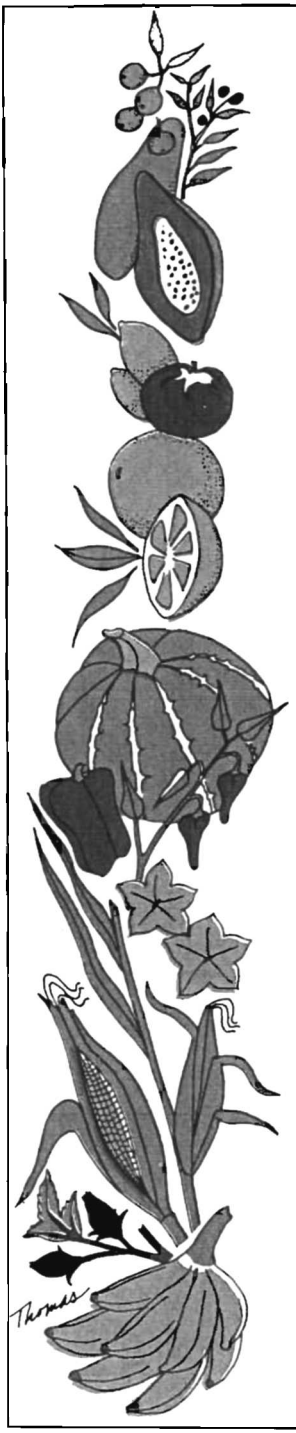

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AGRONOMIC COMPARISON AND HCN CONTENT OF THREE CASSAVA CULTIVARS (*MANIHOT ESCULENTA* CRANTZ) IN PUERTO RICO

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ABSTRACT

Three cassava cultivars, Serralles, Sta. Catarina, and Zenon, were field evaluated at nine and 12 months after planting for root tuber yield and hydrocyanic acid potential (HCN-p) on an Oxisol at the ARS Farm, Isabela, Puerto Rico, during 1993-94. Significant differences were found in root tuber yield and HCN-p among cvs. and also in replication x cv. and HCN-p for replications and harvest dates. Sta. Catarina cv. averaged the highest root tuber yield with 31.9 tons/ha, while the Zenon cv. had the lowest HCN-p, 39.1 ppm. Across cvs., there was no significant difference between the two harvest dates in terms of root tuber yield; however, the root tuber HCN-p was significantly lower at the nine-month harvest (45.6 ppm). According to the findings of a taste-testing panel, the root tubers of all three cvs. at the two harvest dates had good culinary quality. However, at nine months, root tubers of the Zenon cv. were considered superior to the other two cvs.; while, at 12 months, those of the Sta. Catarina cv. were slightly preferred by the panel.

INTRODUCTION

In Puerto Rico and in many other tropical countries, cassava (Manihot esculenta Crantz) is a major staple food and a good source of carbohydrates. It is native to tropical America but can be grown in many other areas of the tropics (Purseglove, 1969; Toro and Atlee, 1981; Odigboth, 1983; Ramírez et al., 1983; and Cárdenas and Vázquez, 1990). Cassava can be cultivated in soils of low fertility and low pH and has tolerance to insects, diseases, and drought.

Throughout the world, approximately 15.7 million hectares of cassava are under cultivation, representing 33% of the total area devoted to root and tuber crops (47.2 million hectares). Sweet potatoes constitute 20% (9.3 million hectares), and yams, 6% (2.6). World production of roots and tubers is 574.6 million tons, and cassava production accounts for 153.7 million tons (27% of the total). According to FAO, the country with the highest cassava production in 1991 was Brazil (24.6 million tons), followed by Thailand (20.3), Nigeria (20.0), Zaire (18.2), and Indonesia (16.3). In the Caribbean, less cassava is generally grown than in other areas of the tropics. The main producer is Cuba (7,200 hectares and 0.3 million tons) followed by Haiti (6,800 hectares and 0.29 million tons) (FAO, 1992).

