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A LOW INPUT MANAGEMENT SYSTEM FOR THE EFFICIENT PRODUCTION OF THE 'BINUGAS' YAM (Dioscorea alata) ON STEEP LAND

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ABSTRACT

An experiment was conducted to determine the yield potential of the 'Binugas' yam grown with reduced inputs on hillside land. This yam planted without vine support on flat rows at the closer plant spacing of .76 by .30 m yielded 60,328 kg/ha of marketable tubers during a 7.5-month growing period. About 80.5% of the production was classified as premium. Tubers mean weight was not affected by planting systems.

INTRODUCTION

Yam is the most important economic root crop in Puerto Rico. During 1988 the production was 11,950,000 kg with a farm value of $8.2 million. About 3,335,000 kg were imported to meet the local demand (Antoni et al., 1990). Most of the local yam production is confined to the east and west-central highlands on red clayey soils with a low inherited fertility and steep topography (Espinet-Colón, 1972).

In Puerto Rico and elsewhere in the tropics the use of man-made trellises for yam vine support is a traditional agronomic practice. This management practice has been associated with higher yields (Caro-Costas et al., 1968 and Abruña et al., 1981). On the other hand, it is labor-consuming and the most costly agronomic practice in yam cultivation. Including labor and materials the expense of erecting man-made trellises under intensive management in Puerto Rico was estimated in about 21.4% of the total cost of production (Irizarry and Rivera, 1988).

Recently, it was found that the 'Binugas' yam (Dioscorea alata) can be grown successfully without vine support (Irizarry and Rivera, 1989). This high yielding cultivar develops vigorous vines, thrives well on low fertile clayey soils and produces ovate or semi-rounded shallow setting tubers which facilitate harvest specially on heavy soils. In addition, this yam possesses field resistance to foliar diseases and viruses (Hepperly and Vázquez, 1989). However, one major constraint is the frequent production of over-sized and off-shaped tubers which impose lower prices at the farm gate level.

This paper reports on the yield potential of the 'Binugas' yam grown without vine support on flat rows at closer spacing on hillside land.

MATERIALS AND METHODS

The experiment was planted June 30, 1989 and harvested February 15, 1990 at the Corozal Substation, Agricultural Experiment Station of the University of Puerto Rico. The Substation is located in the humid north-central highlands at an elevation of about 200 m. Throughout the experiment minimum and maximum mean monthly temperatures were 17.8° and 29.9° C, respectively. Total rainfall was 1,297 mm and pan evaporation 798 mm.

The soil is a red-acid Corozal clay (Aquic Tropudults clayey, mixed, isohyperthermic). The top 30 cm of soil contained 7.6 mg/kg of P (Bray method 2) and exchangeable base capacity of 8.2 cmol(+)/kg of soil. The soil was plowed and harrowed to a 25 cm depth and limestone applied at the rate of 4.2 t/ha to increase the pH to about 5.2. The experimental site had about 15% slope.

Semi-rounded tubers of uniform size were divided into pieces of approximately 112 g. The tuber segments were planted on raised and flat rows, both spaced at .76 and 1.52 m between rows and .30 m in the rows, about 43,860 and 21,930 plants/ha, respectively. The four treatments were arranged in a split-plot design with 6 replications. No vine support nor foliage disease spraying program were provided.

Weed growth was suppressed with a pre-emergence application of Ametryne at the rate 4.5 kg/ha, followed by selective hand weeding in the wider spacing plots. No post-emergence weed control was necessary in the closer spacing plots.

Two weeks after planting Temik 10G was applied in a 15 cm wide band on top of rows at the rate of 34 kg/ha. All plants received 2000 kg/ha of a 10-5-20-5 (N, P_2O_5, K_2O, MgO) fertilizer divided into equal applications 1 and 3 months after planting.

Seven and a half months after planting the middle two and four rows in the wider and closer spacing plots, respectively, were harvested. On the basis of tuber size and shape the produce was classified in three categories: marketable premium (smooth ovate tubers with no protuberant lobes), marketable non-premium (over-sized and off-shaped tubers) and non-marketable (under-sized, split or hollowed tubers). The tubers were counted and weighed, and the mean weight determined.

RESULTS AND DISCUSSION

The 'Binugas' yam planted without vine support at the closer spacing of .76 by .30 m (about 43,860 plants/ha) produced the highest premium and total marketable yields with 48,559 and 60,328 kg/ha, respectively (Table 1). This yield compares favorably with the local peak production previously reported for the 'Binugas' cultivar grown on raised rows with vine support (Irizarry and Rivera, 1989). Row spacing had no significant effect on either premium or off-shaped tubers size. Non-marketable weight was 9.4% in the closer row spacing of .76 m and 14.0% in the wider spacing of 1.52 m.

The type of planting row had no meaningful effect on premium and total marketable yields, neither influenced tuber mean weight or size (Table 1). The only practical advantage of raised rows over flat rows was that hand harvesting was easier in the former and tubers were less propense to mechanical damage. However, the hand preparation of raised rows is another costly practice and difficult to perform on steep land.

