Strong upright plants 91 cm tall. Tolerant to TMV. Source: Twilley Seed Co.

4. **Imperial** a hybrid that matures in 63 days. European type, bears early crops. Attractive, long, slender fruits to 20-25 cm x 5 cm. Fruits are cylindrical with glossy purple-black skins and green calyx. Productive plants grow 90-100 cm tall. Resistant to TMV. Source: Twilley Seed Co.

5. **Jersey King** - a hybrid maturing in 63 days. Long fruits average 25 cm and 11 cm wide. Dark purple fruits. Source: Stokes Seed Co., Inc.

6. **Midnite** - a hybrid which matures in 75 days. Uniform attractive fruits, broad-egg shape, dark purple. Vigorous upright plants 60-70 cm tall. Resistant to TMV. Source: Peto Seed.

E. Okra

1. **Blondy** - open-pollinated variety that matures in 48 days. Early high-yielding with dwarf growth habit. Clemson Spineless type with ribbed pods. Early enough for harvest in northern areas. Plants 91 cm high. Developed by South Carolina Agricultural Experiment Station. Source: Twilley Seed Co.

2. **Clemson Spineless** - an open pollinated variety that matures in 60 days. High quality, spineless, rich green pods. Highly productive plants growing up to 122 cm. Developed by South Carolina Agricultural Experiment Station. Good for fresh market and home gardens. Source: Twilley Seed Co.

3. **Emerald Green** - an open-pollinated variety maturing in 57 days. Attractive dark emerald green pods and smooth, spineless and stay tender longer. Vigorous, highly productive plants with height up to 91 cm. Source: Twilley Seed Co.

4. **Perkins Mammoth** - open-pollinated variety that matures in 57 days. Plants grow 1.2-1.5 m and produce long dark green, fleshy, tender pods 15-20 cm long and 4 cm in diameter. Source: Stokes Seeds Co., Inc.

F. Cantaloupe

1. **Dixie Jumbo** - a hybrid that matures in 84 days. Early Hale's Best Jumbo type. Matures early for first market. Recommended for the southeast and other areas where Hale's Best Jumbo and Planters Jumbo succeed. Large fruits 18 cm x 15 cm, weigh 1.6 to 1.8 kg each, have light netting, light sutures, salmon flesh has extra high sugar content. Good for fresh market and home garden. Source: Twilley Seed Co.

2. **Hymark** - a hybrid that matures in 85 days. A Topmark type. High quality shipper, with improved shaped, quality and uniformity. Fruit size 14 cm x 14 cm, no suture. Fruit weighs 1.6-1.8 kg. Salmon flesh color. Resistant to powdery mildew. Source: Abbott & Cobb, Feasterville, PA.

3. **Magnum 45** - a hybrid that matures in 80 days. Bred especially as a shipping type for Texas, Florida, and southern states, also performs well in the northeast. Large uniform, slightly oval fruits weigh 1.0-1.4 kg, measuring 14-15 cm with good netting, light sutures. Deep orange flesh, small, dry seed cavity, outstanding taste. High-yielding plants have concentrated set. Resistant to powdery mildew. Good for shipping. Source: Twilley Seed Co.

4. **Planters Jumbo** - open-pollinated variety that matures in 88 days. Recommended for the southeast and other areas where Dixie Jumbo succeed. Large fruits weighing 1.4-1.8 kg each. Fruit 17 cm long with a diameter of 14 cm. Have heavy netting, firm ribbed rind. Resistant to PM. Good for fresh market or home garden. Source: Twilley Seed Co.

G. Watermelon

1. **Crimson Sweet** - an open-pollinated variety which matures in 88 days. Very popular shipping type, uniform round melons average 11 kg each. Thick, tough rind is light green, striped green. Delicious deep red, firm flesh has very high sugar content. Small dark brown seeds. From Kansas State Agricultural Experiment Station. Resistant to A and F. Source: Twilley Seed Co.