In Puerto Rico, cassava production has declined in recent years, while importations of the root crop have increased. During 1975, 3909 tons were produced locally, and 709 tons were imported. This trend has continued up to the present time (Fig. 1). During 1991, 2,545 tons of cassava were produced, with a farm gate value of $987,840, and 2,287 tons (47%) were imported. In 1993, only 1,591 tons were produced locally, with a farm gate value of $542,850, and 2,328 tons (59%) were imported. The local price of cassava in 1993 was $341/ton at the farm gate as compared to yams ($682/ton) and sweet potatoes ($396/ton) (Ortiz, 1994).

Cassava is usually planted in Puerto Rico during April and May and harvested approximately 10 months after. Most of the acreage devoted to cassava is located in the northwestern part of the island in the Isabela area.

In the past five years, the USDA, ARS Tropical Agriculture Research Station (TARS), Mayaguez, Puerto Rico, has evaluated more than 50 introductions of cassava for high yield, low HCN-p, and good culinary quality. Two cassava cvs. from the TARS collection (Serralles and Sta. Catarina)

that were found to be superior in previous trials (Cárdenas and Vázquez, 1990; Cárdenas et al., 1991) were compared in a field evaluation with the Zenon cv. recently introduced from the Dominican Republic.

These cvs. were evaluated for yield, HCN-p, and culinary quality at nine and 12 months after planting.

MATERIALS AND METHODS

The experiment was conducted at the Isabela ARS Farm. Table 1 provides information on weather data and the general characteristics of the experiment site. Throughout the experiment, the temperature ranged from 21.9 to 32.8° C, and total rainfall was 1,031 mm.

The growth pattern of all cvs. was similar. The root tubers of the Serralles and Zenon cvs. were alike in shape and color with brown skin and white flesh, while those of Sta. Catarina had light-brown skin and cream-colored flesh.

The experimental design was a complete randomized block with an arrangement of a split plot with four replications. Cultivars were the main plots and harvest dates the subplots. Plots consisted of 20 cuttings 15-20 cm long of each cv. planted in two rows (10 plants per row) 10 m long and one m apart. Weed control was done by hand, and plots were sprinkler irrigated when needed. No fertilizer or pesticides were applied.

On December 15, 1993, and March 15, 1994, (nine and 12 months after planting), the cassava cvs. were harvested using a 24 hp Farmall International tractor and a special system devised at the Isabela Farm which consisted of a chain and a piece of metal attached to the PTO of the tractor to pull the root tubers out of the ground.

The root tubers were cleaned and weighed in the field, and root samples were immediately taken to the TARS laboratory for HCN-p determination. The analysis was performed using the rapid method recommended by CIAT (CIAT, 1984), which involves the use of picric acid, sodium carbonate, and toluene. Five drops of toluene were added to one g of fresh root tuber sample. An alkaline-picric acid strip was put in the vial containing the sample for a 24-hour period. The strip color was read against a color chart prepared by CIAT. The color ranged from yellow (low HCN-p) to dark red (high HCN-p). Four persons from TARS were selected for the taste-testing panel to evaluate the culinary quality of the root tubers of the three cvs. at the two harvest dates.

RESULTS AND DISCUSSION

Regardless of plant maturity at harvest, the Sta. Catarina cv. significantly out yielded the Serralles and Zenon cvs., with an average production of 31.9 tons/hectare (Table 2). The three-month harvest delay did not significantly increase yield.

Previous experiments with the Sta. Catarina cv. grown in an Oxisol at the Isabela Farm resulted in average yields of 20.7 tons/ha (Cárdenas and Vázquez, 1990) and in an Ultisol soil at Corozal, Puerto Rico, 24.3 tons/ha (Ramírez et al., 1983). There was a significant difference between Zenon and the other two cvs. for root tuber HCN-p, Zenon having the lowest level, 39.1 ppm (Table 2). The delay in harvest did not affect the HCN-p of the cvs. These HCN-p findings are in accord with previously reported levels (Ramírez et al., 1983; Cárdenas et al., 1991).

