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CARIBBEAN FOOD CROPS SOCIETY

45

Forty Fifth

Annual Meeting 2009

**Frigate Bay
Federation of St. Kitts and Nevis**

**Vol. XLV
Number 2**

PROCEEDINGS
OF THE
45th ANNUAL MEETING

Caribbean Food Crops Society
45th Annual Meeting
July 12 to 17, 2009

St. Kitts Marriot Resort and Royal Beach Casino
Federation of St. Kitts and Nevis

**“Reality and Potential of Food Security and Agricultural Diversification in
Small Island Developing States”**

**“Realidad y Potencial de la Seguridad Alimentaria y la Diversificación
Agrícola en Pequeños Estados Insulares en Desarrollo”**

**“Sécurité alimentaire et diversification agricole dans les petits états
insulaires en développement: réalisations et perspectives”**

Edited by Wanda I. Lugo and Wilfredo Colón

Published by the Caribbean Food Crops Society

ISSN 95-07-0410

Copies of this publication may be obtained from:

Secretariat, CFCS
P.O. Box 40108
San Juan, Puerto Rico 00940

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PAPAYA TOLERANCE TO HURRICANE FORCE WINDS

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ABSTRACT: During the mid and late 1990s the US Virgin Islands experienced frequent hurricanes which destroyed most of the papaya crops. From this experience, papaya breeding focused on developing short and compact lines with fruit set within one meter of the soil to reduce the center of gravity. A papaya plot was established in a double-row system, 2 m between plants in a row, 1 m between rows and 3 m between sets of double rows. Papaya trees seven months after transplanting, laden with fruit and in the first month of harvest, were subjected to hurricane Omar force winds in October 2008. Papaya varieties over two meters in height 'Tainung 1', 'Tainung 5', 'Known-You 1' and 'Kapoho'; had 10 to 20% broken stem, and 70 to 80% were blown down. Three compact papaya lines, 1-1.5 m tall, had no broken stems and only up to 15% of the plants were blown over. These results indicate that short productive trees, with a lower center of gravity, were able to tolerate hurricane force.

Keywords: cyclone, typhoon, dwarf papaya, compact papaya, *Carica papaya*

INTRODUCTION

During the mid to late 1990s, hurricanes were a yearly occurrence in the U.S. Virgin Islands. Many of the papaya cultivars grown then took ten months from sowing seed to obtain mature fruit (Kowalski and Zimmerman, 2001). This caused much loss of plants and particularly loss of crosses for seed to develop the next generation. However, it was noticed that seeds were obtainable from early-bearing cultivars such as '356-3', 'Puerto Rico Dwarf' and 'Cariflora'. The goal of the papaya breeding program was to develop wind tolerant early-bearing, compact or dwarf lines that set 1-kg or larger fruit with reddish flesh within one meter of the ground. The theory was that moving the fruit set closer to the ground would lower the center of gravity of the plant in order to tolerate hurricane force winds.

MATERIALS AND METHODS

Papaya use in the breeding program was based on characteristics desired in the new line. These characteristics include early bearing (within one meter of the soil), large fruit (≥ 1 kg), % brix (≥ 10), Papaya Ring Spot Virus (PRSV) tolerance and reddish flesh (Kowalski and Zimmerman, 2006; Zimmerman and Kowalski, 2004). Crosses were always made with a hermaphrodite as a female, and selection pressure was used for hermaphrodite/female lines.

Field plots were established on March 8, 2009 from seeds sown January 12, 2008. Plots were set up in a double-row staggered plant configuration with 2 m between plants within a row, 1 m between rows and 3 m between sets of double-rows. Data was collected monthly on plant height. After six and a half months in the field, fruit set and stem diameter at 1 m were collected. The evening of October 15, seven months after transplanting papayas to the field, St. Croix experienced sustained winds of 160 km/h from hurricane Omar. Data were analyzed using ANOVA and mean separation used LSD. Data collected as percentages were arc sin transformed before data analysis.

