Fruits - vol. 31, n°11, 1976

Growth and Yield Patterns of Nigerian Plantains

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ETUDES DE CROISSANCE ET DE RENDEMENT DES PLANTAINS NIGERIANS

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Fruits, nov. 1976, vol. 31, n°11, p. 672-277.

RESUME - A l'Université de Nsukka (Nigéria) des plantains installés au début de la saison humide ont fleuri après 9-20 mois. La croissance a été maximale d'avril à octobre et minimale de janvier à mai. La production mensuelle de feuilles a atteint un maximum durant les mois de septembre et d'octobre (4-5 feuilles par mois). Elle a été la plus faible durant la saison sèche de décembre à mars. Le poids du régime était plus important au cours du premier trimestre de l'année, et moindre pendant le troisième trimestre. L'humidité du sol a influencé de façon prépondérante le poids des régimes. L'auteur conclut aux bienfaits de l'irrigation pour améliorer la production de contre-saison.

Plantain is an important food crop in Nigeria. However, it is not yet grown as an organized plantation crop. Most of the plantain fruits are produced from plants grown haphazardly in a «compound» cropping system or as shade plants in cocoa plantations. The consumption of plantain has risen tremendously in Nigeria in recent years because of rapidly increasing urbanization and the great demand for convenience foods by the non-farming urban populations. To satisfy this demand, especially in the large urban markets and catering institutions (schools, hospitals, prisons, etc.) it is necessary to develop plantain into a major plantation crop in Nigeria.

Before plantain can be developed into a plantation crop, there should be a careful study of its growth habits and production patterns under Nigerian conditions. No information on the growth and production pattern of plantain in Nigeria is thus far available to the author. For large scale plantation production, one would expect certain problems to arise. These problems include the effect of weather on plantain growth and productivity, problems associated with nutrition, cultural practices, disease and insect attack. This paper deals primarily wich the effects of weather on the phenology of plantains in an area with well drained soil and short but severe dry season.

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Communication présentée à la Première réunion internationale de travail sur les bananes plantains et autres bananes de cuisson (Ibadan, A.G.C.D./I.I.T.A., 27-29 janvier 1976).

REVIEW OF LITERATURE

Plantain is grown extensively in several tropical countries of West Indies, West Africa and South and Central America. The few reports available on the crop deal mainly with descriptions of local cultivars grown in the various countries (SIMMONDS, 1966 ; KARIKARI, 1971 a et b, 1973; SANCHEZ-NIEVA et al., 1968) and the ripening and storage properties of plantains (HERNANDEZ, 1973 ; SANCHEZ-NIEVA et al., 1970 ; NDUBIZU, 1975). Some reports are available on the processing of plantains into chips (RAHMAN et al., 1963 ; RAHMAN, 1963). None of the above studies deal with the effect of weather on plantain

production.

However, some studies have been conducted on the effect of weather on growth and productivity of bananas, a close botanical relative of plantains (MOBBS, 1955). The climate of Hawaii, Malaya and northern Jamaica are considered ideal for banana growing (SIMMONDS, 1966). Fairly good banana growing climates having equable temperature but with marked rainfall variation include those of Uganda and Cameroun, with the later having a climate that closely approximates that of Nigeria.

Of the different climatic factors, rainfall and temperature have the most profound effect on growth rate and yield of bananas. For normal growth and productivity, monthly rainfall of about 100 mm (4 inches) is considered satisfactory while less than 50mm (2 inches) per month is regarded as unfavourable. In the subtropical latitudes, where temperature may fall below 80 F during the growing period, flowering may be delayed and fruit bunch development during the winter months is usually much reduced (SIMMONDS, 1966). The time from planting to flowering of bananas in the tropics may be delayed at high altitudes. Adverse weather due to inadequate rainfall or temperature conditions or both, account for the generally observed annual periodicity of banana production. SANCHEZ-NIEVA et al. (1969) reported that montecriston bananas grown in the South coastal area of Puerto Rico under irrigation, flowered after 12-17 months.The flowering time had a direct effect on the development of the bunch and yield. Flowers that opened between August and October took less time to mature that those opening at other months of the year. Both bunch weight and number of fingers per bunch varied in a cyclic way throughout the year.

