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YAM AND CASSAVA INTERCROPPING: A VIABLE ALTERNATIVE TO REDUCE THE HIGH COST OF STAKING IN YAM

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ABSTRACT

Cassava (Manihot esculenta, Crantz) and pigeon pea (Cajanus cajan (L), Millsp.) were timely intercropped with yam (Dioscorea rotundata, Poir) to evaluate these cropping systems as potential substitutes for traditional hand made structures for yam vines support. Yam grown with vines crept-up on cassava plants yielded 36,054 kg/ha of tubers; when vines were supported by fence-trellises the production was 37,171 kg/ha. Yield of yam grown with the vines entangled on pigeon pea plants was drastically reduced to 29,452 kg/ha. Total yield from the yam/cassava intercropping was 50,880 kg/ha during a planting to harvest cycle that lasted 10 months for yam and 18 months for cassava. This combined yield was 37% higher than yam grown as a monoculture with vines supported by fence-trellises.

INTRODUCTION

The staking of yam (Dioscorea spp.) is a traditional agronomic practice well accepted in tropical farming systems. The beneficial effect on yield is properly documented in the literature. Among the most relevant contributing factors are: greater leaf-area production and exposure, maintenance of functional leaves for a longer period of time, increased efficiency in the utilization of N and K (Chapman, 1965; Enyi, 1972), reduced weed competition and less damage by foliar diseases and pests (Wilson and Akapa, 1980). Depending on types of vine supports, soil and climatic conditions, and other agronomic practices, Campbell and Gooding, 1962,; and Caro-Costas et al., 1968 reported yield increases of 42 to 100% with staking over no staking.

On the other hand, staking is the most costly management practice in yam production. Including hand-labor and materials, this expense is estimated to be 17 to 31% of the total production cost (Wholey and Haynes, 1971; Anonymous, 1984). Since the tendency of wages and materials is to continue increasing, this practice may soon become non-economical.

In the tropics, small farmers use intercropping as an insurance against failure of one of the crops, to slow down soil erosion, control weeds, and to obtain an early cash income.

This study reports on the viability of intercropping yam with cassava as a mean to reduce production costs and to increase food production per unit area.

MATERIALS AND METHODS

The experiment was established on a red-acid, Corozal clay (Aquic Tropudults-clayey, mixed with isohyperthermic), at the Corozal Substation. Before planting the soil pH was raised to 5.2 and contained 3% organic matter, 2 ppm of "available" P (Bray method #2), and 0.7, 0.9 and 4.4 meq of K, Mg and Ca, respectively, per 100 g of soil.

The substation is located in North-Central Puerto Rico, about 200 m in elevation. Mean annual rainfall is 1,300 mm with average minimum and maximum temperatures of 19.5 and 30.5 °C, respectively. The field was plowed and harrowed twice, and ridged rows were prepared 1.5 m apart.

To provide living support for yam vines, cassava (Manihot esculenta Crantz) cuttings of the Serralés cultivar and seeds of the pigeon pea (Cajanus cajan (L.) Millsp.) determinate inbred line 148 were planted 3 m apart in the bottom of every two rows in November, 1983. The inn-row spacings were 0.3 and 0.9 m for pigeon pea and cassava, respectively. Fence-trellises were prepared with 2.1 m long wooden posts spaced 4.6 m in the row and connected in the top with a gauge #10 galvanized wire. The treatments were arranged in a randomized complete block design with 5 replications.

Eight months later, July, 1984, pre-germinated tuber sections of the dormant-insensitive yam Guinea Negro (D. rotundata, Poir) weighing 115-170 g were planted in the top of each ridged row spaced .3 m apart, about 22,000 plants/ha.

Weeds growth was suppressed with a pre-emergence application of ametryne at the rate of 4.5 kg/ha, and spot applications of glyphosate at 1% before planting the yam.

All three crops were fertilized with a 10-5-20-3 (N, P_2O_5, K_2O and MgO) fertilizer. The pigeon pea was band-fertilized at the rate of 300 kg/ha, one and two and a half months after planting. The cassava and yam received 800 and 1,800 kg/ha, respectively, splitted into equal applications at one and four months after planting.

The pigeon pea was harvested during February-March, 1984 and the yield expressed in kg/ha of mature-green pods. Both, yam and cassava were harvested May, 1985 about 10 and 18 months after planting, respectively, and the production expressed in kg/ha of marketable tubers.

RESULTS AND DISCUSSION

Yields of yam intercropped with cassava were similar to the production obtained from fence-trellises, averaging 36,612 kg/ha (Table 1). Previous attempts to find a suitable living support for yam have failed because the tested plants either collapsed under the weight of the vines (Wood, 1933; Cruzado et al., 1964) or competed for nutrients and sunlight (Brown, 1931; Okoli and Wilson, 1981) resulting in lower yields. In this association, plant competition appeared not to be a limiting factor. The yam and cassava were separately planted on the top

and bottom of ridged rows, respectively, and both crops were individually fertilized. Also, the Serrallés cassava cultivar possess a thin canopy with so-called "strap leaves" (Lawson and Jackai, 1982) which allows more penetration of sunlight.

In addition, the yam/cassava association yielded 14,826 kg/ha of cassava marketable tubers for a total production of 50,880 kg/ha during a planting to harvest cycle that lasted 10 months for yam and 18 months for cassava (Table 1). This combined yam/cassava tubers weight was 37% higher than yam grown in monoculture using fence-trellises for vines support. Although the cassava was harvested 6 months after the recommended harvesting age, the tubers were of excellent culinary quality.

The yields of yam intercropped with piegon pea were drastically reduced to 29,452 kg/ha (Table 1). These results are similar to the findings of Cruzado, et. al., 1964. However, other aspects of this association should be further studied including the evaluation of vigorous indeterminate cultivars, early planting dates, wider in-row spacing and perhaps pruning techniques.

At present, the cost of erecting fence-trellises for yam vines support in Puerto Rico is estimated in $1,632.50/ha (Table 2). This represents 21.4% of the total cost of producing an hectare of yam under intensive management. The most expensive item is the untreated wooden posts which cost of $967.50/ha. This cost is almost tripled if treated posts are used, however, they provide the opportunity to be utilized for several plantings.

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Table 1. Effect of living and artificial vine supports on the yield of Guinea Negro yam (D. rotundata)

Type of vines support	Yam tubers weight	Cassava tubers or pigeon pea pods weight	Total weight
	kg/ha	kg/ha	kg/ha
Fence-trellises	37,171[a] 1/	_____	37,171[b]
Cassava plants	36,054[a]	14,826	50,880[a]
Pigeon pea plants	29,452[b]	1,862	31,314[b]

1/ Means followed by the same letters do not differ significantly at the 5% probability level (Duncan's Multiple Range Test).

Table 2. Estimated cost of materials and wages in erecting fence-trellises for yam vines support in a field 50 m wide by 200 m long.

Item	Quantity	Man days	Unit price($)	cost/ha($)
Wooden posts, size 2.1 m long by 6-7.5 cm in diam.	774 1/	_____	1.25 each	967.50
Reels of gauge ± 10 galvanized wire	7.3 2/	_____	50/reel	365.00
Hand labor 3/	_____	15	20/day	300.00

1/ Each post spaced at 3m apart between rows and 4.6 m in the row, 34 additional posts utilized for crossbars at the end of the rows.

2/ Each reel weighed 45.5 kg and provided about 459 lineal m of wire.

3/ Wages paid for erecting the wooden posts and fastening the wire.

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