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Response of Tanier to different water regimes

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An experiment to determine the response of taniers (Xanthosoma sp.) to irrigation was established at three locations in Puerto Rico. Drip-irrigated taniers were grown with different water regimes, where water application was based on tensiometer readings at 15-, 30- and 45-cm depths. Plots were irrigated when soil moisture tension was above 40 cbars. The combined analyses of the data showed that plots receiving the highest amount of water (based on tensiometers at 15-cm depth) yielded significantly higher than plots receiving the intermediate and lowest amounts of water (tensiometers at 30- and 45-cm depths, respectively). At two locations, number of marketable cormels was significantly higher in plots with the high water regime than in the inter immediate treatment. Mean cormel weight was not affected by the irrigation treatments at two locations. Symptoms of dry rot were conspicuous at both locations. The results show that tanier yields can be increased by irrigation even in the presence of dry rot.

Keywords: Tanier; Xanthosoma spp.; Irrigation; Dry rot

Introduction

Tanier (Xanthosoma spp.) is a staple in the diet of many people in tropical counties. A native plant of tropical America, it is now cultivated around the world under tropical and subtropical conditions. Tanier is one of the most important root crops in Puerto Rico. However, production has been steadily declining in the last four decades, from 32, 430 tonnes in 1952-53 to only 5,760 tonnes in 1985-86. Even though yields of 20,000 kg/ha have been reported (Rodriguez-Garcia, 1981,) most farmers are experiencing heavy decreases in yields. One of the main limiting factors is the dry rot condition (mal seco) which affects the root system.

Irizarry et al. (1977) suggested that abnormal rainfall distribution, coupled to the highly selective moisture requirement of taniers, contributes to the erratic yields of the crop. Tanier requires ample moisture throughout the growing season. The importance of water distribution and constant availability has been recognized (Kay, 1973 and Onwueme, 1978). In Puerto Rico, Abruna-Rodriguez et al. (1967) found that moisture availability was an important factor in tanier production. Irizarry et al. (1977) reported a tendency for higher yields when taniers were irrigated. However, differences were not significant, probably because of the wet and short growing season under which the taniers were grown. Most farmers depend solely on rainfall to satisfy the moisture requirements of the crop.

This study was conducted to measure the effect of different water regimes on yield, number, and weight of tanier cormels.

Materials and methods

The experiment was established at three distinct ecological locations (Fortuna, Isabela, and Corozal Substations) varying in rainfall and soil conditions. At Fortuna, on the semiarid southern coast, the soil is classified as San Anton (Cumulic Haplustoll), pH 7.4. Average annual rainfall is about 920 mm. Rainfall during the crop cycle was 520 mm while evaporation was 1690 mm (Fig. 1). At Isabela, on the northwestern coast, the soil was classified as Coto (Tropeptic Haplorthox), pH 6.0. Average annual rainfall is about 1640 mm. Rainfall and pan evaporation during the crop cycle were 1800 and 1370 mm, respectively (Fig. 2). At Corozal, in the humid central uplands, the soil was classified as Corozal (Aquic Tropudults), pH 4.7. Average annual rainfall is about 1650 mm. Rainfall and pan evaporation during the crop cycle were 1160 and 900 mm, respectively (Fig. 3).

In all locations the fields were disc-plowed and harrowed twice. Tanier (cv. Alela) was planted on beds using pregerminated corm pieces. At Isabela and Fortuna, plants were spaced at 1.07 m between rows and 0.61 m between plants. At Corozal, the planting distance was 0.91m x 0.61m. Taniers received a total of 125, 15, 156 and 48 kg/ha of N, P, K and Mg, respectively. At Isabela and Fortuna a commercial micronutrient formula was applied at a rate of 56 kg/ha. Plots were hand weeded when necessary.