MATERIAL AND METHODS

Two hundred and sixty plantain «sword» suckers were collected from selected plantain plants at the permanent crops farm, University of Nigeria, Nsukka, in May 1973. The suckers were treated with Aldrin dust to eliminate nematodes (NIEVA et al., 1969) and planted in a 30 x 30 x 15 cm planting holes at a spacing of 4 x 4 meters. One head pan of poultry manure was applied to each stand at planting time. A total of 405 kg nitrogen from ammonium sulphate, 270 kg of P_2O_5 from superphosphate and 810 kg potassium from muriate of potash were applied per hectare in three equal instalments at one, three and twelve months after planting. The plants were sprayed monthly with Dithana M 45 fungicide during the rainy season (July - September). Weeds were controlled by regular monthly slashing throughout the growing period. At the beginning of the dry season in November, the plants were mulched heavily with grass straw. Growth as monthly leaf production and retention, flowering date, harvest date and bunch yield were taken. Weather data (rainfall and radiation) were obtained from the Nsukka meteorological station located within the University farm.

RESULTS AND DISCUSSION

Plantains planted at Nsukka, 6 52'N at the biginning of the rainy season in 1973, grew vegetatively for an average of 15 months before shooting (visible flowering) started. Rapid vegetative growth occurred from the month of April through October then dropped off in November-December and remained almost static in the hot dry period of January to March. The observed periods of growth, flowering and harvest are shown in Fig. 1. During the period of moisture sufficiency from the month of May (Table 1), when the plants were in active vegetative growth phase, leaf production occurred at the rate of 2-3 leaves/month. A maximum rate of 4-5 leaves per month was observed in September-October period, when both rainfall (soil moisture balance) and radiation appeared satisfactory for plant growth. Leaf production was minimal during the dry months of December to March. Plantain plants retained more leaves in the rainy season (10-17 leaves per plant) than in the dry season (1-6 leaves per plant). This may be due not only to the formation of more new leaves by the plant in the rainy season, but also to greater longevity of leaves in the rainy than in the dry season. Leaves that opened in the rainy season may live between 9-15 weeks while dry season leaves senesce in less than 8 weeks. The plants lost the lower leaves very rapidly at the beginning of the dry season in late November. The sudden loss of the lower leaves coincided with the drop in both the monthly rainfall and soil moisture balance (Table 1). There was therefore a concomitant reduction in leaf area per plant in the dry season since the older leaves died off and only few new ones were formed.

The earliest plants to flower had a vegetative growth period of 9-10 months while the slowest ones flowered 20 months after planting (Fig. 1). Plantain is a determinate plant and flowering occurred at any time of the year, provided a certain amount of vegetative growth involving the production of a definite number of leaves had occurred (SIMMONDS, 1966). However, the main flowering period coincided with the on set of the rainy season. Peak flowering occurred in June-July period and dropped off at the on set of the dry season (Fig. 3). SANCHEZ-NIEVA and al (1966) reported that in Puerto Rico, vegetative growth of Maricongo and Guayamero plantains occurred in the relatively dry periods and peak flowering coincided with increase in rainfall.

Fruit maturation and harvests followed a pattern similar to that of flowering, occurring 2 1/2-3 months later so that fruits may be harvested from the plantain plants all year round. However peak harvest period was between August