As compared to standard agronomic practices, the production of premium tubers of 'Binugas' yam is closely related to proper field management (Figure 1). The following agronomic practices are recommended to obtain high economic yields and premium quality tubers: use uniform shaped tubers as propagating material, plant without vine support, plant late to shorten the growing season to 7-8 months, propagate small segments of about 112 g in weight, use closer spacings or high population densities and plant on either flat or raised rows depending on the land topography and the availability of farm machinery.

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Table 1. Effect of planting systems on premium and total yields of the 'Binugas' yam grown without vines support

Treatments	Premium tubers weight	Premium tubers mean weight	Off-shaped tubers weight	Off-shaped tubers mean weight	Total marketable weight
	kg/ha	kg	kg/ha	kg	kg/ha
Plant spacing					
.76 by .30 m	48,559[a]	0.77[a]	11,769[a]	2.82[a]	60,328[a]
1.52 by .30 m	25,356[b]	0.73[a]	8,671[a]	2.76[a]	34,027[b]
Type of Planting row					
Flat row	39,346[a]	0.73[a]	8,462[a]	2.92[a]	47,808[a]
Raised row	34,569[a]	0.77[a]	11,978[a]	2.66[a]	46,547[a]

1/ Means followed by the same letters in each planting system do not differ significantly at P = 0.05

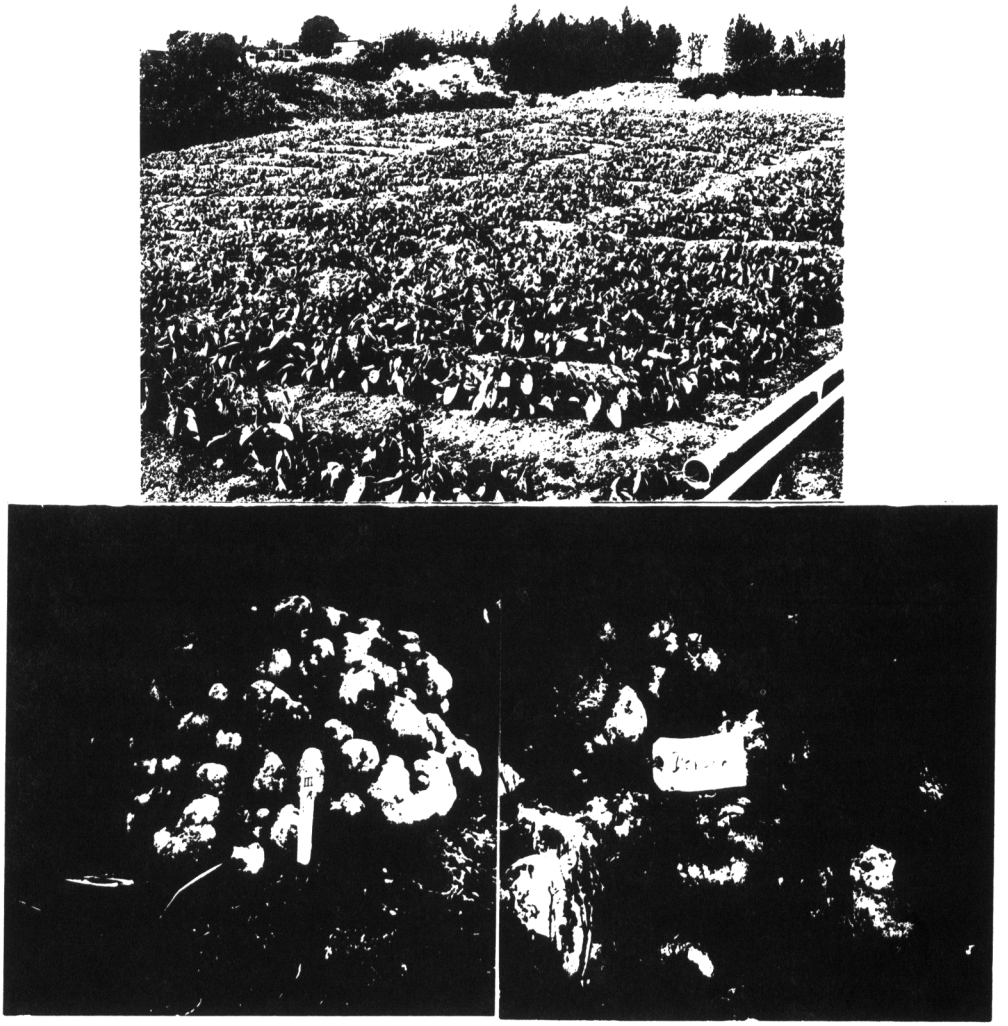

Fig. 1. (Top) two month old 'Binugas' field experiment growing without vines support on flat and raised rows at closer spacing. Bottom (left) premium tubers, (right) over-sized and distorted tubers.

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