RESPONSE OF SWEET POTATO AND MAIZE INTERCROP TO NITROGEN LEVELS (N) AND EFFECT ON WEED BIOMASS IN HUMID TROPICAL ENVIRONMENT OF SOUTH-EASTERN NIGERIA

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ABSTRACT
An experiment was conducted in Western and Eastern farms of National Root Crop Research Institute Umudike in 2006 and 2007 cropping season to investigate the response of maize (zea mays.L.) and sweetpotato (Ipomoea batatas (L) Lam) to nitrogen rates and its effect on weed biomass in South Eastern Nigeria. The treatments were sole, intercrop and 4 levels of nitrogen 0, 40, 80 and 120kgN/ha laid out in a 2x4 factorial in randomised complete block design. The results showed that weed recorded higher in sole maize than sweet potato sole and intercrop. Higher yield were also obtained in sole to intercrop were 80 and 120kgN/ha gave the highest yield. The LER in the intercrop was greater than unity (LER>1) indicating yield advantage in terms of land usage. This shows that (Oba Super 2) maize could be successfully intercropped with sweet potato (TIS/0087) for optimum yield.About 80kgN/ha was therefore recommended for intercropping of both crops.

Keywords: Intercrop, Maize, Sweet potato and Weed biomass

INTRODUCTION
Sweetpotato is a perennial crop but cultivated as an annual with a growing period of 3-6 months depending on the growing condition and cultivar. It is a stable starchy food containing vitamins, particularly vitamin A and minerals comparable to those of various fruits (Truong, 1989). It serves as staple food crop for man and feed for livestock. The leaves are rich protein (34.5% crude protein) (Nwinyi, 1988).

Maize is the principal staple food, produced and consumed by most farming households while it is relatively less important in western and central Africa (FAO, 2005). Maize provides a major source of calorie, especially of Nigeria and Ghana. Its grain, stalk, leaves cobs, tassels and silks all have commercial value in most settings.

Intercropping has been shown to provide yield advantages in the form of increase in over all productivity (Sullivan, 2001) and minimization of crop failure and dietary need of farmers. The combination of sweet potato and maize gives excellent result provided the maize is well spaced. Where soil fertility is low, the advantage of intercropping over pure stands is some 20-40% measured by LER (Land equivalent ratio) this advantage tends to disappear where soil fertility is higher (Romain, 2001). Yield advantage occur because intercropping ensures better use of environmental resources such as light, nutrient and water as well as better control of weeds (Trenbath, 1986).

Effective weed control has been cited as one of the benefits of intercropping. The general presumed mode of action is that one crop through competition with weeds provides an environment of reduced weed biomass for other crops.(Vandermeer,1989). More complete crop cover and high plant density available in the intercropping cause severe competition with weeds and thus reducing the weed growth (Enyi, 1983). Maize-cowpea intercrop failed to suppress weeds in the early cropping season but had a significant effect in late season, because the canopy level cowpea have not been formed at that early stage. Under high soil fertility level Shetty, (2002), reported that cassava intercropped with beans, maize, sweetpotato or beans plus maize was less effective in weed control. However, Hart (1994) found that weed control in sweet potato/beans/maize intercrop was generally less at high than low soil fertility.

MATERIALS AND METHODS
The study was carried out in 2006 and 2007 cropping season in the western farm of National Root Crop Research Institute Umudike Abia State, located between lat 05^0 29' N, longitude 07^0, 23' E,

122m above sea level of south eastern Nigeria. The field was cleared of the existing vegetation ploughed, harrowed, ridged and was laid out in 3 replicates with a plot size of 4mx3m in 2x4 factorial in RCBD. The component crops were maize (Oba super2) and sweet potato (T1587/0787). The nitrogen levels were 0kgN/ha, 40kgN/ha, 80kgN/ha 120kgN/ha.

