

# Effect on Tanier Yields of Artificial Shade Levels and of Intercropping with Plantains<sup>1,2</sup>

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## ABSTRACT

Yields of taniers in a field affected by "mal seco" increased from 7,900 kg of tubers and 13,000 kg of corms/ha produced in full sunlight to 12,700 kg of tubers and 22,700 kg of corms/ha produced under 53% artificial shade. In another experiment, where "mal seco" did not occur, yields decreased from 20,660 kg of tubers/ha in full sunlight to 13,960 and 9,090 kg/ha produced under 53 and 70% artificial shade, respectively. Yields of corms, which averaged 20,700 kg/ha, were not appreciably affected by shade levels.

In a third experiment, taniers unaffected by "mal seco" produced 17,900 kg of tubers/ha and 48,300 kg of corms/ha when grown alone, but only 7,000 kg of tubers and 33,000 kg of corms/ha when planted together with plantains spaced at 2.4 × 2.4 m. Closer spacing of the plantains and planting the taniers 2 months after the plantains, decreased yields of both tubers and corms.

## INTRODUCTION

Taniers, or cocoyams, (*Xanthosoma spp.*) are an important root crop of the humid tropics. They are generally consumed on the farm or sold in local markets. Taniers can produce 20,000 kg of edible tubers/ha and a similar quantity of corms, which Soldevila and Vicente-Chandler (5) have shown can be valuable in the feeding of pigs. Taniers have relatively low fertility requirements and the Morada variety (*X. nigricum*) can be left unharvested in the ground over relatively long periods without deteriorating.

Little research has been conducted with taniers. In Puerto Rico, the effect of various cultural practices on yields has been studied by Abruña et al. (1) and by Silva and Irizarry (4), and the productivity of different varieties of taniers was determined by Irizarry et al. (3).

Taniers are not severely attacked by insects, nematodes or viruses, but are susceptible to a condition termed "mal seco" that can destroy the root system. This condition is the most limiting factor to increase tanier production at least in Puerto Rico. All varieties of taniers are apparently susceptible to "mal seco." Various fungi have been found associated with

<sup>1</sup> Manuscript submitted to Editorial Board May 12, 1980.

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“mal seco” but the condition has not been successfully controlled with fungicides. This condition does not appear to be related to nutrition, since it affects both well and poorly fertilized plantings. “Mal seco” is more prevalent on heavy soils, especially if they are poorly drained. During wet years it can be very damaging even on steep, well drained soils, particularly where moisture is concentrated in the draws. “Mal seco” is apparently not a problem on sandy or calcareous well drained soils in Florida.

Repeated observations in fields affected by “mal seco” indicate that damage to taniers is much less where they are partially shaded. On the other hand, growing healthy taniers under shade provided by trees or plantains sharply reduces yields. In Puerto Rico, Vicente-Chandler et al. (6) found that taniers grown under about 50% shade provided by “guaba” (*Inga vera* Willd.) trees yielded only 3,320 kg of tubers/ha as compared with 12,470 kg/ha produced in full sunlight. In Nigeria, Devos and Wilson (2) found that taniers growing in full sunlight yielded 7 T of tubers/ha as compared with only 3 T/ha by taniers planted together with plantains.

The experiments described in this paper were conducted to determine the effect on yields of growing taniers under artificial shade and of intercropping them with plantains.

#### MATERIALS AND METHODS

One experiment was conducted at the Gurabo Substation to determine the effect of full sunlight and 30 and 53% artificial shade provided by Saran<sup>4</sup> screen on taniers. Elevation is about 80 m above sea level. Minimum and maximum temperatures are 17.5 and 30.5° C, respectively. Average annual rainfall is about 1,450 mm. The soil is Mabí clay (Vertic Eutropepts) with a pH of 6 and with 16 me of exchangeable bases/100 g of soil.

Two experiments were carried out at the Corozal Substation. One determined the effect of 0, 30, 53 and 70% artificial shade and another the effect on tanier yields of intercropping taniers with plantains. Elevation is about 200 m. Average minimum and maximum temperatures are 19 and 30° C, respectively. Mean annual rainfall is 1,650 mm. The soil is Corozal clay (Aquic Tropudults) with a pH of 5.5 and with 10.3 me of exchangeable bases/100 g of soil.

In all three experiments, the taniers received a total of 1,000 kg/ha of 10-5-15 fertilizer containing 2% Mg and 20 kg of a mixture of minor elements. Two equal applications were made 1 and 7 months after planting. The soil at Corozal was limed to about pH 6. The land was plowed and harrowed twice. Corm sections of the Morada variety weigh-

<sup>4</sup> Values in columns followed by the same letter do not differ statistically at the 5% level (Duncan's new multiple range test).

ing about 100 g were planted at  $70 \times 70$  cm. The taniers were irrigated every 2 weeks at the rate of 70 mm during dry periods. Weeds were controlled by hoeing. Individual plots were  $4 \text{ m} \times 4 \text{ m}$ . All treatments were replicated six times in a complete block design. The taniers were harvested 14 months after planting.

In the experiment on intercropping, plantains were spaced at  $2.4 \times 2.4$  m in one treatment and at  $1.8 \times 2.4$  m in another treatment. At both planting distances, taniers were planted at the same time as the plantains and 2 months later. The fifth treatment consisted of growing the taniers alone (in full sunlight). The plantains were intensively managed and received 3,000 kg/ha of 10-5-20 fertilizer/ha.

