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FIELD EVALUATION OF CONVENTIONAL AND TISSUE-CULTURE MATERIAL OF THE HUA MOA PLANTAIN (*Musa acuminata x M.balbisiana*, AAB)

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ABSTRACT

The Hua Moa plantain is a clone commercially grown in Hawaii and other Pacific islands for fresh food. This plantain has not been field evaluated in Puerto Rico, but preliminary culinary tests conducted at TARS determined that it has potential for diverse uses as either a green or ripe fruit. The fruit is somewhat cylindrical and stout, producing large, uniform slices, and the pulp texture is soft. Three types of planting material, field-obtained conventional suckers (Conv) and 3- and 6-month-old greenhouse grown explants (TC-A and TC-B), were evaluated for plant and bunch characteristics and yield. The treatments were arranged in a randomized complete block design with six replications and four plants per replications. Means for days from planting to harvesting (DPH), days from flowering to harvesting (DFH), and plant height (PHT) were significantly different. Bunches from Conv plants were harvested earlier (361 days) than those from TC-B (390) and TC-A (410). Fruits of TC-A plants reached the mature green stage earlier (57 days) than those of TC-B (67) and Conv (68). Conv plants were shorter (2.12 m) than those of TC-B (2.23) and TC-A (2.32). There was no significant effect among treatments on yield components. Bunch weight ranged from 8.0 to 9.2 kg and fruit weight from 0.26 to 0.29 kg, with an average of 31 fruits per bunch for all treatments.

INTRODUCTION

Plantains (*Musa* spp.) are a major staple food in the tropics. Like bananas, they are normally propagated vegetatively by suckers. The need for producing large quantities of pathogen-free material has stimulated investigators to produce plantains via meristem culture (Krikorian, 1988; Liu et al., 1989; Arias, 1987). For several years, there has been increased interest in, and development of, *in vitro* vegetative shoot tip culture methodology for plantain propagation. The Tropical Agriculture Research Station of the USDA-ARS is the official US National Plant Germplasm System repository for bananas and plantains and has the responsibility for introducing and evaluating *Musa* germplasm of potential value to users in the US, the Caribbean, and elsewhere.

The Hua Moa plantain, originally from Hawaii, was recently introduced into the repository of TARS in Mayaguez, Puerto Rico. In Hawaii, the Hua Moa is considered one of the finest cooking plantains on the island. It was selected for this experiment based on the

results of preliminary culinary tests conducted at TARS which showed that it had potential commercial use as a green or ripe fruit.

MATERIALS AND METHODS

Establishment of *in vitro* material

In 1992, two suckers of the Hua Moa plantain were planted at TARS and field evaluated. In 1993, four shoot tips of one plant were isolated from four suckers which were cut from the source plant and cleaned thoroughly in running water. The sheathing leaf bases were removed and trimmed until corm tissue cubes of about 1–2 cm were obtained (Vuylteke, 1989). The tissue cubes were rinsed in 95% ethanol for 20–30 sec then immersed for 20 min in a solution of 10% bleach (Chlorox) containing a wetting agent (Tween 20 at two drops per 100 mL) to enhance penetration. All stages after this one were done under aseptic conditions. The beaker containing the bleach solution and the cubes was shaken frequently. After 20 min it was decanted and the cubes were rinsed three times with sterile, deionized, distilled water, with 5 min between rinses. After the last rinse, the cubes were immersed in a sterile solution of 1% ascorbic acid to minimize tissue oxidation until the excision was made. The shoot tips were then transferred to the modified culture media of Murashige and Skoog (Muer and King, 1962) containing 5 g of activated charcoal (neutralized) for callus formation and shoot multiplication. After multiplication by subculturing, always immersed in an antioxidant mixture solution, the shoots were transferred to a regeneration medium supplemented with activated charcoal. Once shoots rooted, the plantlets were transferred to natural conditions at 3–and 6-month intervals, placed in sterilized Promix, and covered with transparent plastic cups and watered. After 2 weeks, the cups were removed and the plants were fertilized with a solution of all-purpose plant food (20–20–20). Four weeks later, 50 plants of each stage were planted in 10-cm pots containing peat moss and sand and moved into the greenhouse, where they were maintained for about 3 months.