RESULTS AND DISCUSSION

The papaya plot was actively growing and setting fruit although becoming infected with PRSV. The stem diameter and fruit set were not significantly different after 6.5 months of growth in the field; however, plant height clearly distinguished differences between the standard and compact papayas (Table 1). Fruit harvest had begun six months after transplanting to the field.

Hurricane Omar, as a category three typhoon, was devastating to the island of St. Croix and much of the papaya research plot. The taller papaya cultivars sustained the most damage with either broken stems or plants blown over (Figure 1). However, distinct differences were seen between the compact lines and the cultivars, with most of the compact lines still standing and no broken stems (Figure 2, Table 2). Except for the damage to the leaves, UVI lines 9 and 43 were still standing strong (Figure 3) after Omar. The standard height papaya trees were more susceptible to breaking in Omar force winds. Plants were considered blown down when their angle to the ground was less than 45 degrees. Most of the damage, sustained to the standard-sized papaya trees, was from being blown down (Figures 1, 2; Table 2). Both UVI-9 and UVI-43 are compact lines that start setting fruit one-half meter from the ground. This concentrated lower fruit set gives the plant a lower center of gravity, which gives it the ability to withstand hurricane force winds.

The new lines of papaya with the compact low-to-the-ground fruit set, developed at the University of the Virgin Islands, are more wind-tolerant than the standard papaya cultivars. This tolerance may be due to a lower center of gravity for the fruit set on the plants, all of which allows them to withstand 160 km/h-force winds. The Caribbean and Asian Pacific areas are frequented by cyclones. These areas could benefit from these dwarf papaya lines.

ACKNOWLEDGEMENT

The research on which this report is based was financed in part by USDA Hatch funds #201092. The assistance provided by Carlos Montilla, Willie Ventura, James Gordon, Anna Bastien, Noel Burnett, and Trevon Nelson was greatly appreciated.

REFERENCES

- Kowalski, J.A. and T.W. Zimmerman. 2001. Evaluation of papaya germplasm in the U.S. Virgin Islands. *Carib. Food Crops Soc.* 37:24-28.
- Kowalski, J.A. and T.W. Zimmerman. 2006. Papaya Characteristics under different Spacing Regimes. *Proc. 42nd Caribbean Food Crops Society.* 42:399-402.
- Zimmerman, T.W. and J.A. Kowalski. 2004. Breeding and Selection for Early Bearing Papayas. *Acta Hort.* 632:53-55.

Table 1. Papaya plant characteristics collected two weeks prior to hurricane Omar.

Cultivar/Lin	Height* (cm)	Stem Diameter (cm)	Number Fruit Set
Tainung 1	234.8 b	8.3	30.3
Tainung 5	232.2 b	7.4	31.1
Known You 1	228.7 b	6.9	26.4
Kapoho	270.3 a	8.9	26.2
Maradol	128.7 d	6.6	30.0
UVI-43	153.5 cd	7.2	28.7
UVI-9	176.2 c	6.8	34.0

*Mean separation within columns conducted using LSD P=0.05

Table 2. Percentage damage occurring in papayas upon experiencing 160 km/h-force winds after seven months in the field.

Cultivar/Line	Standing	Broken	Down
Tainung 1	10.3 b	14.6 a	75.1 a
Tainung 5	8.4 b	17.4 a	74.2 a
Known You 1	9.1 b	20.9 a	70.0 a
Kapoho	9.8 b	9.6 a	80.6 a
Maradol	91.8 a	0 b	8.2 b
UVI-43	86.2 a	0 b	14.8 b
UVI-9	94.6 a	0 b	5.4 b

*Mean separation within columns conducted using LSD P=0.05



Figure 1. Wind damage to 'Tainung 5' after hurricane Omar.



Figure 2. Post-hurricane Omar view of 'Tainung 1' (left) and line UVI-43 (right).



Figure 3. Post Omar view of lines UVI-43 (foreground) and UVI-9 (background).