Three water regimes (high, intermediate and low), based upon readings of tensiometers installed at 15, 30 and 45 cm depths, were established after planting. Irrigation was applied when moisture tension exceeded 40 cbars. Plots with tensiometers at 15-cm depth were the most frequently irrigated since evapotranspiration is higher at the soil surface. An additional treatment was established at Corozal, where taniers were not irrigated at all to conform with farmers' practices. Treatments at all locations were arranged in a randomized complete block design. Irrigation water was provided through a drip (trickle) system. Main and submain lines consisted of 3.8-cm PVC tubing. A dual chamber drip line with outer spacing of 20.32 cm was used.

The Isabela and Fortuna experiments were harvested approximately ten months after planting. At Corozal the crop was harvested about seven months after planting when maturity symptoms and cormel sprouting were observed. Weight and number of marketable cormels were recorded and mean cormel weights calculated.

Results and discussion

Table 1 presents data on yields by location. The statistical analysis of the data shows that yields of marketable taniers increased with increasing water applications. Plots receiving the greatest amount of water (tensiometers at 15-cm depth) yielded significantly higher than the other treatments at Fortuna and Corozal. At Isabela, yield differences between plots at the highest and intermediate water regimes were not significant. Yields of the intermediate and low moisture regimes were not significantly different at any location.

Significantly lower yields were recorded in the non-irrigated plots at Corozal. Yields were only about 25% of those obtained at the low water regimes, despite a total rainfall of 1160 mm during the crop cycle. Plants without irrigation might have suffered because of monitor stress induced by poorly developed root system coupled with uneven distribution of rainfall. A yield difference of 87% was observed between the non-irrigated and the highest water regime plots.

Table 1 Yield of marketable taniers (kg/ha) as affected by water regimes

Water Regime (tensiometer depth) (cm)	Location		
	Fortuna	Isabela	Corozal
15	13,080 a[1)]	8,860 a	9,260 a
30	7,860 b	6,430 ab	4,840 b
45	6,020 b	4,540 b	4,750 b
Non-irrigated	-	-	1,180 c

1) Values in columns followed by the same letter do not differ significantly at $p = 0.01$.

Little or no dry rot was evident at Fortuna. Dry rot symptoms in the aerial parts of the plant were not observed during the growing period. However, an evaluation of the root system at harvest indicated some root damage, which decreased with increments in the amount of water applied. Low incidence of dry rot could be related to low rainfall and an even distribution of irrigation water (Fig. 1). Where rainfall was higher and unevenly distributed, as at Isabela and Corozal (Figs. 2 & 3), symptoms of dry rot were conspicuous, especially at Corozal. Most farmers claim that dry rot occurs when a dry spell is followed by heavy rainfall. The relationship between moisture regime and occurrence of dry rot was not determined in this study.

A combined analysis of the yield data from all locations indicated that a mean yield of 10,630 kg/ha at the high water regime was significantly greater, at the 1% level, than mean yields of 6, 580 and 5,280 kg/ha obtained at the intermediate and low water regimes, respectively. There were no other significant differences. Thus, irrigation based on tensiometer readings at 15 cm depth resulted in yield increments of about 62% and 101% more than the other two treatments, respectively. The results indicate that growers can attain good commercial tanier yields with adequate crop management practices, specifically those related to irrigation.

Cormel number, one of the most important components of yield, increased as the frequency of irrigation increased (Table 2). A significantly higher number of cormels was produced with the high water regime than with other regimes. The intermediate and low water regimes produced similar amounts of cormels at two locations.

As Isabela and Corozal, mean cormel weight was not significantly affected by the irrigation regime (Table 3). However, there was a tendency for heavier cormels in the most frequently irrigated plots. A significantly lower men Cormels weight was produced at Fortuna at the low water regime. These data suggest that yield differences attributable to treatments can be explained on the basis of cormel number more than cormel weight.