Treatment Combinations

Maize

Maize + sweetpotato and sole at 0kgN/ha
Maize + sweetpotato and sole at 40kgN/ha
Maize + sweetpotato and sole maize at 80kgN/ha
Maize + sweetpotato and sole maize at 120kgN/ha

Sweetpotato

Sweetpotato + maize and sole sweetpotato at 0kgN/ha
Sweetpotato + maize and sole sweetpotato at 40kgN/ha
Sweetpotato + maize and sole sweetpotato at 80kgN/ha
Sweetpotato + maize and sole sweetpotato at 120kgN/ha

Phosphorous (P) as a single phosphate at 40kg P_20_5/ha and potassium (K) as a muriate of potash at 40kg/ha were applied to all plots as blanket application at the time of nitrogen application. Weed sampling was done using 1.0mx1.0m quadrant. This was done by throwing the quadrant randomly in each plot. The weeds were collected separated and counted according to the number of sedges, broadleaves and grasses. The oven dried weights were collected. All agronomic practices were carried out and data were collected accordingly and subjected to standard analysis of variance as outlined by Gomez and Gomez, (1986) using Genstat package. Mean separation was carried out using least significance difference (LSD) at $P<0.05$.

RESULTS AND DISCUSSION

The physio-chemical analyses of the soils of the experimental sites in both years were sandy loam and acidic (Table 1) organic carbon and organic matter were higher in 2006 and very low in nitrogen.
In table 2 the cropping system did not influence the no of sedges, broadleaves and grasses but significance differences was observed in total number of weeds, while more number of weeds were observed in sole maize for both years. The highest number of sedges, grasses and total dry weight of weeds were observed in plots with fertilizer application of 120kgN/ha.

Nitrogen fertilization (Table 3) significantly affected the tuber yield of sweetpotato and maize grain, where increase in yield were achieved in 80kg/N and 120kgN/ha application in 2006 and 2007. Intercropping reduced the tuber and grain yield, while sole cropping gave the highest yield in both 2006 and 2007.

It was observed that all the combinations had LER greater than one (LER>1.0) except when maize was intercrop with sweet potato at 0kgN/ha which gave an LER of 0.97 in 2007. There was an intercrop advantage of both crops where a higher productivity per area of land over the sole crop were achieved. Yield advantages of between 6 and 32% (2006) and between 23 and 35% (2007) were achieved.

The significant effect observed in the total number of weeds, where the highest number observed in sole in 2006 than 2007 could be due to early rain observed in 2006. Although, more weeds were recorded higher in sole maize than sweet potato and intercrop. This could be as a result of shading effect of the canopy of the crops. This is in line with the report by Parker and Fryer (2001) who noted that the canopy cover of sweet potato is expected to suppress weed. Okwor (1991) and Shetty (2002) reported that it could be due to its sparse canopy which allowed penetration of light to the lower components and also affected fertility and moisture status of the soil.

The highest no of sedges, grasses and total dry weight obtained in N application of 120kgN/ha corroborates the work done by Olojede (2005) who stressed that higher fertility level often cause

proportionately greater weed growth and crop reduction Caussanel (1994) also reported that higher N rated stimulated a faster rate of occupation of available space by the weeds.

The marked increase of the tuber and grain yield of the component crop which was observed in sole than intercrop in both years could be due to competition effect between mixtures. Fageria (1999) reported that the reduction in yield by intercropping could be its effects on yield component which were also reduced. The highest yield obtain from both crops in 2006 and 2007 was not surprising. This increase could be attributed to the findings of Corey (2003) who emphasized that high nitrogen rates brought about increase in yield.

The higher productivity of sweet potato and maize intercrop achieved per area of land over the sole crop stands was attributed to other environmental factors and evenly distributed rainfall (Table 1). Moreover, maize contributed more to total LER in both years than sweet potato, this is in line with Donald (2003) who observed that maize being a fast growing crop has a competitive efficiency and has more extensive root system, this could have contributed in its competitive advantage than the component crop.

CONCLUSION

The results of the experiment showed that weeds were recorded higher in sole maize for both years than sweet potato and intercrop due to shading effect of the canopy of the crops. Higher yields were obtained in sole than intercropping and also in nitrogen rates of 80kgN/ha and 120kgN/ha. Generally, the LER in the intercrop were greater than unity (LER>1) indicating yield advantage in terms of land usage. Since there were no significant differences between the yield obtained in 80kgN/ha and 120kgN/ha, considering the high cost of fertilizer which are not readily available to the local farmers, 80kgN/ha is therefore recommended for maize and sweet potato intercropping system.