2. **Dixie Lee** - a popular open-pollinated variety maturing in 92 days with excellent flesh color and sweetness. Oblong-round melons average 11-14 kg, may attain 16 kg. Smooth, tough rind 1.3 cm thick is light green with dark green stripes. Extremely vigorous plants have strong seedling emergence. Intense red flesh has high sugar content. Source: Twilley Seed Co.

3. **Royal Sweet** - a hybrid variety that matures in 85 days. Uniform, large fruit. Oblong melons weigh 9-11 kg each, green rind and medium green stripes. Bright red flesh, small, dark seeds vigorous medium vines. Resistant to F. Source: Twilley Seed Co.

4. **Royal Charleston** - a hybrid variety which matures in 80 days. Small seeds average 28 per g. Early, quality money-maker. Very uniform, oblong melons weighing 8-11 kg each. Thick, tough, gray green rind and sweet red flesh with outstanding flavor, small dark seeds. Vigorous, productive vines and resistant to F. Source: Twilley Seed Co.

5. **Sugar Doll** - a hybrid variety that matures in 75 days. A sugar baby icebox type. Attractive round melons weighing 4-5 kg each; very dark green, thin rind. Delicious bright red flesh, dark seeds. Uniform plants. Good for fresh market. Source: Twilley Seed Co.

Appendix 2.
Key to vegetable diseases.

A. Tomato, Eggplant and Pepper

ASC - Alternaria Stem Canker
BSp - Bacterial Speck
F - Fusarium Wilt
F_1 - Fusarium Wilt, Race 1
F_2 - Fusarium Wilt, Race 2
N - Root Knot Nematode
St - Stemphylium (Gray Leaf Spot)
TMV - Tobacco Mosaic Virus
V - Verticillium Wilt
V_1 - Verticillium Wilt, Race 1
V_2 - Verticillium Wilt, Race 2
PVY - Potato Virus Y
TEV - Tobacco Etch Virus
Stip - Stip

B. Cucumber, Cantaloupe and Watermelon

ALS - Angular Leaf Spot
A - Anthracnose
CMV - Cucumber Mosaic Virus
DM - Downy Mildew
PM - Powdery Mildew
S - Scab
TLS - Target Leaf Spot
WMV_1 - Watermelon Mosaic Virus, Race 1
WMV_2 - Watermelon Mosaic Virus, Race 2

Fresh harvest samples of bell peppers from 1991 drip irrigation trial.

Appendix 3.
Characteristics of promising sweet potato varieties for the Virgin Islands.

Variety	Days to harvest	Skin color	Flesh color	Tuber size (g)	SPW[1]
Colorette	90-120	purple	orange	275	I
CS - 2	120	cream	white	192	I
Perla	90-120	white	white	306	I
Picadito	120	red	white	438	I
Sunny	120	tan	orange	230	I
SKB - 4	120	pink	white	213	I
Tapato	120	pink	white	440	I
Trompo Negro	120	cream	yellow	167	I
Viola	120	purple	white	306	I

[1]SPW = Sweet potato weevil resistance is inconsistent (I) among varieties. More research is needed to establish ratings for resistance to SPW.

Appendix 4.
Monthly rainfall at UVI-AES, 1988-1992.

Month	Monthly rainfall (mm)				
	1988	1989	1990	1991	1992
January	58.1	86.4	47.5	35.6	55.1
February	0	48.5	41.2	67.3	23.9
March	38.3	70.4	54.6	45.7	73.4
April	1.9	47.0	42.9	26.4	67.1
May	41.9	42.7	50.0	44.7	277.1
June	33.0	130.6	36.8	28.2	26.9
July	40.0	31.2	40.0	78.5	62.0
August	90.0	212.1	133.6	36.1	58.4
September	36.0	360.2	168.4	52.6	128.5
October	37.0	19.8	350.8	98.8	159.3
November	7.0	27.2	135.1	92.0	263.1
December	18.5	26.4	60.5	38.1	107.7
Total	**401.7**	**1102.5**	**1161.4**	**644.0**	**1302.5**

Soil tensiometer installed near pepper plant to determine soil moisture level around the plant. Tensiometer readings are used to schedule irrigation.

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