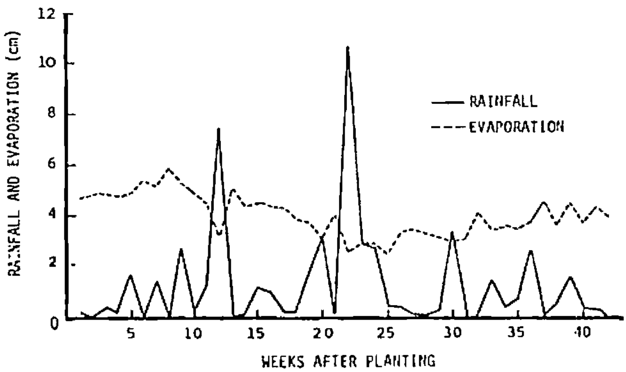

Figure 1 Weekly rainfall and evaporation from 13 June 1986 to 31 March 1987 at the Fortuna Substation

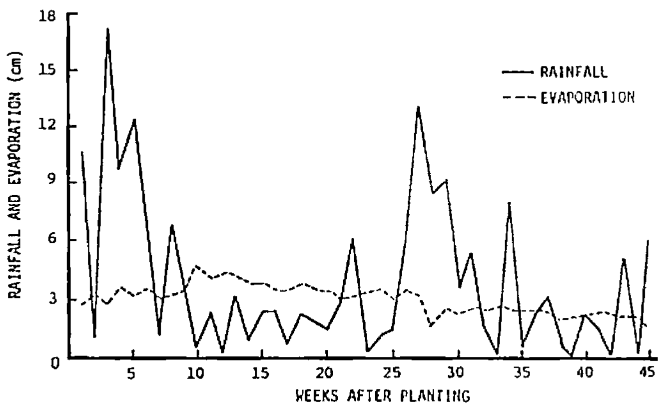

Figure 2 Weekly rainfall and evaporation from 9 April 1986 to 18 February 1987 at the Isabela Substation

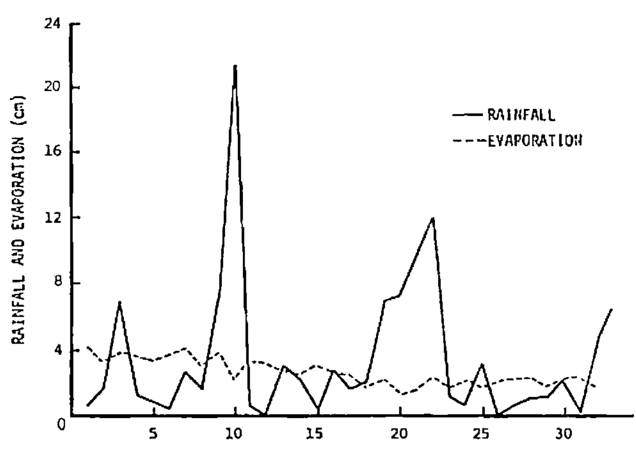

Figure 3 Weekly rainfall and evaporation from 26 June 1986 to 12 February 1987 at the Corozal Substation

Table 2 Number of Cormels (,000/ha) as affected by water regimes

Water Regime (tensiometer depth) (cm)	Location		
	Fortuna	Isabela	Corozal
15	73.6 a[1)]	45.9 a	74.2 a
30	46.8 b	37.6 b	45.7 b
45	46.6 b	26.1 c	42.9 b
Non-irrigated	-	-	10.9 c

1) Values in columns followed by the same letter do not differ significantly at p = 0.05.

Table 3 Mean cormel weight (g) as affected by water regimes

Water Regime (tensiometer depth) (cm)	Location		
	Fortuna	Isabela	Corozal
15	176.4 a[1)]	193.9 a	124.6 a
30	166.7 a	182.2 a	105.0 a
45	129.6 b	170.7 a	110.1 a
Non-irrigated	-	-	112.9 a

1) Values in vertical columns followed by the same letter do not differ significantly at p = 0.01.

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