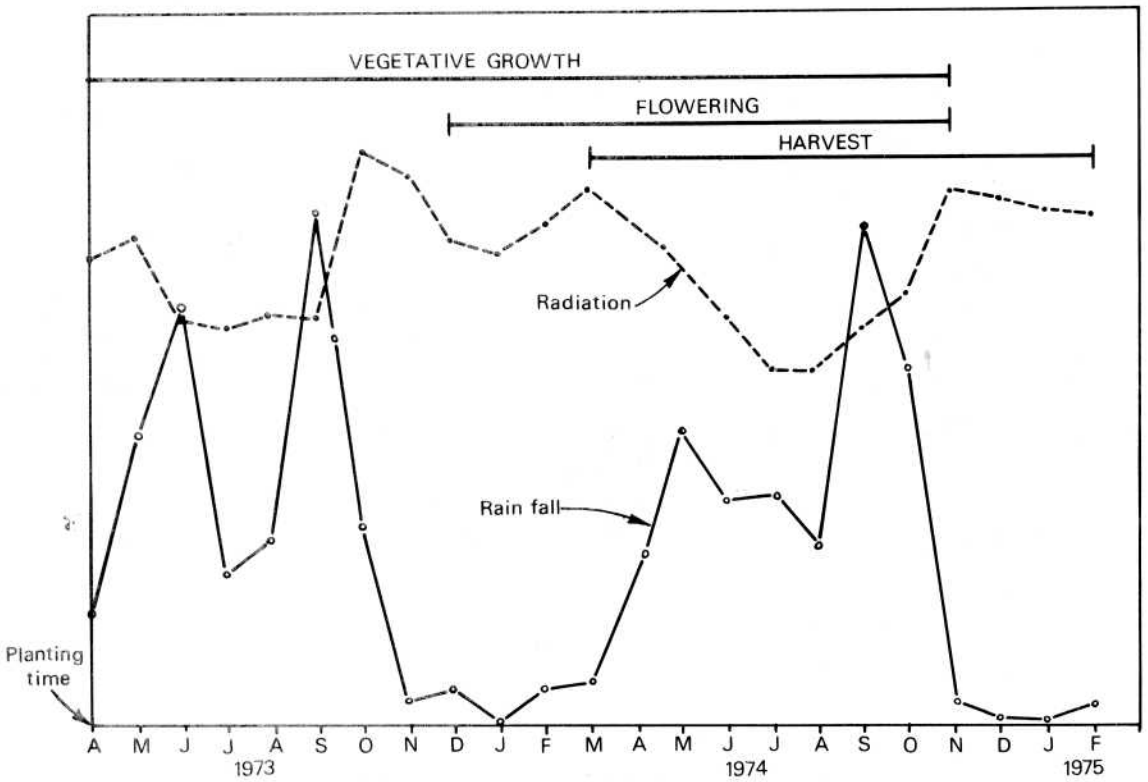

Figure 1. Agro-metrological data and seasonal growth patterns of Nigerian plantains grown at Nsukka (lat. 6°, 52 N)

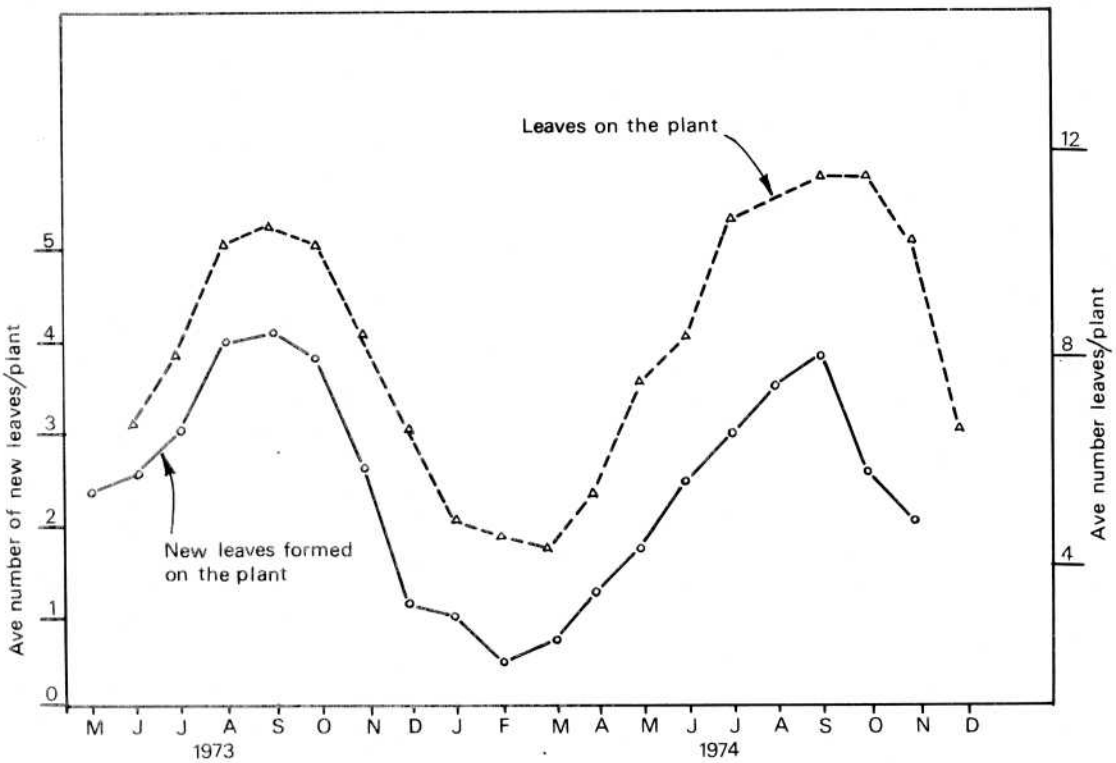

Figure 2. Leaf production and leaf retention patterns of plantains grown in Nsukka area.