The culinary quality of the cooked root tubers for all cvs. were classified as having good taste and texture, although nine-month-old root tubers of the Zenon cv. were considered superior and those of Sta. Catarina were slightly preferred at the 12-month harvest. On the basis of yield, HCN-p, and culinary quality, all three cassava cvs. are recommended for commercial production in Puerto Rico and the tropics in general. Throughout the experiment, root tubers of the Zenon cv. were damaged by rodents, thereby reducing their yield. This may have been due to the lower HCN-p in the root tubers of this cv. Since there was no significant difference in yield between harvest dates, it is recommended that these cvs. be harvested at nine months after planting.

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REFERENCES

Cárdenas, F.M., and Vázquez, F. 1990. Agronomic characterization of cassava (Manihot esculenta Crantz) in Puerto Rico. Proceedings, 26th CFCS Meeting, Mayaguez, P.R., July 29-Aug. 4, 1990, pp. 419-426 (in Spanish).

Cárdenas, F.M., Hepperly, P., and Vázquez, F. 1991. Effect of fungicide treatment on post harvest losses of cassava (Manihot esculenta Crantz) cultivars in Puerto Rico. Proceed ings, 27th CFCS Meeting, Roseau, Dominica, July 14-20, 1991, pp. 206-212.

CIAT. 1993. Cassava Program Report 1987-89, Working Document No. 91,Cali. Colombia, pp. 55, 561-565.

Hardy, B. 1993. Cassava turns to cyanide for self-defense. CIAT International 12(1):10-11.

Hardy, B. 1993. "Friendly insects" battle across continents to save neglected crop. CIAT International, 12(1):3-4.

Odigboh, E.U. 1983. Cassava: production, processing, and utilization. In: Handbook of Tropical Foods, H. T. Chan, Jr., Ed., Marcel Dekker, Inc., New York, pp. 145-200.

Ortiz López, J. 1994. Personal communication. 1994.

Purseglove, J.W. 1969. Euphorbiaceae. In: Tropical Crops, Dicotyledons 1, Longmans, Green and Co. Ltd., London, pp. 172-180.

Ramírez, O.D., Green, J.J., and Beauchamp de Caloni, I. 1983. Evaluation and acceptability of cassava cultivars. J. Agric. Univ. P.R. 67(1):16-21.

Toro, J. C., and Atlee, C. B. 1981. Agronomic Practices for Cassava Production. A Review of Literature. CIAT, Cali, Colombia, 44 pp.

Table 1. Description of the experiment site for the field evaluation of the three cassava cultivars.

Location	Isabela, Puerto Rico
Latitude	18° 30' N
Longitude	67° W
Temperature range	18.8° - 29.4° C
Elevation	128 m
Annual rainfall	1,675 mm
Soil	Oxisol (Coto)
Organic matter	2.5%
Exchange capacity	23 meq/100 g soil
pH	5.0
P (ppm)	53
K (ppm)	140
NO_3 (ppm)	10

Table 2. Root tuber yield and HCN-p of three cassava cultivars harvested at nine and 12 months after planting at Isabela, Puerto Rico during 1993-94.

Character						
	Yield (tons/ha) Months			HCN-p (ppm) Months		
Cultivar	Nine	Twelve	X	Nine	Twelve	X
Serrallés	24.89 b[1/]	25.13 b	25.01 b	51.25 a	52.50 a	51.87 a
Sta. Catarina	32.75 a	31.00 a	31.87 a	51.88 a	52.50 a	52.19 a
Zenón	21.38 b	25.13 b	23.25 b	33.75 b	44.38 b	39.06 b
X	26.34 a	27.09 a		45.63 a	49.79 a	

[1/] Means followed by the same letter within rows or within columns are not significantly different (P>0.05) based on an LSD test.