### RESULTS AND DISCUSSIONS

The following tabulation shows that at Gurabo, where the taniers growing in full sunlight were strongly affected by "mal seco", yields increased from 7,900 kg of tubers/ha produced in full sunlight to 12,700 kg/ha produced under 53% artificial shade. Yields of corms also increased from 13,000 kg/ha produced in full sunlight to 22,700 kg/ha under 53% shade. These data confirmed observations that taniers grown under shade suffer less from "mal seco":

<i>Shade Level</i>	<i>Marketable tuber yields (kg/ha)</i>	<i>Corm yields (kg/ha)</i>
Full sun	7,900 b <sup>4</sup>	13,000 b
30% shade	10,000 a,b	17,800 a,b
53% shade	12,700 a	22,700 a

Table 1 shows that composition of the leaf laminas 6 months after planting was not appreciably affected by shade levels. Levels of the various nutrients were similar to those found in high yielding fields of taniers.

There is no apparent explanation for the beneficial effects of shade on growth and yield of taniers in fields affected by "mal seco." Possibly, shade reduces transpiration and, therefore, moisture stress.

The following tabulation shows that at Corozal, where the taniers were not affected by "mal seco", yields of tubers decreased from 20,660 kg/ha

TABLE 1.—*Percent dry weight composition of tanier leaf laminas sampled 6 months after planting under three levels of artificial shade at Gurabo*

Shade level	N	P	K	Ca	Mg
			<i>Percent</i>		
Full sun	2.15	.14	3.08	1.14	.57
30% shade	2.10	.16	3.61	1.10	.52
53% shade	1.81	.14	3.33	1.03	.46

TABLE 2.—*Effect of planting taniers unaffected by "mal seco" together with plantains at 2 spacings at Corozal*

Crop and spacing	Tuber yields	Corm yields
	Kg/ha	Kg/ha
Taniers planted alone in full sunlight	17,900 a <sup>1</sup>	48,300 a
Plantains spaced 2.4 × 2.4 m—both crops planted at the same time	7,000 b	33,300 b
Plantains spaced 2.4 × 2.4 m—taniers planted 2 months after plantains	4,800 b	26,300 b,c
Plantains spaced 1.8 × 2.4 m—both crops planted at the same time	4,700 b	22,500 b,c
Plantains spaced 1.8 × 2.4 m—taniers planted 2 months after plantains	3,400 b	15,300 c

<sup>1</sup> Values in columns followed by the same letter do not differ statistically at the 5% probability level (Duncan's new multiple range test).

produced in full sunlight to 13,960 and 9,090 kg/ha produced under 53 and 70% shade, respectively. Yields of corms, however, were not significantly affected by shade levels, averaging about 20,700 kg/ha, as shown below:

Shade Level	Yield of marketable tubers (kg/ha)	Yield of corms kg/ha
Full sun	20,660 a <sup>5</sup>	20,450 a
30% shade	13,680 b	22,470 a
53% shade	13,960 b	21,280 a
70% shade	9,090 c	18,630 a

Table 2 shows that yields of taniers, which were also unaffected by "mal seco", decreased from 17,900 kg of tubers/ha when the taniers were planted alone to 7,000 kg/ha when they were intercropped with plantains spaced at 2.4 × 2.4 m. Planting taniers 2 months after the plantains and planting plantains at closer spacings further decreased yields. Yields of corms were reduced from 48,300 kg/ha when the taniers were planted alone to 33,300 kg/ha when they were interplanted with plantains spaced at 2.4 × 2.4 m. Planting taniers 2 months after planting plantains at closer spacings further decreased corm yields.

#### RESUMEN

Se determinó el efecto de varios niveles de sombra artificial en la producción de yautías (variedad morada) en un campo afectado por "mal seco" y en otros no afectados por esta condición. Además, se determinó la producción de yautías no afectadas por "mal seco" sembradas solas e intercaladas con plátanos.

<sup>5</sup> Values in columns followed by the same letter do not differ statistically at the 5% level (Duncan's new multiple range test).

La yautía en un campo afectado por "mal seco" produjo 12,700 kg/ha de tubérculos y 22,700 kg de cormos (madres) cuando se sembró bajo 53% de sombra artificial, y 7,900 kg de tubérculos y 13,000 kg/ha de cormos a pleno sol.

En un campo no afectado por "mal seco", la producción se redujo de 20,660 kg/ha de tubérculos cuando se sembró a pleno sol a 13,960 kg/ha cuando se sembró bajo 53% de sombra artificial y a 9,090 kg/ha bajo 70% de sombra. La producción de cormos no se afectó señaladamente por la sombra, alcanzando un promedio de 20,700 kg/ha.

Las yautías no afectadas por "mal seco" produjeron 17,900 kg de tubérculos/ha cuando se sembraron solas, y sólo 7,000 kg/ha cuando se sembraron intercaladas con plátanos sembrados a  $2.4 \times 2.4$  m. La producción de cormos se redujo de 48,300 kg/ha cuando las yautías se sembraron solas, a 33,300 kg/ha cuando se sembraron intercaladas con plátanos. Tanto la producción de tubérculos como la de cormos se redujo cuando los plátanos se sembraron a distancias mas cortas o cuando las yautías se sembraron 2 meses después de sembrarse los plátanos.

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