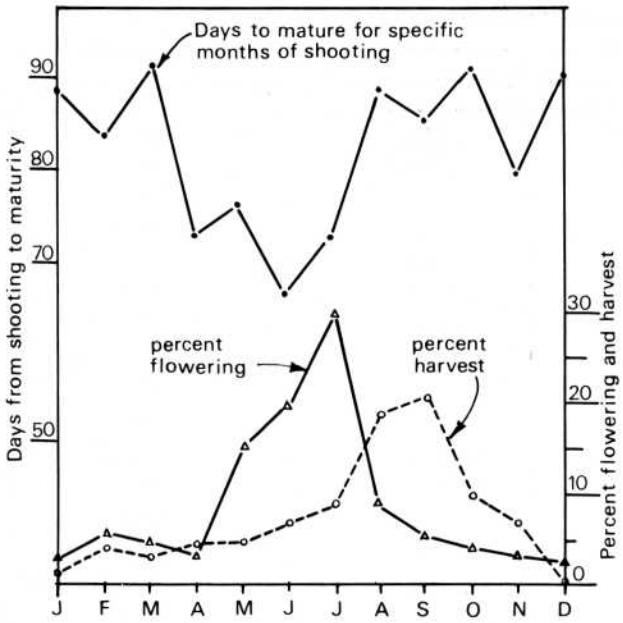

Figure 3. Flowering and harvest shedule of plantain grown at Nsukka (lat. 6 °, 52 N)

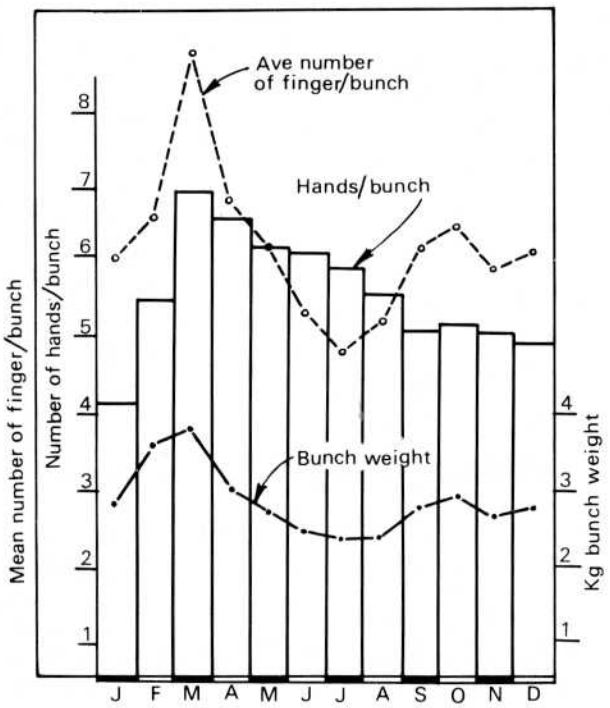

Figure 4. Fingers/Bunch, hands/bunch and monthly bunch weight of harvested plantain.

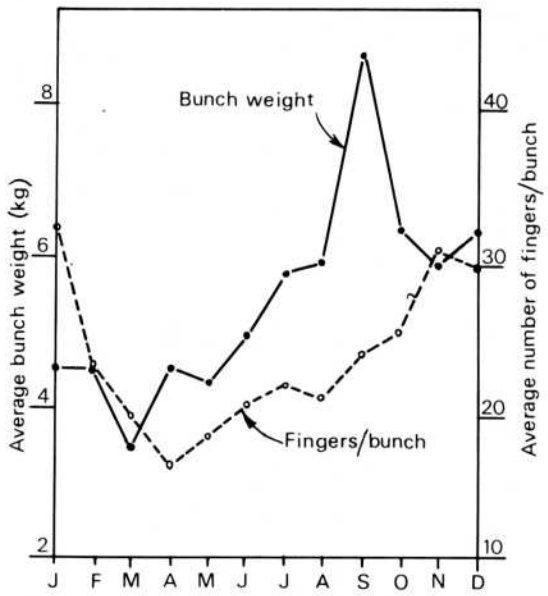

Figure 5. Relationship between the time of shooting formation and subsequent yield of plantains.