Field planting

The field experiment was performed at the Isabela ARS farm and consisted of tissue-culture plant material of the two age stages and conventional suckers obtained from the two original plants at TARS. Four plants per treatment in a randomized complete block design were established with six replications each. At planting date, aldicarb (Temik 10-G) was administered at the rate of 28 g/plant. A drip irrigation system was established for the experiment, which was planted in November, 1993. Fertilizer (10–5–20 + ME) was applied every 3 months at the rate of 3.5 t/ha. During early growth, weeds were controlled by rototiller cultivation, and thereafter sporadic applications of glyphosate (Round-up) at the rate of 2% were made During the growth period, data were taken on the number of days from planting to harvesting and days from flowering to harvesting. Harvesting began in November, 1994, when the fruits were at the mature green stage. At that time, data on plant height, number of leaves, and pseudostem diameter were taken. After obtaining the gross bunch weight, the number of fruits per bunch was counted, and those of the third and last hands were used to

determine average fruit weight. All data obtained were analyzed statistically, and comparisons were made according to LSD (0.05).

RESULTS AND DISCUSSION

In vitro responses

Some 100 plants were produced by tissue culture from the four suckers taken from the Hua Moa plant grown at Mayaguez. Callus and shoot multiplication were induced by means of the modified culture medium of Murashige and Skoog. The *in vitro* response of vegetative stem tips was very similar to that observed with other *Musa* clones (Krikorian, 1988). No pathogen damage was observed on the plantlets in the laboratory.

Field evaluations

Plant crop data from the field observations indicate that plants grown from field-obtained suckers (Conv) responded somewhat differently from 3- and 6-month-old tissue culture-derived plants (TC-A and TC-B) in the parameters of days from planting to harvest (DPH) and plant height (PHT) (Table 1), with a DPH of 361 days and 2.12 PHT at harvest. The number of days from flowering to harvesting, 57, was lower for TC-A plants than that of Conv and TC-B, which required 68 and 67 days, respectively (Table 1). No significant differences were observed for pseudostem diameter that ranged from 45.8 to 46.7 cm or number of leaves per plant that varied from 11 to 12.3 (Table 1). Bunch weight (8 to 9.2 kg) and fruit weight (0.26 to 0.29 kg) and the number of fruits per bunch (an overall average of 31) did not vary significantly among the three treatments (Tables 1 and 2). The data on fruit weight and number of leaves compare favourably with those of Irizarry and Rivera for the Superplantain clone, 0.27 kg per fruit (I and R), and 13.2 for the Maricongo cultivar (Rodriguez and Irizarry, 1979).

The data indicate that the Hua Moa plantain can be successfully propagated by *in vitro* techniques without any deviation from the parental material and has the potential for use commercially.

Table 1 Characteristics of conventional and 3-month (TC-A) and 6-month-old (TC-B) Hua Moa plantain tissue culture planting material

Characteristic	Conventional	TC-A	TC-B
Days from planting to harvest	361	410	390
Days from flowering to harveest	68	57	67
Plant height (m)	2.12	2.23	2.32
Pseudostem diam. (cm)	46.1	46.7	45.8
No. of leaves	11.3	11	12.3
Bunch weight	9.2	7.8	8.0
No. of fruits	31	31	31
Fruit weight (kg)	0.29	0.26	0.26

Table 2 F-values and coefficients of variation (CV) for the analyses of variance of conventional and 3- and 6-month-old Hua Moa plantain tissue-culture planting material

F-values	P diam* (cm)	Bunch wt (kg)	No. fruits	Fruit wt. (kg)
Replication	0.96	2.80	0.81	3.19
Treatment	0.26	0.98	0.01	2.11
CV	4.6	21.6	19.3	12.5

*P diam = pseudostem diameter).

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