ROOT AND SHOOT DEVELOPMENT DURING THE PLANT CROP AND THE FIRST RATOON OF BANANA AND PLANTAIN (*MUSA* SPP.) WITH IMPLICATIONS FOR PERENNIAL CULTIVATION ON DEGRADED ULTISOLS IN SOUTH-EASTERN NIGERIA.

DESARROLLO DE RAÍCES Y OTRAS PARTES DE LA PLANTA DURANTE EL PRIMERO Y SEGUNDO CICLOS DE PRODUCCIÓN EN BANANO Y PLÁTANO (MUSA SPP) CON IMPLICACIONES PARA CULTIVOS PERENNES EN ULTISOLES DEGRADADOS EN EL SURESTE DE NIGERIA.

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SUMMARY: The effect of cycle on root system and shoot development was studied for two crop cycles (plant crop and first ratoon). The study revealed that shoot and root system development declined from the plant crop to the first ratoon for plants grown on degraded Ultisols in south-eastern Nigeria.
Key words: plant crop, ratoon crop, root system

RESUMEN: El efecto cíclico en el sistema radical y en el desarrollo de otras partes de la planta fue estudiado durante dos ciclos de producción (siembra y primer renuevo). El estudio reveló que el desarrollo del sistema radical y otras partes de la planta declinó desde el momento de la siembra hasta el primer renuevo en plantas sembradas en Ultisoles degradados en el sureste de Nigeria.
Palabras clave: siembra, renuevo, sistema radical

INTRODUCTION

The lifetime of a *Musa* spp. plantation is variable ranging from one crop cycle to several cycles (5) with a progressive yield decline from cycle to cycle necessitating for example the replanting of plantain fields after 2 to 3 cycles (8). After several cycles, 'high mat' results in less vigorous sucker and root growth (2) which increases cycle duration. Well-developed suckers reduce the cycle duration thus increasing yield per unit time (6). The effect of cycle on root and shoot development has not been studied extensively yet this knowledge is necessary since bananas and plantains are perennials. The objective of this study was therefore to evaluate root system and shoot development during the plant crop and first ratoon cycle of *Musa* spp.

MATERIALS AND METHODS

The study was carried out at the IITA High Rainfall station at Onne in southeastern Nigeria. Details of the site have been reported (3). Experimental fields were treated with the nematicide Nemacur and the fungicide Bayfidan to reduce nematode infestation and to control black sigatoka, respectively. Fertilisation was done with muriate of potassium and Urea. Five genotypes namely 'Calcutta 4' (*Musa* AA group), 'Valery' (*Musa* AAA group) and the tetraploid hybrids 'TMP4x 548-9', 'TMP4x 5511-2' and 'TMP4x 1621-1' were field-established in a completely randomized design at a spacing of 4 m x 4 m using *in vitro* planting materials. Four plants per genotype were assessed at both flower emergence (FE) and harvest (H) of the plant crop and the first ratoon. Data were taken on leaf area (LA, cm²), number of leaves (NL), plant height (PH, cm), pseudostem circumference (PC, cm), the number of suckers (NS), height of the tallest sucker (HS, cm), root dry weight (DR, g), number of cord roots (NR) and length of cord roots (LR, cm). The data collected were analyzed using PROC GLM in SAS (7).

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RESULTS

The number of suckers significantly (P=0.05) influenced the cycle duration. The cycle duration in 'Calcutta 4' with unregulated suckering was significantly shorter than in 'Valery' and the tetraploid hybrids which have regulated or inhibited suckering. In 'Calcutta 4' the first ratoon crop was harvested only 34 days after harvesting the plant crop while in 'Valery' and the tetraploid hybrid varieties it took at least four months from harvesting the plant crop to the harvest of the first ratoon (Table 1). Significant differences in shoot and root growth traits were mainly observed between the diploid 'Calcutta 4' and the other assessed genotypes. There was a significant (P=0.05) effect of crop cycle on the NS and the HS. At flower emergence NS decreased from 16 in the crop plant to 12 in the first ratoon, while HS decreased from 120 cm in the crop plant to 68 cm in the first ratoon (Table 2). Similarly, LR reduced from 3,778 cm and 2,268 cm at flowering and harvest of the crop plant to 3,003 and 1,841 at flowering and harvest of the first ratoon. Roots absorb water and minerals from the soil and therefore better rooting or root ramification results in vigorous shoot growth and development. Management practices such as mulching which enhances root ramification (1) are recommended for sustenance of banana and plantain production. The LA also reduced from 65,801 cm^2 for the plant crop to 61,166 cm^2 in the first ratoon. The leaves are the main photosynthetic tissues and thus a large functional LA ensures more assimilates for fruit filling and hence high yield.

CONCLUSION

Shoot and root development becomes less vigorous during subsequent cropping cycles. This leads to a reduction in yield and productivity of plantations under conditions of degraded Ultisols in south-eastern Nigeria.

Table 1: Different plant growth traits for the different genotypes.

Genotype	DTFL	DTH1	DTH2	CD
Calcutta 4	255±14	395±13	429±7	34
Valery	429±53	514±56	641±32	127
TMP4x 548-9	408±25	499±30	747±25	248
TMP4x 1621-1	422±10	495±14	774±37	279
TMP4x 5511-2	431±29	499±23	779	280

DTFL: days to flower emergence, DTH1: days to harvest of the plant crop, DTH2: days to harvest first ratoon, CD: cycle duration (days)

Table 2: Shoot and root characteristics of the plant crop and the first ratoon crop.

	Plant crop		First ratoon	
Trait	FE	H	FE	H
LA	65,801±4,579	8,161±2,368	61,166±3,114	7,025±3,019
NL	10.5±0.5	1.9±0.4	9.9±0.4	1.5±0.5
PH	195±9	196±11	215±8	201±13
PC	55±2	47±3	54±2	46±2
NS	16±1	16±1	12±1	13±1
HS	120±10	158±12	68±11	93±12
DR	130±12	111±13	146±13	90±8
NR	134±11	123±7	149±8	131±11
LR	3,778±355	2,268±192	3,003±333	1,841±121

FE: Flower emergence, H: harvest, LA: leaf area, NL: number of leaves, PH: plant height, PC: pseudostem circumference, NS: number of suckers, HS: height of the tallest sucker, DR: root dry weight, NR: number of cord roots LR: length of the cord roots.

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