TABLE 1. Estimate of Monthly water balance a/for Nsukka Soil over the (1973-1975) growing period (mm moisture)

Month	Moisture balance (mm) a/
January	- 100
February	- 100
March	- 92
April	- 37
May	92
June	200
July	200
August	200
September	200
October	200
November	100
December	- 47

a/ Monthly water balance calculated from the equation

B = R Swi - Etp (mm)

B monthly water balance

R monthly rainfall

Swi available water stored in the soil (vander Vossen 1969)

Etp Evapotranspiration (SURRE 1968)

TABLE 2. Monthly Flowering and Yield distribution of Plantains grown in Nsukka area.

Month of Flowering	Number of Plants Flowering	Months of Harvest	Yield distribution (%) during months of Harvest	
January	5	March/April	March	20 %
			April	80 %
				100 %
February	12	April/May/June	April	20 %
			May	50 %
			June	30 %
				100 %
March	11	June/July	June	75 %
			July	25 %
				100 %
April	8	June/July	June	20 %
			July	80 %
				100 %
May	32	July/August	July	35 %
			August	65 %
				100 %
June	47	August/September	August	45 %
			September	55 %
				100 %
July	66	September/October	September	70 %
			October	30 %
				100 %
August	17	October/November	October	30 %
			November	70 %
				100 %
September	4	November/December	November	50 %
			December	50 %
				100 %
October	8	January	January	100 %
November	6	January/February	January	80 %
			February	20 %
				100 %
December	8	March/April	March	80 %
			April	20 %
				100 %

and October when over 50 percent of the harvests for the year was obtained. Fruits formed at the early part of the rainy season (April-July) matured in less than 80 days while those formed at any other time of the year matured in more than 80 days (Fig. 3).

The average bunch weight per plant was highest for fruit harvested during the first quarter of the year (January-March). However, fruits harvested at this period represented a small fraction of the total annual harvest. The mean bunch weight per plant dropped starting in April, reaching the lowest level in the third quarter of the year (Fig. 4). Fruits harvested in the first quarter of the year (January-March) came from flowers that opened in the last quarter (October-December) when the plants were finishing the season's active growth and when soil moisture and sunshine were still adequate for bulking of fingers. The June-July harvests which gave the lowest mean bunch weight per plant were obtained from plants which flowered in February-April months, when the soil moisture deficit was greatest (Table 2). Bunch weight/plant is a function of the number of fingers per bunch as well as the size of the individual fingers. The relatively high bunch weight noted in the first quarter, was due mainly to higher number of fingers per

bunch associated with flowers formed in the last quarter of the year. The second peak observed in September resulted from the size of the individual fingers in the bunch. Fruits which matured in September month had adequate rainfall and good soil moisture conditions, thus the individual fingers were larger and better filled. Figure 5 shows the effect of the time of flower formation on bunch weight of fruits subsequently developed. Flowers formed in the months of January-April when radiation was high and soil moisture lowest, produced bunches with the fewest fingers and lowest bunch weight. Mean bunch weight increased for flowers formed starting in May as the rainfall (soil moisture) increased even though radiation fell steadily. The number of fingers/bunch and thus the ultimate bunch weight rose and fell with available soil moisture.

The months of April-July are traditionally regarded as the period of food shortage. Within this period, the other staple annual crops such as yams, rice and cocoyams have all been planted but in the fields but none is yet mature for harvest. Since plantain is a «tree» crop, it can be made to supply much of the needed food during this period of annual food shortage through application of proper husbandry methods. For example, the application of supplementary water to the plants during the months of December through March may change the growth pattern of the plant. Dry season irrigation can keep the rate of monthly leaf production at the rainy season level and thus shift the peak production time toward the period of annual food shortage. It can also raise the bunch weight of the May-July fruits which are formed from flowers that opened in the dry season.

Similarly, a well timed application of fertilizers can influence the rate of vegetative growth, making it possible for plants to produce higher leaf number during the time when soil moisture and radiation are optima, thus hastening flowering time as well as positively influencing the number of fingers per bunch and hence raising bunch weight.

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