Table 1: Physical and chemical characteristics of the soils at the experiments sites at Umudike in 2006 and2007 cropping seasons

	2006	**2007**
Physical characteristics		
Sand (%)	72.10	71.80
Silt (%)	4.10	12.70
Clay	23.80	15.50
Texture	Sand clay loam	Sandy loam
Chemical characteristic		
Organic carbon (%)	1.093	0.52
Organic matter (%)	1.882	0.90
Total N (%)	0.063	0.056
Exchangeable bases		
Mg (cmol/kg)	1.60	1.60
Ca (cmol/kg)	2.80	2.40
K (cmol/kg)	0.087	0.128
Na (cmol/kg)	0.070	0.157
Effective CEO (vmol/kg)	5.837	6.625
Base saturation (%)	78.07	65.67
pH (H_2O)	5.02	5.07
Available P (mg/kg)	21.60	17.00
Exchangeable acidity (cmol/kg)	1.28	2.24

Table 2: Yield performance of maize and sweet potato intercrop on nitrogen levels

Cropping System	2006 Sweetpotatoes t/ha	Maize kg/ha	LER	2007 Sweetpotato t/ha	Maize kg/ha	LER
Maize+Sp 0	6.24	1.09	1.06	4.03	1.12	0.97
Maize+Sp 40	8.88	1.42	1.23	8.15	1.54	1.34
Maize+ Sp 80	19.39	2.64	1.18	17.16	2.77	1.28
Maize+Sp 120	21.09	3.33	1.32	18.50	3.28	1.35
LSD 0.05	3.02	0.19		2.72	0.16	
Sweet potato						
Sole	18.8	-	-	15.70	-	-
Intercrop	8.99	-	-	8.22	-	-
LSD 0.05	2.14	-	-	1.93	-	-
Maize						
Sole	-	2.45	-	-	2.49	-
Intercrop	-	1.10	-	-	1.83	-
LSD 0.05	-	0.14	-	-	0.11	-

(SP=Sweet potato)

Table 3: Weed biomass (kg/ha) in maize/sweet potato intercropping system in 2006 and 2007.

	No of sedges/m^2			No of broad leave			No of grasses/m^2			Total no of weeds/m^2			Total dry wt gm/m^2		
Cropping system	**2006**	**2007**	**mean**	**2006**	**2007**	**mean**	**2006**	**2007**	**mean**	**2006**	**2007**	**mean**	**2006**	**2007**	**mean**
Sole maize	3.45	1.92	2.66	3.92	3.17	3.55	6.83	4.67	5.75	14.25	9.5	12.0	73.50	66.8	70.15
Inter crop	2.60	1.58	2.06	2.36	2.42	6.78	4.10	3.83	9.93	9.06	7.83	8.46	61.50	52.40	56.75
Sole sweetpotato	1.80	2.25	2.03	2.40	1.83	2.12	3.98	3.33	3.66	8.18	7.42	7.80	68.50	57.20	62.85
LSD 0.05	Ns			Ns			Ns			0.53			Ns		
Nitrogen kg/ha															
0	1.23	1.00	1.12	2.88	2.67	2.76	4.55	3.11	3.82	7.52	6.78	7.15	56.7	53.3	55.0
40	2.69	2.44	2.57	2.25	1.67	1.97	3.69	4.22	3.96	8.42	8.33	8.38	63.8	59.5	61.7
80	2.93	1.44	2.19	2.33	2.67	2.50	4.20	3.89	4.05	10.20	8.00	9.10	68.0	56.5	62.3
120	5.45	2.78	3.14	2.98	2.89	2.94	8.90	4.50	5.20	11.28	10.22	10.75	88.5	65.8	76.9
LSD 0.05	**0.944**			**Ns**			**1.285**			**Ns**			**1.234**		

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